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REVISED FINAL ENVIRONMENTAL SCOPING REPORT

FOR A

PROPOSED 400 MW(t) PEBBLE BED MODULAR REACTOR DEMONSTRATION POWER PLANT (PBMR DPP)

AT THE

KOEBERG POWER STATION SITE

IN THE

WESTERN CAPE

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REVISED FINAL SCOPING REPORT FOR A PROPOSED 400 MW(t) PEBBLE BED MODULAR REACTOR DEMONSTRATION POWER PLANT (PBMR DPP) AT THE KOEBERG POWER STATION SITE IN THE WESTERN CAPE

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

Against a backdrop of a rapidly growing demand for electricity, Eskom, South Africa's power utility, continually evaluates various ways of addressing this demand, including the appraisal of various electricity generating technologies. These include commercially proven technologies such as conventional coal-fired power stations, conventional nuclear power stations, pumped storage schemes, wind energy and large-scale hydro. Eskom also considers technologies that are not commercially proven or have not previously been applied in the South African context. In order to facilitate their utilisation Eskom undertakes research, development and demonstration (RD&D) of such technologies to evaluate their viability in the South African energy demand and supply context. Examples of such RD&D projects are the Klipheuwel Demonstration Wind Energy Facility commissioned in 2003, the Underground Coal Gasification project first constructed in 2005 near Amersfoort, and a proposed concentrated solar thermal power plant in Upington. Within this suite of technology options, Eskom is currently investigating the commercial feasibility of the Pebble Bed Modular Reactor (PBMR) technology and proposes to establish a demonstration plant in which the commercial viability of such a technology can be investigated and demonstrated. It is that demonstration power plant (DPP) that forms the principal subject of this revised scoping report.

As part of the project feasibility investigations, Eskom has commissioned an Environmental Impact Assessment (EIA) on the proposed demonstration project. The EIA is required by law (all forms of power generation of more than 10 MW require an EIA) but is also a key input into the project planning process. The first phase of the EIA is 'Scoping' and it is this scoping process and its outcome that are presented in this report. As the name implies, Scoping serves to define the scope of the detailed assessment of the environmental and social implications of the proposed project, which is the subsequent stage of the EIA process.

The revised scoping report has been structured to present the envisaged EIA process. This includes public consultation, a detailed description of the proposed PBMR DPP project as well as the assessment of alternative ways in which the project needs could be met. The existing state of the environment in the area proposed for the development, and the scope of the further investigations that will be conducted as part of the overall EIA are also included in the report. The document is in its own right an important part of the EIA process, and anyone interested in, or affected by the project is invited to review this document and submit comments on the same. Details regarding registering as Interested and Affected Parties (IAPs) and the submission of comments on this document are presented in Box 1-1.

Box 1-1: How do you register as an Interested or Affected Party?

Should you wish to participate in the EIA process being conducted for the proposed PBMR DPP, and have not already registered, your are urged to please register your interest by contacting:

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1.2 WHY A REVISED SCOPING REPORT?

This document is a revision of an earlier scoping report that was developed and submitted to the National Department of Environmental Affairs and Tourism (DEAT) as the lead authority and the Western Cape Province Department of Environmental Affairs and Development Planning (DEA&DP) as the main commenting authority. In reviewing the Scoping Report, the DEAT appointed a review panel which functioned as an extension of the Department and served to advise them on the report.

In conclusion, the DEAT highlighted a number of additional issues that they believed needed to be addressed. They also requested that a revised final scoping report (RFSR) be prepared and submitted for public and authority review. As such the decision was made to substantially revise the scoping report with a view to presenting key issues more explicitly and that is the motivation for this revised report.

1.3 ADDITIONAL DEAT REQUIREMENTS

The issues that DEAT highlighted and which will be addressed in the RFSR, are indicted in the following sections:

1.3.1 COMPLIANCE WITH LEGAL REQUIREMENTS

In this regard it was indicated that:

- the revised final scoping report (RFSR) and the environmental impact report (EIR), as appropriate, should ensure that a description and assessment of the activities for which application has been made in terms of the Environmental Conservation Act, is provided (please refer to sections 2.4.3 and 2.4.4 of the RFSR);
- the rationale for the separate applications for the PBMR DPP (Eskom) and for the fuel manufacture and transport of nuclear materials (NECSA) must be elaborated on (please refer to section 7.5 of the RFSR);
- the Environmental Impact Report (EIR) should clearly demonstrate how the proposed project is consistent with the principles contained in the National Environmental Management Act 107 of 1998 (see section 2.2.2 of the RFSR).

1.3.2 DEAT/NNR COOPERATIVE AGREEMENT

In this regard it was indicated that:

- the RFSR should include a clear explanation of the DEAT-NNR co-operative agreement, including the linkage between the processes and the mechanism whereby the agreement will function (see section 2.5.1 of the RFSR); and
- all issues, inclusive of radiological related health and safety issues that were identified during the scoping phase must be recorded in the RFSR and transferred to the plan of study (PoS) for the EIR. The health and safety issues must be addressed and assessed on a sufficient level of detail to enable DEAT to make an informed request for input from the NNR (please refer to section 7.3 of the RFSR).

1.4 INSTITUTIONAL CONTEXT

In this regard it was indicated that:

- the terms of reference (ToR) for the consultants must be provided (see section 2.7 of the RFSR);
- a summary of Eskom's mandate and policies with regards to the proposed project must be elaborated on (see section 4.2 of the RFSR);

- the need and purpose of the PBMR DPP needs to be placed in the context of the suite of energy generation options (see section 4.3.7 of the RFSR);
- the rationale for the evolution in the PBMR design from 302 MW(t) to 400 MW(t) must be provided (see section 4.6 of the RFSR);
- the proposed size of the PBMR DPP must be clearly explained and motivated (see section 4.6 of the RFSR);
- a motivated rationale of what needs demonstration in the PBMR DPP must be expanded on and made more prominent (see section 4.8 of the RFSR);
- the history of tested and untested parts of the PBMR technology and the DPP must be discussed in more detail in the RFSR (see section 4.8.1 of the RFSR);
- the legal implication of changeover from a demonstration plant to a commercial plant must be dealt with in the EIR (see section 7.7 of the RFSR);
- the RFSR should explain the relationship between Eskom and the PBMR company, in order to allay public fears of misuse of tax-payers' money (see section 4.11 of the RFSR); and
- the fate of financial investment in the PBMR DPP should be explained in the EIR, in terms of future economic pathways (potential costs and benefits to the country). Please refer to section 7.7 of the RFSR.

1.4.1 INVOLVEMENT OF INTERESTED AND AFFECTED PARTIES (IAPs)

The following aspects were required:

- the comments of the authorities and IAPs on the RFSR must be incorporated into the RFSR and the PoS for the EIA (please refer to sections 7.3 and 8.7 of the RFSR);
- the views of affected national departments (e.g. Trade and Industry, Public Enterprises, Science and Technology) must be obtained and included into the EIR (see section 7.7 of the RFSR); and
- the relevant local and provincial authorities must be engaged more assertively (i.e. City of Cape Town, Provincial Planning Department) on policies and planning frameworks and the consistency thereof with the proposed PBMR DPP (see section 7.7 of the RFSR).

1.4.2 CONSIDERATION OF ALTERNATIVES

Regarding the issue of alternatives, the following were indicated:

- the NO-GO option must be recorded in the RFSR and assessed in the EIR (see section 6.6 of the RFSR);
- a comparative evaluation on technologies must be more comprehensively provided with a rationale on the merits of the PBMR DPP. Full motivation must be provided should the alternative technologies be scoped out (please refer to section 6.4 of the RFSR); and

- a defensible rationale for the scoping-out of site alternatives must be provided in the RFSR (see section 6.5 of the RFSR).

1.4.3 SCOPING PROCESS AND REPORTING

In this regard it was required that:

- the RFSR must contain a consistent trail of issues that will be categorized and coded (e.g. health, safety, technical, etc) and that will cross reference the destination of the issue i.e. carried forward to the EIR or closed out with a motivated reason (see section 7.3 of the RFSR);
- issues that are scoped out (excluded) from the EIA, must be motivated (see section 7.4.2 of the RFSR and the issues register (section 8.7);
- relevant issues from the 302 MW(t) must be included in the RFSR and unclosed issues must be carried forward to the PoS for EIA. Please refer to the issues register (section 8.7 of the RFSR);
- the revised PoS for EIA must clearly address the ToR for specialist study and input and be in accordance with the Western Cape guideline series for specialist studies and the DEAT's requirements. Please refer to the revised PoS for EIA, which is attached to this RFSR);
- a baseline study of the current incidence of childhood leukaemia in Cape Town should be undertaken as part of the EIA (see 7.3.6 of the RFSR); and
- the RFSR must rectify the reference to the "official review panel" and clearly delineate the role of the DEAT (see sections 1.2 and 1.3 of the RFSR).

1.4.4 QUALITY ASSURANCE

It was also indicated that details of the qualifications, experience and professional registration of individual consultants and specialist peer reviewers should be included in the RFSR and EIR documentation, as relevant (see sections 2.7 and 8.14 of the RFSR).

1.5 YOUR COMMENT

Your comment on any aspect of this RFSR or the proposed project is a very important part of the EIA process. The comment period extends from 8 **January 2007, to 8 February 2007**. Please note that if you have already commented on the previous scoping report, those comments will have been addressed in this RFSR, or will be carried through to the EIA phase, as appropriate.

CHAPTER 2: APPROACH TO THE EIA

2.1 INTRODUCTION

The legal requirement for conducting an Environmental Impact Assessment (EIA) is driven by the listing of set of activities deemed to have the potential to impact on the environment. The generation of electricity is one of several listed activities relative to the proposed PBMR DPP that invokes the need for an EIA. In this Chapter the EIA process that is being conducted for the proposed PBMR DPP is presented and detailed. This presentation takes the form of a more detailed description of the legal and regulatory framework that defines the need for and process of EIA, the role of South Africa's pre-eminent environmental legislation, namely the National Environmental Management Act and the process that will be used in response to these various requirements.

Additional regulatory requirements that are relevant to the proposed PBMR DPP are also presented together with specific reference to the requirements that govern nuclear facilities. Finally reference is made to the previous EIA process and its outcome before the consultant's terms of reference are presented together with an overview of the consultants and their experience.

2.2 THE REGULATORY FRAMEWORK FOR EIA

2.2.1 EIA REGULATIONS

The process by which an Environmental Impact Assessment (EIA) must be completed is defined in 'EIA regulations'. Since 1997, these regulations (published in Government Notice R1182, R1183 and R1184 of 1997) were structured and housed within the Environmental Conservation Act (ECA) (Act No. 73 of 1989). However, in July 2006 the ECA regulations were replaced with new regulations (as published in Government Notice No. R385, R386 and R387 of 2006, which came into effect on 21 April 2006) structured and housed within the National Environmental Management Act (NEMA) (Act no 107 of 1998). The original application for the proposed PBMR DPP, was submitted within the context of the ECA EIA regulations, and it is thus within these regulations that the EIA is now being conducted. However, in recognition of the new (NEMA) regulations, the EIA process is being structured to uphold as far as possible the spirit of the new regulations.

2.2.2 THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT

The National Environmental Management (NEMA) provides 'the legal framework for implementing the state's constitutional obligations with regard to environmental management' (NEMA, 2003). A key element of NEMA is that it includes a defined set of principles for decision-making on proposed activities that could affect the environment. These principles provide a well-defined framework for effecting sound environmental management and indeed upholding and promoting sustainable development.

The National Environmental Management Act (Act no 107 of 1998) provides for a broad environmental management framework and a set of principles to be adhered to, to ensure an environmentally responsible development undertaking.

Given that these principles serve to provide an overarching environmental management framework it will be important to examine the degree to which the proposed PBMR DPP upholds or detracts from the relevant NEMA principles.[1] These NEMA principles are quoted below, as well as a description of the implementation of these principles in the EIA process.

- Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably.
- Development must be socially, environmentally and economically sustainable.
- Sustainable development requires the consideration of all relevant factors including the following:
  - that the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimized and remedied;
  - that pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimized and remedied;
  - that the disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided, or where it cannot be altogether avoided, is minimized and remedied;
  - that waste is avoided or where it cannot be altogether avoided, minimized and re-used or recycled where possible and otherwise disposed of in a responsible manner;
  - that the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;
  - that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardized;

[1] Taken from the NEMA, 1998

    - that a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and
    - that negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimized and remedied.
- Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option.
- Environmental justice must be pursued so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons.
- Equitable access to environmental resources, benefits and services to meet basic human needs and ensure human well-being must be pursued and special measures may be taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination.
- Responsibility for the environmental health and safety consequences of a policy, program, project, product, process, service or activity exist throughout its life cycle.
- The participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation and participation by vulnerable and disadvantaged persons must be ensured.
- Decisions must take into account the interests, needs and values of all interested and affected parties, and this includes recognizing all forms of knowledge, including traditional and ordinary knowledge.
- Community wellbeing and empowerment must be promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means.
- The social, economic and environmental impacts of activities, including disadvantages and benefits must be considered, assessed and evaluated and decisions must be appropriate in the light of such consideration and assessment.
- The right of workers to refuse work that is harmful to human health or the environment and to be informed of dangers must be respected and protected.
- Decisions must be taken in m open and transparent manner and access to information must be provided in accordance with the law.

- There must be intergovernmental co-ordination and harmonization of policies, legislation and actions relating to the environment.
- Actual or potential conflicts of interest between organs of state should be resolved through conflict resolution procedures.
- Global and international responsibilities relating to the environment must be discharged in the national interest.
- The environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage.
- The costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimizing further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment.
- The vital role of women and youth in environmental management and development must be recognized and their full participation therein must be promoted.
- Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

The principles are also important in guiding the EIA process, specifically in terms of:

- the participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation and participation by vulnerable and disadvantaged persons must be ensured;
- decisions must take into account the interests, needs and values of all interested and affected parties, and this includes recognizing all forms of knowledge, including traditional and ordinary knowledge;
- the social, economic and environmental impacts of activities, including disadvantages and benefits must be considered, assessed and evaluated and decisions must be appropriate in the light of such consideration and assessment;
- decisions must be taken in an open and transparent manner and access to information must be provided in accordance with the law.

From the initiation of the Scoping Process of the EIA for the proposed PBMR DPP the above principles where considered as the guideline for process design and execution. This EIA process is driven by the issues raised by IAPS during the extensive consultation process that were followed. The consultation process build on the capacity building process that was part of the EIA for the 302 MW(t) PBMR. During this capacity building process all potentially disadvantaged communities were engaged in forums with the specific purpose to expand the understanding of these communities regarding nuclear and its issues. Therefore the affected communities have a capacity to engage in this process. The Public Participation Process is designed to afford all IAPS an opportunity to raise issues and concerns at a forum best suited for its specific needs. Access to information is also facilitated by the utilisation of various media (print and electronic) to distribute information.

An extensive social Impact Assessment is included in the scope of the EIA. The EIA process assesses all relevant social, environmental and economic issues related to the proposed PBMR DPP. consideration of the factors mentioned below as descriptive of sustainable development are included in the terms of reference of specialist studies and assessments to be performed in the EIA phase.

A specific deliverable of the EIA phase is an Environmental Management Plan (EMP). The EMP will consider the best environmental option for the mitigation and management of impacts associated with the proposed PBMR DPP and will be based on the assessment outcomes of the EIA, inclusive of synergistic impacts.

Health and Safety, and financial provisions for the mitigation and lifecycle management of impacts are aspects to be assessed in the EIA phase and reported on in the EIR. The assessment of Health and Safety issues and consideration of the assessment is also the specific topic of a co-operative agreement between the DEAT and the NNR. This EIA is performed within the guidelines of the said agreement and NEMA with regard to this specific issue.

2.2.3 EIA PROCESS REQUIREMENTS

The EIA process defined in the applicable ECA regulations is presented schematically in Figure 2.1.

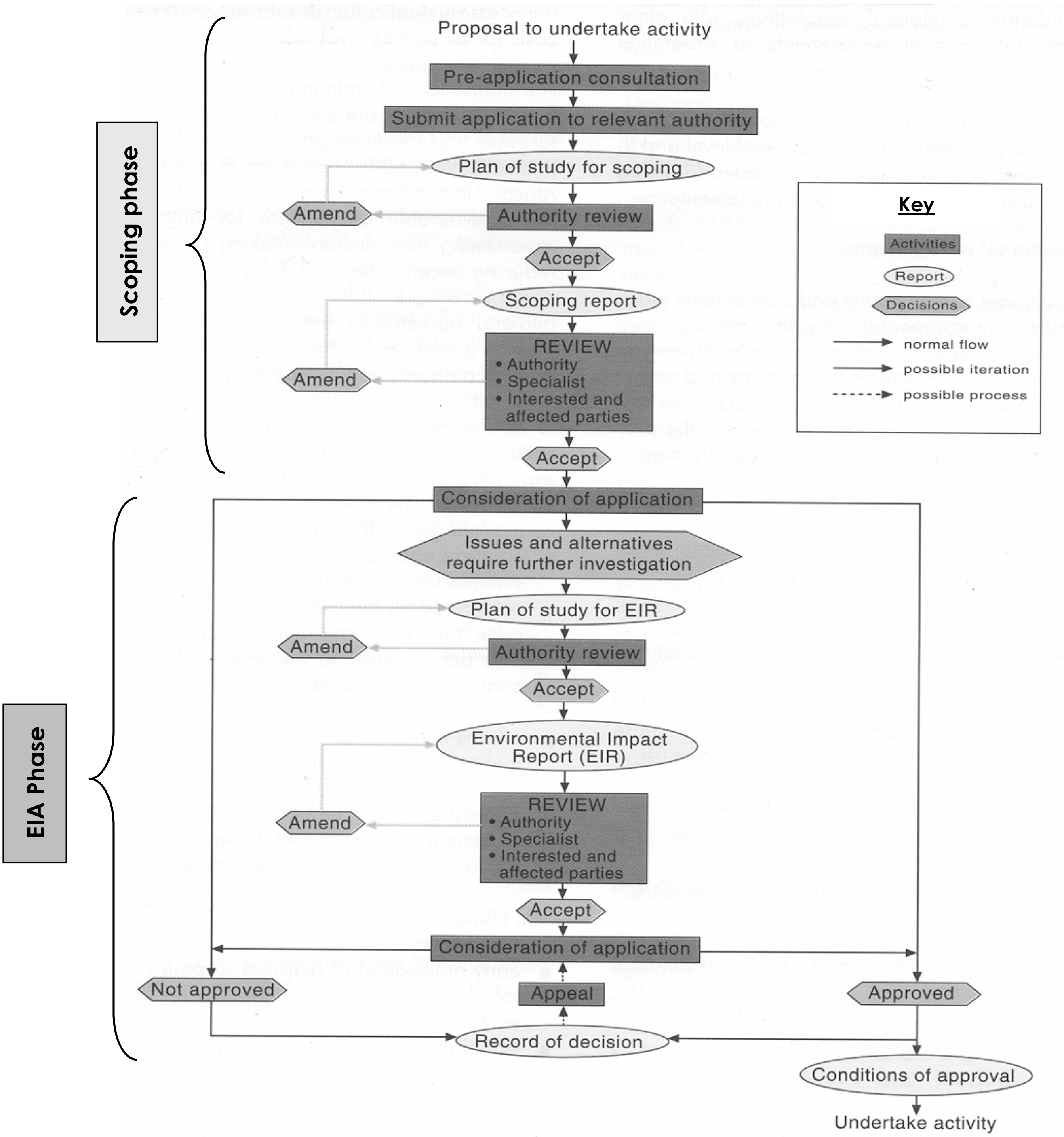

Figure 2-1: The Environmental Impact Assessment Process

In reference to Figure 2-1, provision is made for the completion of Scoping (summarised in a Scoping Report) and a detailed assessment of the potential environmental impacts of the proposed PBMR DPP (summarised in an Environmental Impact Report (EIR)). The process also makes provision for detailed consultation with interested and affected parties to ascertain their views, questions, concerns and other issues as these pertain to the proposed development. These issues are driven by a presentation of the proposed development and a process in which opportunity is created for IAPs to be identified and invited, to participate in the process. Furthermore they may submit their various issues on the proposed development. In broad terms this element of the EIA process is defined as Scoping, and this is described in more detail in the section that follows.

a) Scoping

The purpose of Scoping is to define the scope of the detailed assessment that will form the core of the EIA process. That scope is defined as a function of the various issues raised by participating stakeholders as well as the general understanding of the key potential impacts that are known to be associated with the proposed development. The requirements for scoping are to:

- identify the scope of the project in terms of the EIA requirements;
- identify viable or feasible alternatives to the project or subcomponents thereof;
- gather background information regarding the location, local conditions and the environmental requirements of the proposed project;
- identify interested and affected parties (IAPs);
- provide IAPs with information regarding the proposed project;
- identify the issues, concerns and information requirements of IAPs; and
- compile a scoping report that includes the following information:
  - a brief project description;
  - a brief description of how the receiving environment may be affected;
  - a description of the environmental issues identified (this includes the issues raised by IAPs) and which issues should be further studied, considered and assessed during the EIA phase;
  - a description of all alternatives considered;
  - a description of the public participation process followed; and
  - a description of the terms of reference for the Environmental Impact Report (EIR).

In summary, once completed, Scoping serves to provide the scope of the detailed assessment that will be conducted and presented as the Environmental Impact Report (EIR). Before describing the impact assessment phase it is necessary to reflect that the scoping phase for the 400 MW(t) PBMR DPP took cognisance of the issues and aspects raised during the 302 MW(t) PBMR scoping phase and the specialist studies completed during the previous EIA process. These issues and aspects, where relevant, have been considered and integrated with the issues and comments identified/raised during the scoping process for the 400 MW(t) PBMR DPP. The key issues that were identified during the scoping process are discussed in section 7.3 of the FRSR and will provide the basis for the Plan of Study for the EIA.

b) The impact assessment

In this stage of the EIA process, the scope of work defined in the scoping phase is executed. This sees detailed investigations being undertaken by appointed specialists with a view to providing objective, professional opinion on the issues at hand. Impacts are identified as a function of environmental aspects of the proposed activity and these are considered within the context of the receiving environment. On this basis possible impacts are identified and the significance of the impacts assessed. The approach to conducting the assessments is described in more detail in Chapter 7. The assessment findings are summarised and presented in an environmental impact report (EIR). The EIR is then presented to participating stakeholders for their review, after which the document is finalised by responding to and addressing comments that have been received. The impact assessment stage is the penultimate stage of the EIA process and is followed by decision-making on the acceptability or otherwise of the proposed development.

2.3 ADDITIONAL REGULATORY REQUIREMENTS

2.3.1 STATUTORY FRAMEWORK APPLICABLE TO THE PROPOSED PBMR DPP

Further to the applicable legislation for an EIA, namely ECA and NEMA several other acts, regulations, treaties and policies apply to this particular proposed study. These include, *inter alia*:

a) Acts

Name of Act	No and Date:	Departments
The Constitution of South Africa	Act 108 of 1996	Office of the State President
Atmospheric Pollution Prevention Act	Act 45 of 1965	Environmental Affairs and Tourism
Air Quality Act, 2004	2004 (in force 11/09/05)	Environmental Affairs and Tourism
Disaster Management Act	Act 57 of 2002	Provincial Government, Local Authority.
Electricity Act	Act 41 of 1987	Public Enterprises
Hazardous Substances Act	Act 15 of 1973	Labour and Industry
National Heritage Resources Act	Act 25 of 1999	South African Heritage Resources

Name of Act	No and Date:	Departments
		Agency
National Building Regulations and Building Standards Act	Act 103 of 1977	Labour, Local Authority.
National Key Points Act	Act 102 of 1980	Public Enterprises
National Nuclear Regulator Act	Act 47 of 1999	Minerals and Energy
Nuclear Energy Act	Act 46 of 1999	Minerals and Energy
National Roads Traffic Act	Act 94 of 1996	Transport
National Water Act	Act 36 of 1998	Water Affairs and Forestry
Occupational Health and Safety Act	Act 85 of 1993	Labour
Physical Planning Act	Act 135 of 1991	Land Affairs
Promotion of Access to Information Act	Act 2 of 2000	Justice
Seashore Act	Act 21 of 1935	Environmental Affairs and Tourism

In addition to the national statutes (acts and regulations) a number of provincial and local authority regulations/ordinances must be satisfied, particularly those related to land-use planning, economics and service provision. These include Land Use Planning Ordinance (Ordinance 15 of 1985) and Local By-laws.

b) Regulations

The following regulations are applicable:

- the EIA regulations contained in Government Notice, 1183, as published in the Government Gazette of 5 September 1997 as amended;
- national road traffic regulations as published in the Government Gazette of 17 March 2000; and
- regulations for the safe transport of radioactive material (IAEA No. TS-R-1) (ST-1 revised).

c) Treaties/conventions

South Africa, as a responsible member of the world community, has become a signatory to a variety of international agreements, dealing with issues such as marine conservation and pollution, whaling, the atmosphere, fauna and flora, biodiversity, Antarctica, and the conservation of wetlands. These conventions place specific environmental impact management requirements and obligation on the South African Government in complying with the aims and objectives of these conventions. In cases where the proposed undertaking of an identified activity may influence or affect compliance with these conventions or is likely to have a significant detrimental effect across South Africa's international boundaries, special procedures and EIA requirements may be required. Relevant treaties include:

- National Nuclear Non-Proliferation Treaty enacted by the Nuclear Energy Act; and
- The Basel Convention on Trans-boundary Waste Transport.

d) Policies

The following policies are applicable:

- the White Paper on the Energy Policy of the Republic of South Africa issued on 17 December 1998;
- the Western Cape's White Paper on "Preparing the Western Cape for the Knowledge Economy of the 21st Century" which sets out the Western Cape's vision and policy on *inter alia* sustainable development; and
- the National Radioactive Waste Management Policy.

The different authorities that administer these Acts/Regulation/Treaties/Policies each have their own unique processes for approval and governance. The environmental authorisation process (i.e. the EIA) is only one of these processes and not an all-embracing or final approval process. Approval by one authority does not automatically entail approval by another authority.

To ensure diligent governance, the government has decided that the National Cabinet will, in addition to the other compliance processes, jointly decide on the progressive development of the project. This will provide the public with further assurance on diligent governance.

2.4 THE APPLICANT AND THE APPLICATION

2.4.1 APPLICANT

Eskom Holdings Limited is the applicant for the activity.

2.4.2 THE APPLICATION

An application form and checklist was submitted to the Western Cape Province, Department of Environmental Affairs and Development Planning (WC DEA&DP) in terms of Section 21, 22, 26 and 28A of the Environment Conservation Act, (Act No. 73 of 1989).

The section 28A exemption application that was initially submitted with the application was withdrawn after consultation between the consultants and Eskom. The application includes information concerning the applicant, the proposed project and activities applied for (see listing below) as well as the independent project consultants and their CVs. A declaration of independence from the consultants was included in the application.

A plan of study for scoping was submitted to the Department of Environment Affairs and Tourism. Provisional approval for this plan of study was received on 8 November 2005. The Department of Environmental Affairs and Development Planning (DEA&DP) reference is **E12/2/1-AC4-ESKOM FARM DUYNEFONTEIN NR 34, CAPE TOWN**.

2.4.3 ACTIVITIES IN TERMS OF THE ENVIRONMENTAL CONSERVATION ACT, 1989

In terms of Government Notice R1182 (Schedule 1), the proposed 400 MW(t) PBMR DPP and associated infrastructure involve the following listed activities:

Activity 1. The construction, erection or upgrading of:

(a) facilities for commercial generation with an output of at least 10 megawatts and infrastructure for bulk supply;

(b) nuclear reactors and facilities for the production, enrichment, processing, reprocessing, storage or disposal of nuclear fuels and wastes;

(c) with regard to any substance which is dangerous or hazardous and is controlled by national legislation:

(ii) manufacturing, storage, handling, treatment or processing facilities for any such substance;

(d) roads, railways, airfields and associated structures;

Activity 2. The change of land use from:

a) agricultural or zoned undetermined use or an equivalent zoning to any other land use;

Activity 9. Scheduled processes listed in the Second Schedule to the Atmospheric Pollution Prevention Act, 1965 (Act No. 45 of 1965):

29. *Power generation processes:* That is to say, processes in which:

a) any fuel burning appliance is used that is not controlled in terms of Part III of this Act, excluding appliances in private dwellings.[2]

2.4.4 ACTIVITIES IN TERMS OF NEMA, 1998

Activities in terms of Section 24(2)(a) and (d) and 24D of the NEMA, 1998 and Regulations 386 and 387 of 21 April 2006 are:

a) Regulation 386

Activity 13 The abstraction of groundwater at a volume where any general authorisation issued in terms of the National Water Act, 1998 (Act No. 36 of 1998) will be exceeded.

Activity 16 The transformation of undeveloped, vacant or derelict land to-

(a) establish infill development covering an area of 5 hectares or more, but less than 20 hectares; or

(b) residential, mixed, retail, commercial, industrial or institutional use where such development does not constitute infill and where the total area to be transformed is bigger than 1 hectare.

b) Regulation 387

Activity 1 The construction of facilities or infrastructure, including associated structures or infrastructure, for-

(a) the generation of electricity where-

(i) the electricity output is 20 megawatts or more; or

(b) nuclear reaction including the production, enrichment, processing, reprocessing, storage or disposal of nuclear fuels, radioactive products and waste;

(c) any process or activity which requires a permit or license in terms of legislation governing the generation or release of emissions, pollution, effluent or waste and which is not identified in Government Notice No. R386 of 2006;

(d) the transmission and distribution of above ground electricity with an capacity of 120 kilovolts or more;

Activity 5 The route determination of roads and design of associated physical infrastructure, including roads that have not yet been built for which routes have been

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[2] This activity is related to the Diesel-generator, which is used as an auxiliary power source and will only be used during power failures on the electricity network. It is not related to the primary generation of electricity.

determined before the publication of this notice and which has not been authorised by a competent authority in terms of the Environmental Impact Assessment Regulations, 2006 made under section 24(5) of the Act and published in Regulation 385 of 2006, where –

a) it is a road administered by a provincial authority

b) the road reserve is wider than 30 meters; or

c) the road will cater for more than one lane of traffic in both directions.

Activity 9 Construction or earth moving activities in the sea or within 100 meters inland of the high water mark of the sea, excluding an activity listed in item 2 of Government Notice No. R386 of 2006 but including construction or earth moving activities in respect of-

(a) facilities associated with the arrival authority in and the departure of vessels and the handling of cargo;

(b) tunnels.

2.5 NUCLEAR GOVERNANCE

The National Nuclear Regulator Act (Act 47 of 1999) provides for the regulation of nuclear activities. The National Nuclear Regulator (NNR) was established to exercise legislated regulatory control and assurance

The National Nuclear Regulator Act (Act No. 47 of 1999) authorises the NNR to:

(a) provide for the protection of persons, property and the environment against nuclear damage through the establishment of safety standards and regulatory practices;

(b) exercise regulatory control related to safety over-

(i) the siting, design, construction, operation, manufacture of component parts, decontamination, decommissioning and closure of nuclear installations; and

(ii) vessels propelled by nuclear power or having radioactive material on board which is capable of causing nuclear damage, through the granting of nuclear authorisations;

(c) exercise regulatory control over other actions, to which this Act applies, through the granting of nuclear authorisations;

(d) provide assurance of compliance with the conditions of nuclear authorisations through the implementation of a system of compliance inspections;

(e) fulfil national obligations in respect of international legal instruments concerning nuclear safety; and

(f) ensure that provisions for nuclear emergency planning are in place.

These safety standard and regulatory practices typically include the following aspects:

- risk criteria addressing risk to public and workers;
- radiation dose limits to the public and radiation workers under various operational scenarios i.e. category a, b and c events;
- fundamental safety principles including as-low-as-reasonably-achievable (ALARA) and defence-in-depth; and
- general safety principles related to international standards and requirements for emergency planning.

The South African radiological safety/health and environmental standards are also based on the standards and norms of the International Atomic Energy Agency (IAEA).

Subject to the NNR board's approval, the Chief Executive Officer (CEO) may:

- refuse an application for a nuclear installation licence and must provide the applicant with the reasons for the refusal in writing; or
- grant an application for a nuclear installation licence, subject to specified conditions.

2.5.1 INTERDEPARTMENTAL COLLABORATION BETWEEN THE DEAT AND THE NNR

At the outset of the EIA, the Department of Environmental Affairs and Tourism (DEAT) as the lead authority on environmental matters, and the National Nuclear Regulator (NNR) agreed to work in close collaboration regarding the assessment of nuclear related matters associated with the project.

As a result a written and signed **cooperative agreement** was established between the departments, a copy of which is attached as section 8.14 . The relationship between the EIA and NNR processes is also indicated.

The scoping report reflected numerous nuclear safety and radiological issues that were raised by IAPs, and, which will be dealt with in terms of this agreement. Such issues will finally be authorised in terms of the National Nuclear Regulator Act (Act No. 47 of 1999).

The cooperative agreement gives the framework within which the DEAT will consult the NNR on issues related to radiological aspects of the proposed PBMR DPP. In principle this framework provides for the consultation of the NNR by DEAT on specific issues. Please note that the decision gates indicated in Figure 2-2 are not joint decision gates and do not necessarily coincide.

The NNR will provide the DEAT with a response to specific questions put forward by DEAT. However, the responsibility to decide on the assessment contained in the EIR on the radiological issues remains with the DEAT. Therefore the consultants will provide DEAT with comprehensive and complete arguments related to the radiological Health and Safety aspects of the proposed PBMR DPP. The above is illustrated by Figure 2-2.

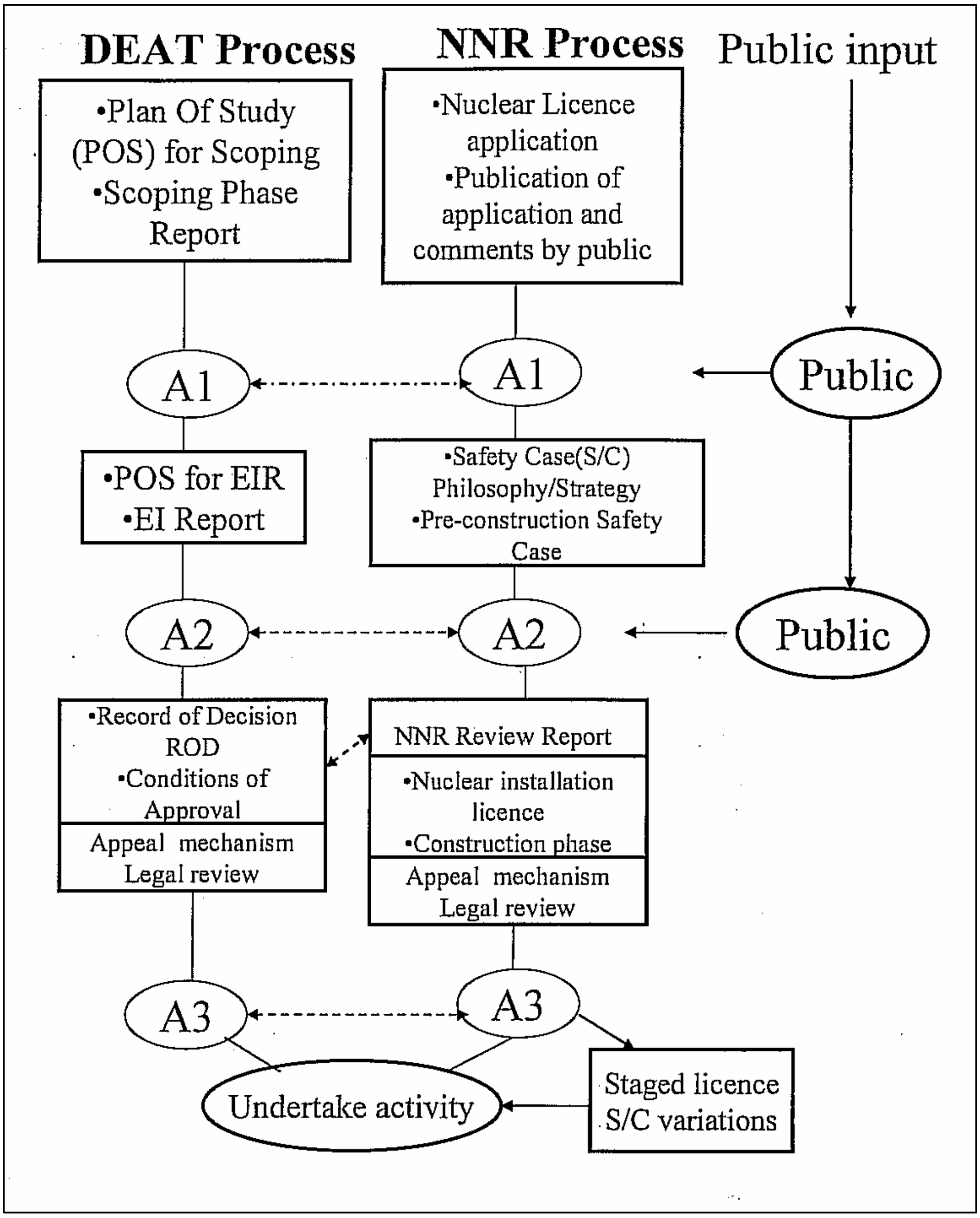

Figure 2-2: Diagram illustrating the DEAT/NNR interaction regarding the radiological Health and Safety aspects of the proposed PBMR DPP

2.5.2 OTHER NUCLEAR GOVERNANCE ASPECTS

Under the Nuclear Energy Act (Act No. 46 of 1999) the authority over institutional nuclear obligations including nuclear non-proliferation is vested in the Minister of Minerals and Energy. The Nuclear Energy Act, Act No. 46 of 1999, addresses the issue of non-proliferation of nuclear weapons.

The Nuclear Energy Act implements South Africa's commitments with respect to the Treaty on the Non-Proliferation of Nuclear Weapons acceded by the Republic on 10 July 1991 and the allied Safeguards Agreement that has been entered into between South Africa and the IAEA. The Minister of Minerals and Energy is accountable and responsible for all safeguards, but may delegate all or part of this function. Partial delegation, to NECSA, has been implemented.

In addition to the above, the Minister of Minerals and Energy must also provide written approval for the transport and disposal of nuclear materials/waste in terms of the Nuclear Energy Act (Act 46 of 1999). This provides a multiple system of checks and balances, to safeguard the public and the environment particularly against radiological damage.

2.6 THE PREVIOUS EIA

2.6.1 BACKGROUND TO THE PREVIOUS EIA

Eskom, in 1999, commissioned a consortium of independent consultants to conduct an environmental impact assessment (EIA) for a 302 MW(t) PBMR DPP, which concluded with the submission of the final environmental impact report to the Department of Environmental Affairs and Tourism (DEAT) in October 2002. The Director-General of the DEAT issued a favourable record of decision (RoD) in June 2003.

Appeals were lodged against the record of decision. The Minister did not rule on these appeals.

An application was also brought before the Cape of Good Hope High Court on behalf of Earthlife Africa (Cape Town). This application sought to have the record of decision issued by the DEAT DG on 25 June 2003 reviewed and set aside. Judgement was handed down on 26 January 2005, which ruled in favour of Earthlife Africa (the applicant) and set aside the record of decision.

In addition, it required the DEAT DG " …. *to afford the applicant (Earthlife Africa) and other interested parties an opportunity of addressing further written submissions to him along the lines as set out in the judgement and within such period as he may determine and to consider such submissions before making a decision anew on the second respondent's (Eskom) application*."

2.6.2 THE NEW APPLICATION & EIA PROCESS

Following the High Court Order, a number of meetings between DEAT and Eskom were held.

- Firstly, to determine the process that will be required to implement the Court order; and,

- secondly, on how to introduce the evolved PBMR DPP design. The design evolved from a 302 MW(t) to a 400 MW(t) reactor with a horizontally configured turbine-generator.

Both DEAT and Eskom sought legal opinion, which found that Eskom should submit a new application for an environmental impact assessment for the evolved design. From the onset of the new EIA process, the Consultants discussed the authority requirements for the new application at a joint meeting between the DEAT, the Western Cape, the Free State, the Northwest and Kwa-Zulu Natal environmental authorities. Specific attention was given to the application procedure and the roles of the provincial environmental authorities.

It was agreed that the new application was to be completed and submitted on the pro-forma application of the Western Cape Department of Environmental Affairs and Development Planning. It was submitted to them and the DEAT, respectively, as the primary commenting and lead authority for the evolved design of the PBMR DPP.

Agreement was furthermore established that the new application and Record of Decision (RoD) will be considered and issued in terms of the Environmental Conservation Act, Act 73 of 1989 (ECA) and the related Regulations.

In view of the impending regulations (that came into force on 21 April 2006) in terms of the National Environmental Management Act, Act 107 of 1998 (NEMA), Eskom, as a state owned enterprise, was sensitized on their obligations towards the Act. The current EIA process and Reports will therefore ***demonstrate the consideration and application of the NEMA*** in its deliberations.[3]

2.7 TERMS OF REFERENCE OF THE CONSULTANTS

Eskom appointed the firm Mawatsan to conduct the EIA for the PBMR DPP in accordance with the requirements of the ECA (73 of 1989) and the associated regulations and other relevant legislation.

Terms of Reference (ToR) of the Consultants:

- to discharge the duties in line with the principles set out in Section II of the National Environmental Conservation Act, Act 73 of 1989;
- to adhere to the Integrated Environmental Management principles while undertaking the EIA;

[3] NEMA, 2003: The National Environmental Management Amendment Bill, Government Gazette No. 25052, 3 June 2003.

- to produce the required Reports (Information document(s), Scoping Reports and Environmental Impact Reports and a high level EMP) and lodge them with the authorities and IAPs in convenient public places;
- to compile an Issues Report (for Scoping) and a Comments Report (for the EIR); and
- on receipt of the record of decision (RoD) inform IAPs of the DEAT's decision.
- to ensure due process during all stages of the EIA from application through to termination of the Appeal period;
- to consult with and provide information to IAPs and the relevant authorities (national, provincial and local) on a continuous basis;
- to consider alternatives and the need for application for exemption for the relevant parts of the EIA;
- ensure the validity of, or alternatively, the updating of existing information that pertains to the EIA studies conducted for the 302 design; and
- advise Eskom on procedural and legal issues with regards to the EIA process and other applicable legislation.

Mawatsan appointed the firms of Netrisk (Pty) Ltd and GeoScientific and Exploration Services (GeX) to assist with the EIA within the Eskom ToR

The Curriculum Vitae of the principal members who conducted the scoping phase of the EIA is given in Appendix 1. These persons are:

- Mawatsan:

  Dr. David de Waal. Dr. de Waal holds a doctorate in social sciences with 24 years of experience in public participation and social impact assessment (SIA).

- Netrisk (Pty) Ltd:

  Mr. Willem Lombaard. Mr. Lombaard holds a masters degree in sciences (occupational health) with 20 years experience in risk assessments and environmental impact assessments.

- GeX:

  Mr. Otto Graupner. Mr. Graupner has 30 years experience in environmental management and impact assessments. He holds an honours degree in natural sciences and wildlife management.

In addition the report was externally peer reviewed by Mr. Sean O'Beirne of SE Solutions (Pty) Ltd who has some 16 years experience in environmental impact assessment.

The CVs of the EIA team is provided in section 8.15 of the RFSR. The CVs of specialist consultants and their subject of specialization will be provided in the Environmental Impact Report.

CHAPTER 3: PUBLIC PARTICIPATION

A comprehensive public participation process was implemented during the scoping phase of the project. The focus was on informing IAPs of the proposed development and of the significant differences between the 302 MW(t) and 400 MW(t) PBMR DPPs. Issues raised during the public participation process for the 302 MW(t) PBMR DPP have been collated and incorporated into the scoping phase of the current process.

3.1.1 COMPONENTS OF THE PUBLIC PARTICIPATION PROCESS

The public participation process consisted of the following activities:

- **advertisements** in national, regional and local news papers;
- **notification** of IAPs regarding the EIA process, consultation activities, and availability of reports and decisions by the authorities using a variety of mechanisms;
- **interviews** with a variety of IAPs with respect to the PBMR demonstration plant;
- **focus group meetings** with relevant sectoral groups (groups of role-players with similar interests, such as the business sector, tourism, agriculture, local government, etc.); and
- **public meetings** which were widely advertised. These provided IAPs with project information, an opportunity to record concerns, issues and suggestions, as well as to identify other IAPs.

3.1.2 OBJECTIVES OF THE PUBLIC PARTICIPATION PROCESS

The objectives of the public participation process were to:

- inform the public of the environmental impacts associated with the proposed 400 MW(t) PBMR DPP;
- confirm previously identified interested and affected parties (IAPs) and identify new IAPs and key stakeholder groupings;
- disseminate information to IAPs;
- solicit and register IAP inputs on issues/concerns, alternatives and mitigation measures. These inputs were evaluated during the scoping phase and relevant issues were put forward for further investigation in the EIA phase;
- provide feedback to IAPs on the manner in which their views have been taken into account in decision making;
- inform IAPs of the results of the study (i.e. scoping report) and obtain their final comments.

3.1.3 IDENTIFYING STAKEHOLDERS

From the outset, the IAP database built on the database developed for the previous PBMR DPP public participation process. Contact details were verified and updated. In addition, a networking process was used to identify and register additional IAPs. In registering IAPs, due care was taken to ensure that the scope of the project was well defined and that the consultation mechanisms and procedures were clear. Currently, there are 2407 IAPs in the database.

Mawatsan endeavoured to ensure that individuals/organisations from a 'vertical' (institutional) as well as a 'horizontal' (geographical) point of view are identified. Geographically, those IAPs (e.g. residents, community groupings and businesses) located in and immediately around the sites had to be included in the process. A 'vertical' approach was used to identify those institutions or individuals that might be affected by, or could make a contribution to the project, but who are not necessarily in the direct sphere of impact.

Participants that attended any of the public events or meetings or requested specific information, were also entered on the IAP database. The IAP database will be continuously updated throughout the EIA process.

3.1.4 INFORMING STAKEHOLDERS ABOUT THE PROJECT AND SCOPING PROCESS

The following methods were employed to notify IAPs of the proposed project and how they could meaningfully participate:

- **Newspaper advertisements** were employed to notify IAPs of the proposed project and of how they could meaningfully participate:

  Advertisements notifying the public of the EIA process and inviting them to the various public meetings were placed in a number of national, regional and local newspapers. Refer to Table 3-1 for a list of the newspapers and the publication dates.

Table 3-1: Newspaper Advertisements

Newspaper	Date published
Star	1/11/2005
Rapport	30/10/2005
Sunday Times	6/11/2005
Table Talk	3/11/2005
Argus	1/11/2005
Tygerberger Coast	1/11/2005

Newspaper	Date published
Swartland/Weskus Herald	3/11/2005
Burger	1/11/2005
City Vision	3/11/2005
Natal Mercury	1/11/2005
Illanga	3/11/2005
Britspos	4/11/2005
Kormorant	2/11/2005
Beeld	1/11/2005

Depending upon the newspaper, advertisements were placed in English or Afrikaans. Refer to Section 8.1 for copies of the advertisements.

- **On site notice:** Notices were placed at the Koeberg site.
- Existing **community forums** were utilised to inform the local residents of the proposed activity and how to register as an IAP.
- **Atlantis radio** broadcasted invitations to the public meetings.
- **Notices** were sent to all IAPS on the database, to the local municipality, to community organisations and the relevant government authorities. In this regard some 600 e-mails were sent and more than 800 letters posted.
- A **Background Information Document** (BID) was compiled, which contained information about the proposed project and the scoping phase. The BID also contained a form to facilitate registration as an IAP. Copies of the BID were sent to registered IAPs and were also available at the various meetings. Please refer to Section 8.2 for a copy of the BID and Section 8.3 for the comments and registration form.
- A **project website** was developed (refer to www.pbmr-eia.co.za) and IAPs were advised of the address. This website contains relevant project documentation, links to appropriate documentation as well as a facility for making comments and IAPs registration.

3.1.5 DISSEMINATION OF INFORMATION

The mechanisms that were employed to notify IAPs about the proposed project and the scoping process (i.e. the newspaper advertisements, posters, written notices, and the BID) were also used to communicate information about the proposed project and the scoping process. In particular, these contained information regarding:

- details of the scoping process and the environmental evaluations that were to be conducted as part of this process;
- details of the public participation process (the dates and venues of public meetings, etc.);
- the role of IAPs, and the steps to be followed to register as an IAP;
- the name and contact details of the public participation facilitator; and
- how and when decisions were to be made, and by whom.

3.1.6 MEDIUM OF COMMUNICATION

The medium of communication and printed information is primarily English.

3.1.7 CONSULTATION MECHANISMS

a) Focus group meetings

Focus group meetings were utilised as a tool for issue-based consultation in order to assimilate issues and concerns raised by IAP groupings. IAPs with similar characteristics and objectives (e.g. businesses) were consulted together in focus groups. The objective was to inform and educate, with the emphasis on making technical information as easily understood as possible.

Focus group meetings were held with the following organisations:

- Afrikaanse Handelsinstituut;
- Wildlife and Environment Society of Southern Africa (WESSA);
- Chambers of Commence and Industry South Africa (CHAMSA;)
- Pelindaba Working Group; and
- Vaalputs community forum.

Minutes of all focus group meetings were recorded, and these were distributed to the attendants of the particular focus group meeting. Please refer to section 8.4 for the minutes of the focus group meetings.

b) Public meetings

A series of public meetings were held. Formal invitations to the public meetings were forwarded to the registered IAPs on the database. An open invitation was also placed in national, regional and local newspapers.

The public meetings served to provide information on the proposed project and the scoping process, and to identify issues and viewpoints. Public meetings were held as follows:

- Cape Town: 9 November 2005 - Milnerton Sports Club, at 18:30;

- Atlantis: 10 November 2005 - Hartebeeskraal Multi Purpose Community Centre at 18:30;
- Midrand: 15 November 2005 - Eskom Convention Centre at 18:30;
- Durban: 17 November 2005 - Durban Exhibition Centre at 18:30.

Formal minutes were compiled for the meetings. Please refer to Section 8.5 for the minutes of the various public meetings.

A second series of public meetings will be held during the public review period for the environmental impact report. In this second round of meetings, the findings, conclusions, and recommendations of the EIR will be presented and the accuracy and appropriateness thereof motivated.

3.1.8 IDENTIFICATION OF ISSUES AND CONCERNS

The following mechanisms have been employed to identify and capture issues and concerns raised by IAPs:

- **Comment sheets.** The BID included a loose reply sheet that IAPs could use to raise initial issues of concern, make suggestions and comment on the proposed public participation process. These comments were incorporated into the issues and response register.
- **Public Meetings and Focus Group Meetings.** During such events, attendants were afforded the opportunity to formally comment on site by raising issues and comments verbally and by filling in a comment sheet. These comments were incorporated into the issues and response register.
- **Written feedback.** IAPs also indicated issues and concerns through the use of the comment sheets, by e-mail and post, etc. All of these comments were incorporated into the issues and response register.

3.1.9 RECORDING AND ANALYSIS OF ISSUES AND CONCERNS

All issues and concerns raised by IAPs were recorded in an issues and response register, which was continually updated. This register described issues raised by IAPs and provided a response. The issues and response register has been incorporated into this scoping report.

The public participation process includes the provision of feedback to IAPs on the manner in which their views have been taken into account in decision making. Two key documents provide such feedback:

- an **issues and response register** in which issues raised by stakeholders during the public participation process have been recorded and response provided; and
- a RFSR, which outlines the issues that will be investigated by specialists during the EIA phase.

A full set of reports have been placed in a number of public places in and around the study area as well as on the project web site for public review. The environmental scoping reports (draft and final) were made available for public review at the following public locations:

ATLANTIS (AVONDALE) LIBRARY Grosvenor Street	**CAPE TOWN (Central Library)** City Hall (Darling Street)	**MELKBOSSTRAND LIBRARY** Merchant Walk (**Duynefontein**)
ATTERIDGEVILLE LIBRARY Mohlaba Street	**DURBAN LIBRARY (2 copies)** City Hall, Smith Street	**MILNERTON LIBRARY (2 copies)** Pienaar Road
BLAAUWBERGSTRAND LIBRARY Andrew Foster Street	**HARTBEESPOORT LIBRARY** Marais Street	**PRETORIA (Mawatsan)** 280 Brooks Street, Brooklyn
JHB (Northcliff) LIBRARY Fir Drive	**TABLE VIEW LIBRARY** Birkenhead Road	**BRITS LIBRARY** City Hall (Van Velden Street)
KOEBERG POWER STATION Visitor's Centre (R27)	**www.pbmr-eia.co.za**	

Stakeholders formally requesting copies of the reports were supplied with an electronic or CD version of the scoping reports. In all, Forty one (41) copies of the CD were distributed to IAPs.

A 30-day period (26 January 2006 to 27 February 2006) was allowed for the public to review the draft report and submit written comments on the contents of the reports. Registered IAPS were notified of the report by e-mail, facsimile or post.

Formal submissions were received from:

- Die Afrikaanse Handelsinstituut;
- City of Cape Town;
- RCH Garbett, CT Garbett, Wat Props Pty, Karee Trust, Itumaleng Farm cc, Professional Aviation Services (Pty) Ltd;
- The Legal Resources Centre – on behalf of Earthlife Africa; and
- The Wildlife and Environmental Society of South Africa.

In addition, a number of IAPs sent notifications requesting us to formally note their objection to or support of the proposed PBMR DPP. These are attached in Section 8.13 .

Once comments were received, the report was updated and the RFSR forwarded to the authorities for their consideration. Copies of the RFSR will be made available in the same public places and website for perusal by the public. Comments received from

IAPs after the submission of the RFSR to the authorities must be addressed to the decision maker (DEAT) and copies submitted to DEA&DP and the consultant.

3.1.10 ADDRESSING CONCERNS ABOUT THE PUBLIC PARTICIPATION PROCESS

The same principle regarding revision of the scoping process will also apply to revisions of the public participation process. Any concerns received from IAPs regarding the process of scoping and public participation will be evaluated and appropriate measures will be put in place after consultation with the relevant authorities. The relevant IAPs will be provided with a response to their concerns. The response will also be circulated to the relevant authorities.

CHAPTER 4: DESCRIPTION OF THE PROPOSED ACTIVITY

4.1 INTRODUCTION

The need for this project is most fundamentally driven by the need to meet the ever-growing demand for electricity in South Africa. In order to understand how Eskom responds to this need it is necessary to understand the regulatory and policy context within which Eskom operates. This policy and regulatory context provides a broad but clearly-defined framework, within which Eskom can and is required, to respond to the continued demand for electricity.

The international status of nuclear power generation is provided and the proposed PBMR technology is then presented against the regulatory, policy and historical background. This includes a description of the technology and the history of its development, together with a description of the fuel, the safety features and the evolution of the design. The requirements for the demonstration plant are then presented before listing the construction and the commissioning activities. The chapter is concluded with an overview of the shareholding in the PBMR (Pty) Ltd. and Eskom's role therein.

4.2 ENERGY POLICY AND ESKOM'S MANDATE

4.2.1 NATIONAL POLICIES AND PLANS

a) White Paper on the Energy Policy of the Republic of South Africa

Development within the energy sector in South Africa is governed by the White Paper on the Energy Policy of the Republic of South Africa (the Energy Policy), published by the Department of Minerals and Energy (DME) in December 1998. The Energy Policy identifies five policy objectives for the energy sector:

- increased access to affordable energy services;
- improved energy governance;
- stimulating economic development;
- managing energy-related environmental and health impacts; and
- securing supply through diversity.

Furthermore, the Energy Policy identifies the need to undertake an Integrated Energy Planning (IEP) process in order to achieve a balance between the energy demand and resource availability, whilst taking into account health, safety and environmental parameters. In addition, the policy identifies the need for the adoption of a National

Integrated Resource Planning (NIRP) approach to provide a long-term cost-effective resource plan for meeting electricity demand, which is consistent with reliable electricity supply and environmental, social and economic policies.

b) Integrated energy plan

The Department of Minerals and Energy (DME) commissioned the Integrated Energy Plan (IEP) during 2003 to provide a framework in which specific energy policies, development decisions and energy supply trade-offs can be made on a project-by-project basis. The framework is intended to create a balance in providing low cost electricity for social and economic development, ensuring a security of supply and minimising the associated environmental impacts. Please refer to Box 4-1 for an overview.

Box 4-1: Overview of the Integrated Energy Plan

The integrated energy plan indicates that:

- energy supply will remain reliant on coal for at least the next two decades;
- diversify energy supply through increased use of natural gas and new and renewable energies;
- continue investigations into nuclear options as a future new energy source;
- promote the use of energy efficiency management and technologies;
- maximise load factors on electricity generation plants to lower levelised lifecycle costs;
- lessen reliance on imported liquid fuels by exploring and developing oil and gas deposits;
- increase existing oil refineries capacity where appropriate rather than greenfields development;
- continue with existing synfuel plants and supplement with natural gas as feedstock;
- new electricity generation will remain coal based with the potential for hydro, natural gas and nuclear capacity;
- ensure environmental considerations in energy supply, transformation and end use;
- promote universal access to clean and affordable energy, with the emphasis on household energy supply being co-ordinated with provincial and local integrated development programmes;
- introduce policy, legislation and regulation for the promotion of renewable energy and energy efficiency measures and mandatory provision of energy data; and
- undertake integrated energy planning on an ongoing basis.

The following conclusions, which are relevant to this project, are extracted from Section 6 of the Integrated Energy Plan:

- Diversification:

  Notwithstanding coal's continued dominance, it is important to diversify energy resources to other energy forms such as natural gas and renewable energies to improve supply security, improve environmental performance and facilitate regional development. This diversification to other energy sources will have associated cost implications that must be traded off against other benefits on a project-by-project basis.

- Nuclear

  The technical and economic feasibility studies into the Pebble Bed Modular Reactor should be completed to determine if it could be a viable future source of electricity generation as well as the possible beneficial role that it could play in the diversification of supply, replacement of fossil fuel as its use diminishes, contributing to the reduction of greenhouse gasses by lowering carbon dioxide emissions and the possibility of establishing a nuclear export industry.

- Electricity Generation

  Coal based electricity generation remains the lowest cost option in the planning horizon. However, there is potential for hydro, natural gas and nuclear generation capacity that will have associated cost implications that must be traded off against other benefits on a project-by-project basis. The use of natural gas to generate electricity should be considered sparingly because of limited reserves and the higher efficiencies obtainable by burning gas directly at the point of application for thermal applications. Moreover, switching from electricity to gas will alleviate the demand on electricity and defer the requirement for increased supply capacity. However, a gas-fired power electricity generation station could provide a base-case for gas to be introduced into a region.

c) National Integrated Resource Plan

In accordance with the Energy Policy, the National Energy Regulator of South Africa (NERSA) developed a National Integrated Resource Plan (NIRP), specifically to address electricity demand and supply scenarios. The objective of the National Integrated Resource Plan (NIRP) is to determine the least cost supply options to the country, provide information to market participants on opportunities for investment in new power stations and evaluate the security of the supply.

The first plan (NIRP1) was completed and published in March 2002. This was subsequently followed in 2004 by an updated plan (NIRP2), which was conducted in two stages, namely a reference case (stage 1) and a risk and sensitivity analysis (Stage 2).

The outcome of the NIRP2 Stage 2 studies show that immediate decisions are required for additional "peaking electricity generating capacity[4]" and "base load electricity generating capacity[5]" from 2006 and 2012 respectively.

NIRP2 includes the PBMR as one of the new supply options (ref: Section 5.4 NIRP2 Reference Case) and also identifies the PBMR amongst the technologies that are being researched and are considered in the screening curve analysis (ref: section 5.4.6 NIRP2 Reference Case).

4.2.2 ESKOM'S MANDATE

The Eskom Conversion Act, 2001 (Act No. 13 of 2001) establishes Eskom Holdings Limited (Eskom) as a State Owned Enterprise (SOE), with the Government of South Africa as the only shareholder, represented by the Minister of Public Enterprises. In terms of the Act, Eskom is obligated to abide by the requirements of the Companies Act, 1973 (Act No. 61 of 1973) (as amended), and the Public Finance Management Act, 1991 (Act No. 1 of 1991) (as amended).

The main object of Eskom, as indicated in the Memorandum of Association required by the Act and the Companies Act, is to "provide energy and related services including the generation, transmission, distribution and supply of electricity, and to hold interests in other entities". The Shareholder Compact signed by Eskom and the representative of the Government of South Africa, as required by the Act, confirms that Eskom's "core business is energy, including generation, transmission, distribution and retail and while other suppliers are being introduced into the system, Eskom remains the critical factor in South Africa's electricity supply"[6].

In order to meet the growing demand for energy, the South African Cabinet decided in October 2004 that Eskom would build at least 70% of the electricity generating capacity required in the next two decades (ref: DPE Minister address to Parliament 15 April 2005).

Eskom is regulated under licences granted by the National Energy Regulator of South Africa (NERSA) in terms of the Electricity Regulation Act, 2006 (Act No. 4 of 2006) and the National Nuclear Regulator (NNR) in terms of the National Nuclear Regulatory Act, 1999 (Act No. 47 of 1999), as well as under authorisations required in terms of other legislation and regulations.

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4 "Peaking electricity generating capacity" refers to power station technology designed specifically to generate electricity during periods of very high demand for electricity, normally on weekdays from 07:00 to 09:00 and 18:00 to 20:00

5 "Base load electricity generating capacity" refers to power station technology designed specifically to generate electricity continuously for all hours.

6 Shareholder Compact 2006/2007 between Eskom and Government, dated 13 July 2006

4.2.3 ESKOM INTEGRATED STRATEGIC ELECTRICITY PLANNING

a) Integrated strategic electricity plan (ISEP)

In support of its mandate, Eskom conducts ongoing and exhaustive studies into future power technologies and energy sources under its integrated strategic electricity plan (ISEP). The most likely future electricity demand, which are based on available resources and long-term Southern African economic scenarios are forecasted. This provides the baseline for Eskom to investigate, and if required, research, develop and demonstrate a wide range of technology options for the generation of electricity to meet that demand.

The demand for electricity is not constant; rather it varies on a 24-hour basis, with peak demand in the early morning and in the late afternoon / early evening. Similarly it varies on a weekly basis, with the demand during the working week being higher than over the weekends. And similarly, the demand in winter is higher than in summer periods.

The generation of electricity is achieved by harnessing different energy sources and applying different technologies. These technologies differ markedly in their generation costs, performance and utilisation characteristics, suitability for the South African environment and state of commercial development. The choice of generation technology is multi-faceted and complicated and is conducted within the context of the South African policy framework, the legal and regulatory framework, and taking into account the required mix of generating technologies to optimally meet the daily, weekly and seasonal variation in demand for electricity.

The ISEP process identifies the timing, quantity and type (base load, peaking) of new electricity generating capacity required over the next 20 years. The planning scenarios are based on an average of 4% growth in demand for electricity over the 20 year period. This equates to the Government target of 6% growth in Gross Domestic Product.

The primary conclusion of the ISEP process indicates that South Africa will require additional peaking electricity generating by 2007 and additional base load electricity generating capacity by approximately 2010. In the longer term (2020 and beyond), the existing power stations will start to come to the end of their economically-viable life, thus requiring their replacement with new power stations.

b) Technology suitability to meet future growth and replacement

There are limited ways in which Eskom can respond to the need to supply base and peak load and there are also limits imposed by the resources that are available within South and Southern Africa.

The base-load demand for electricity in 2005 exceeded 26000 MW for the majority of a typical summer day, exceeded 27000 MW for the majority of a typical winter day, and exceeded 29000 MW for the majority of the day with the maximum demand (please refer Figure 4-1). In November 2006, the daily electricity demand exceeded 29000 MW for the majority of each day, This base load demand implies that an equivalent number of power stations must be available to operate continuously to produce that electricity. However, additional power stations (equivalent to about 15 % of the demand) are expected to be held in reserve in case one or more of the power stations develop a fault and are shutdown for repairs. Thus the total base load capacity that is currently required to meet the demand plus a 15% reserve margin is in excess of 33000 MW. However, additional power stations are also required so that other power stations can be shutdown (for on average 6 – 8 weeks) for planned maintenance and statutory inspections, which increases the required base load capacity. As illustrated by the change from typical summer day of 2005 to November 2006, the required base load capacity will increase as the demand for electricity grows each year. As indicated above, the various planning studies indicate that new base load power stations will be required from approximately 2010 onwards.

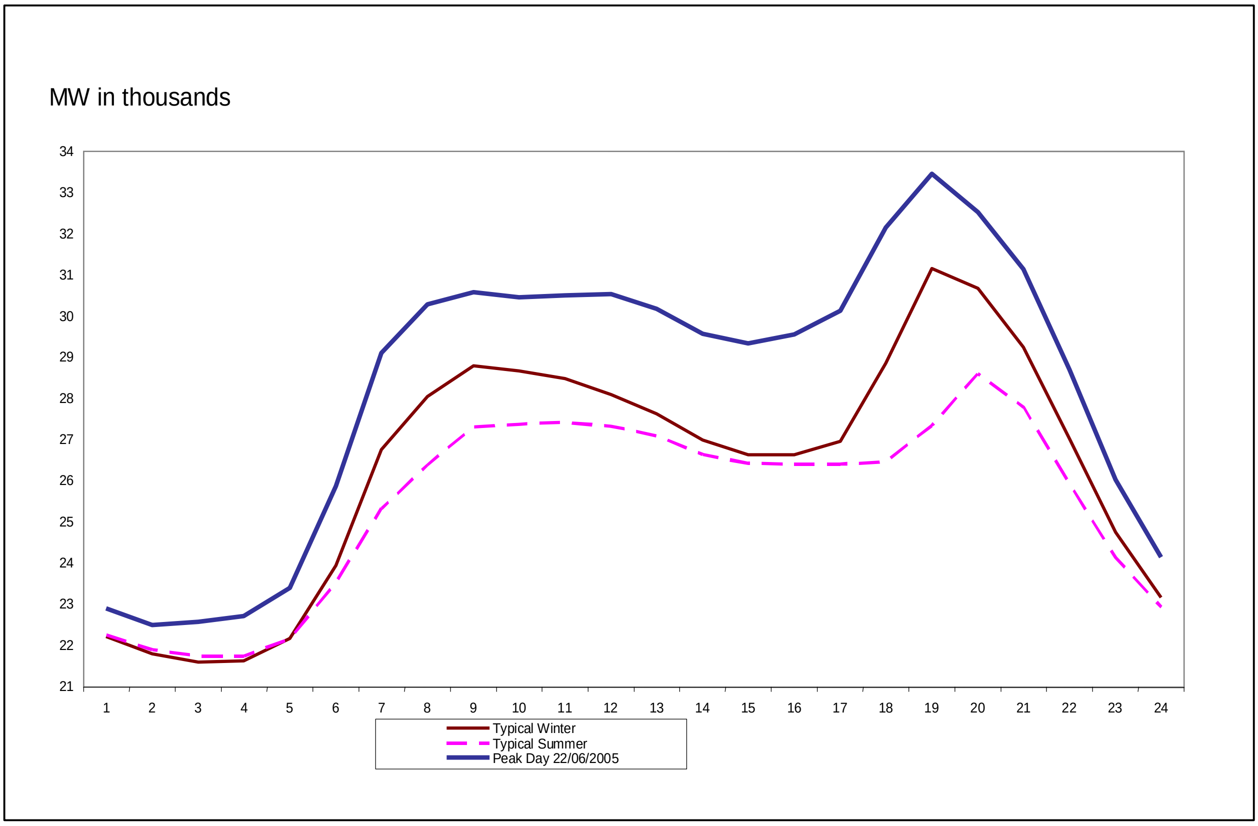

Figure 4-1 Electricity demand patterns

Certain power station technologies are suitable and are optimised for base load supply. In South Africa, the base load capacity currently consists of the coal-fired power stations and a nuclear power station. Other technologies are suitable and optimised for peaking supply – such power stations are capable of starting up from zero output to full output within a matter of minutes. In South Africa the peaking capacity currently consists of hydro- electric power stations, pumped storage schemes and liquid fuel open cycle gas turbines.

Wind and solar renewable energy technologies, that only generate electricity when the wind blows or the sun shines are not dependable base load or peak power supply options, unless appropriate systems for storage of the electricity are available. Currently, apart from pumped storage schemes, no other large-scale (hundreds to thousands of megawatts) system that can store efficiently electricity has been developed internationally. Wind and solar renewable energy sources are thus more suitable as complementary sources of energy that, while they are operating, can reduce the amount of electricity required from other energy sources, but cannot replace the base load and peaking power stations.

South Africa has abundant reserves of coal and uranium, and hence these sources of energy will provide most of the base load capacity required in the future. Natural gas power stations are also under consideration for base load supply. Pump storage schemes and liquid fuel gas turbines are likely to be the primary source of peaking power. Renewable energy sources, such as wind and solar, are being investigated as complementary sources of power.

A number of potential generating technologies are not yet commercially proven, or have not previously been applied in the South African context. Eskom thus undertakes research, development and demonstration (R,D&D) of such technologies to evaluate their viability in the South African energy demand and supply context. Technologies that are currently in the R,D&D programme are discussed in Chapter 6 of the RFSR.

4.3 INTERNATIONAL TRENDS OF NUCLEAR POWER GENERATION

Growing energy needs around the world, rising fossil fuel prices, environmental constraints, and nuclear power performance records are leading to nuclear being considered increasingly as an energy option. The IAEA now projects 423-592 gigawatt (GW(e) – 1000 megawatt) nuclear power installed world wide by 2030, compared to the 366 GW(e) installed by the end of 2004. Nuclear power has grown at the same pace as overall global electricity generation for the past 18 years, and held steady its generating share of 16% of total global generating capacity.

4.3.1 INTERNATIONAL ENERGY TRENDS

In 1993, nuclear power was seen to have limited and declining political and public support in the world. The natural gas-fired power plant was increasingly being viewed as the "rising star" in the power generation sector. Even where there was support for the nuclear option, such as in Japan and France, the presumption was that market needs would be filled by developments of existing nuclear options such as large Light Water Reactors (LWR) and not new technology options. Additionally there was a strong belief that the renewable sources of energy, such as wind, solar and wave power would develop rapidly to provide a substantial and increasingly commercial element in future power generation expansion programmes.

In most first world markets there was still a substantial over-capacity because of the extensive construction programmes initiated in the 1970s, followed by lower than expected growth in the wake of the 1974 oil crisis and the low growth period which existed until the mid 1980s.

In the intervening years, there have been a number of key changes in the power industry.

- The increased use of gas has led to increased volatility in the gas price as infrastructure has not kept up with the demand. Sources and suppliers of domestic gas have been depleted, causing increasing dependence on imported fuels. An example is the projection that the predominant, future sources of gas for Western Europe will be the Russian Federation and Algeria.
- The removal of centralised energy planning has led to increased imbalances in new sources of generating capacity, such as in the USA where over 90% of all new generation is currently planned to be natural gas-fired and the dependence on foreign suppliers has become a serious risk.
- The growing acceptance that climate change is a result of the anthropogenic (i.e. associated with human activities) emissions of green house gases (with carbon dioxide (CO_2) being the primary green house gas emitted by the electricity sector) has led to major opposition to the long term use of fossil fuels.
- Pressure has been exerted on utilities to investigate hydro and other renewable sources. However, the campaign against the large hydro reservoirs, based on the associated environmental and social impact, has intensified simultaneously.
- The economics of renewable energy has improved, but is still not competitive with traditional energy sources. Its limited range of application and slow rate of implementation have, however, led to a realisation that it could not play a substantial role in meeting the world's electricity demand for at least the next 20 years.
- The excess capacity in the first world has been absorbed by the rapid growth in demand during the 1990s. The most obvious examples are those of California in 2001, but similar trends are becoming evident in many other countries.
- The low electricity prices, caused by deregulation and excess capacity are starting to bottom out, but have, until recently, constituted a major barrier to new plant construction in a fully deregulated market.
- Power utilities seek shorter construction periods, reliability, simplicity in achieving required safety standards and improved public acceptance.

The overall impact of these changes has been a growing awareness that the current fossil fuel and large hydro generation options do not necessarily represent the optimal solutions in the longer term. Consequently, there has been a radical shift in the sentiment towards nuclear options in many countries, for example the proposed US energy policy in which nuclear is seen to be a significant part of future generating capacity, the recent announcement by the Dutch government, setting conditions for new nuclear plants, confirming the abandonment of its earlier phase-out policy, and the UK Prime Minister's stance that nuclear power must be considered for the future (Financial Times 17 May 2006).

The implication is that there is a clear window of political and commercial opportunity for new nuclear technology-based power generation plants, such as the PBMR, in the next few years.

4.3.2 THE HYDROGEN ECONOMY

A number of countries have expressed interest in, and initiated studies into the role that hydrogen could play in the energy sector in the future. Hydrogen is an energy carrier rather than an energy source. For example, hydrogen could potentially be used in place of the current liquid fuel based transport system. One major objective of pursuing a hydrogen economy would be to reduce the emission of green house gases into the atmosphere.

The classical hydrogen production route is through electrolysis. There is an alternative route called the thermo-chemical water splitting process. This requires a high-temperature that drives the chemical process that split water with various intermediate chemical processes, The most widely considered one being the iodine sulphur system.

These processes become more efficient as the temperature increases, with a 1000 C input temperature, the efficiency in the order of 55%. It is therefore clear that for the hydrogen economy to be as efficient as possible and if these chemical water splitting processes is used the temperature of the heat source should be as high as practicably achievable, it should be based upon high temperature power plants. If climate change considerations are also taken into account, so that the reduction in the emission of green house gases is also a requirement, then high temperature nuclear power plants have an obvious advantage. The only proven nuclear technology that can reach these high temperatures is the high temperature gas cooled reactor technology (such as the PBMR).

4.3.3 INTERNATIONAL DEVELOPMENT IN HIGH TEMPERATURE REACTORS

The US Administration has proposed the construction of a co-generation (hydrogen and electricity) high temperature gas-cooled reactor at the national laboratory in Idaho. This project (with a total budget of US$1.135bn) has broad support from both parties in the US (Republicans and Democrats) and has been endorsed in a recent report on nuclear power. (It is of note that this report – which has been described as the

Democrats nuclear policy – supports only high temperature gas cooled reactors for advanced nuclear R&D funding in US, and no other nuclear technologies).

In the light of this development a number of teams are being formed to bid for the project. These teams appear to include a French team, at least one US team led by General Atomics (and including Japanese companies) and there is a group led by the ex-CEO of Exelon who is proposing a PBMR based bid.

4.3.4 STATUS OF PBMR

The PBMR DPP is in an advanced stage of the formalised designed process. The procurement of long lead time components has been initiated. In addition since the design is so far advanced, the Safety Analysis Report (SAR) is in the process of being finalised. A few important safety relevant issues still require clearance by both Eskom and the NNR before it can be finalised for submittal. It is currently the plan to start non – nuclear related construction work in the event that a positive record of decision is received.

4.3.5 INTRODUCTION TO PBMR TECHNOLOGY

There is some concern amongst some IAPs that PBMR technology is an old abandoned technology, unproven and/or unsafe, based on the fact that Germany and other countries closed their test reactors down.

To the contrary, nuclear engineers and physicists state that PBMR technology represent 4th generation nuclear technology (advanced) with inherent (robust and limited need for engineered) safety characteristics.

This sub-chapter sets out the history of PBMR technology and describes the integrated design and safety features that Eskom wishes to demonstrate and apply on a commercial electricity generating scale.

4.3.6 DEVELOPMENT/TEST HISTORY OF THE TECHNOLOGY

The PBMR is based on the designs developed as a result of an extensive high temperature reactor (HTR) development programme in Germany. Extensive research and development has been done on the 15 MW(e) [40 MW(t)] Arbeitsyemeinschaft Versuchs Reaktor (AVR) research reactor at the nuclear research centre in Jülich. It was planned, constructed and operated as a reactor test model on an industrial scale, with the intent to furnish an originally German contribution to the development of economic nuclear power on the basis of 'first-of-a-kind' technology. The reactor operated from 1966 to 1988, when it was decommissioned due to political considerations, and because it had fulfilled all planned research tests and experiments.

The main feature of the AVR was a high coolant temperature to allow the generation of steam conditions and correspondingly high plant efficiencies usually reached in modern fossil fuelled steam power plants. The high steam temperatures were possible due to the use of ceramic fuel, and the graphite that was used as fuel structure, moderator, as well as core structure material. Spherical fuel elements were used and fuelling was done with the reactor in operation. The AVR was used to test different designs of fuels, fuel loading systems and safety systems.

Although it was a prototype in test mode, it produced power for 70% of its life. During its 22 years of operation, the design proved the superior behaviour of the coated particle fuel concept, the favourable safety characteristics of the core, and even fulfilled the safety requirements listed today for modern (4th generation) reactors in terms of the control of improbable events

The results of various tests performed on the AVR and operational records assist in the validation of numerous analyses performed for the design and safety demonstration of the PBMR.

Lessons learnt from the AVR were used extensively in the design changes made to the AVR resulting from operating experience were incorporated in the design of the 300 MW(e) [750 MW(t)] Thorium High Temperature Reactor (THTR), which operated between 1985 and 1988. The THTR was a first-of-its-kind production plant intended to demonstrate the viability of the different subsystem hardware designs, with specific emphasis on plant availability and maintainability. To this end, the design concentrated on building a plant with a lifetime of 40 years and an availability of 80% to 90%.

Although both the AVR and the THTR-300 were pebble bed reactors, there were fundamental engineering differences because of the differences in size.

The THTR had a reinforced concrete pressure vessel, a much larger core diameter (AVR: 2.5 m to THTR: 5 m), control rods in the reflector, and shutdown rods in the pebble core. These changes were largely motivated by the presumed need for larger reactor power levels. The concrete pressure vessel led to difficulties in insulation of the low temperature concrete (limit 60° C) from the high-temperature gases (650 °C).

In addition, the in-core shutdown rods caused damage to fuel elements because of the need to insert the rods into the pebble bed by force during the initial testing period. The resulting high scrap level in the fuel system, combined with too high helium flows, led initially to low availability of the fuel handling system.

Despite these and other technical deficiencies, the THTR-300 achieved the following milestones:

- first nuclear power on 6 September 1985;
- first power into the grid on 16 November 1985;
- 100% power performance on 23 September 1986;
- handover to the utilities' consortium (HKG) on 1 June 1987; and
- The THTR-300 was going to be the front-runner of a commercial machine, namely the HTR-500.

Based on the experience gained from the AVR and the THTR, two German-based groups further developed pebble bed reactor designs ranging from high power reactors mainly developed by ABB (previously Brown Boveri), to the modular inherently safe design of Siemens Interatom, the HTR-Modul. These two groups later combined to form Hochtemperatur Reaktorbau GmBh.

Siemens was in the process of negotiating orders for several reactors from the then East German government, the USSR and a large German chemical company when, in 1989, the Berlin wall fell. As a result, all the potential buyers for HTR - Modul reactors broke off negotiations. Siemens subsequently decided to stop further work.

At the same time, the West German government came under pressure to close existing nuclear plants. It was easier to close down the HTR research reactors, which had negligible impact on the electricity supply to Germany, than existing commercial nuclear power stations. In the years that followed, the collapse of the USSR and the reunification of Germany placed constraints on the budgets for further reactors.

Eskom recognized that it could gain access to billions of rands worth of fully developed technology that might otherwise lie idle. In 1999, Eskom obtained the right to access the HTR engineering database that included details of the Siemens/Interatom HTR-Modul design. This design can be regarded as the forerunner of the PBMR as an inherently safe reactor.

The PBMR core design was made using the same design philosophy as was used in the design of the HTR-Modul. A concept licence was issued for this reactor, and the safety arguments used in the HTR-Module safety application are relevant for the PBMR safety case.

Many components used in the fuel handling and control systems of the PBMR are modified copies of those used in the THTR programme. They include all the improvements made over the years, thus saving a lot of costly development work.

The PBMR concept also includes the technological advances made in gas turbine technology since the 1980s. The small plant size and the elimination of a steam cycle both contribute positively to the safety case.

The fuel design of the PBMR falls within the qualified fuel design parameters of the German fuel programme. These parameters are:

- temperature of operation and following the postulated accident events;
- burn – up level achieved by the fuel at discharge to the spent fuel storage system; and
- the integrated fast neutron dose received by the fuel during its lifetime.

The actual fuel design is the same as was specified for the Interatom HTR Modul reactor design, the so called HTR Modul Proof Test Fuel. The HTR – Modul reactor received provisional regulatory certification in Germany.

It needs to be stated that Germany wanted to also demonstrate the viability of a direct cycle power conversion system. As part of this objective, helium turbines using fossil heated helium were researched extensively. The plan was to eventually couple the helium turbine to the AVR in a Brayton thermo-dynamic cycle integration (Same as PMBR). Unfortunately due to the complete shutdown of the AVR in the late 80's, this objective would not be fulfilled.

It must therefore be realised that the term First – Of – A – Kind (FOAK) used for PBMR is in reality a First – Of – A – Kind configuration of the developed technologies namely the reactor unit and the helium turbine.

Although, as described above, the key components of the PBMR technology have been tested and proven, the integrated PBMR DPP is a "First-of-a-kind engineering" project. In this regard, Eskom wishes to demonstrate the techno-economic feasibility of the integrated system.

The South African project is internationally regarded as the frontrunner in High Temperature Gas Cooled Reactor technology. The PBMR includes locally unique and patented technological innovations, which will make it particularly competitive in the generation of nuclear energy

4.3.7 NEED & PURPOSE FOR THE PEBBLE BED MODULAR REACTOR (PBMR) PROJECT[7]

The recent increase in oil prices, the exhaustibility of fossil fuels and the urgent need for stable, reliable, non-polluting sources of electrical energy that are indispensable to a modern industrial economy focuses attention on renewable energy sources future nuclear power generation, and generation IV type reactors.

Nuclear power generation can provide a future mitigation strategy for greenhouse gas reductions, since nuclear power generation produces less carbon dioxide emissions, smoke or any other obnoxious gases than conventional fossil fuel technologies. France's carbon dioxide emissions from electricity generation fell by 80 percent between 1980 and 1987 as its nuclear capacity increased. Germany's nuclear power programme has saved the emission of over two billion tons of carbon dioxide from fossil fuels since it began in 1961.

Renewable energy sources would represent the most benefits. Unfortunately, the technology is such that it cannot fulfil the world's immediate and future energy

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7 Information Memorandum prepared for the Eskom Holdings Limited Investment And Finance Committee, March 2005

http://www.scienceinafrica.co.za/2003/june/pbmr.htm

http://www.gen-4.org/Technology/evolution.htm requirements on a commercial scale. However, Eskom has committed to and is in the process of investigating viable renewable options.

Eskom investigated the option of nuclear high temperature gas reactors during the 1990s, under its supply side research and development program for potential application as a power source in South Africa and as a viable South African export product.

Eskom is particularly interested in the PBMR plant, since it is regarded as a so-called Generation IV plant. The Generation IV International Forum (GIF) defines Generation IV plants as those reaching the objectives of improved nuclear safety, improved proliferation resistance, minimized waste and natural resource utilisation and decreased cost to build and run such plants.

There are other Generation IV plants, but Eskom is particularly interested in the PBMR because the PBMR concept is based on the philosophy that new reactors should be small and modular in design. A commercial PBMR module would be sized to produce about 165 MW, which is about one fifth the capacity of a conventional Pressurised Water Reactor such as Koeberg. The PBMR design ensures less instability in case of a trip to the national grid, allows for flexibility to add additional modules in accordance with national demand, and provides for a reduced construction time.

The fundamental concept of the design is aimed at achieving a plant that has no physical process that could cause a radiation hazard beyond the 400m site boundary.

This is achieved in the PBMR as the integrated heat loss from the reactor vessel exceeds the decay heat production in a post-accident condition. In addition, the peak temperature that can be reached in the core is below the demonstrated fuel degradation point, and far below the temperature at which the physical structure is affected. This precludes any prospect of a core damage accident.

Due to the inherent built in safety characteristics the PBMR and its possible commercial use for Hydrogen production or other forms of co-generation such as desalination, the plant is expected to have a large number of worldwide sales. Further the PBMR's inherent safety is fundamental to the cost reduction achieved over other nuclear designs, as less safety systems are required and the plants ease of operability also reduces the need for large numbers of maintenance and operating staff.

With regard to exports, if as few as 10 modules per year are exported, the project could contribute up to R8 billion to the local Gross Domestic Product (GDP) and R10 billion per year in exports. In addition, about 57 000 direct and indirect jobs could be created.

4.3.8 TECHNOLOGY DESCRIPTION

The PBMR has a vertical steel reactor pressure vessel, which has a 6.2 m inner diameter, and is approximately 27 m high. The reactor pressure vessel contains and supports a metallic core barrel, which contains the pebble fuel spheres. This annular fuel core is located in the space between central and outer graphite reflectors.

Reactivity control elements can move into and out of the reactor. Two diverse reactivity control systems are provided for shutting the reactor down; one being reactivity control rods, and the other being small absorber spheres.

A schematic diagram and the physical layout of the main power system are shown in Figure 4-2 and Figure 4-3 respectively.

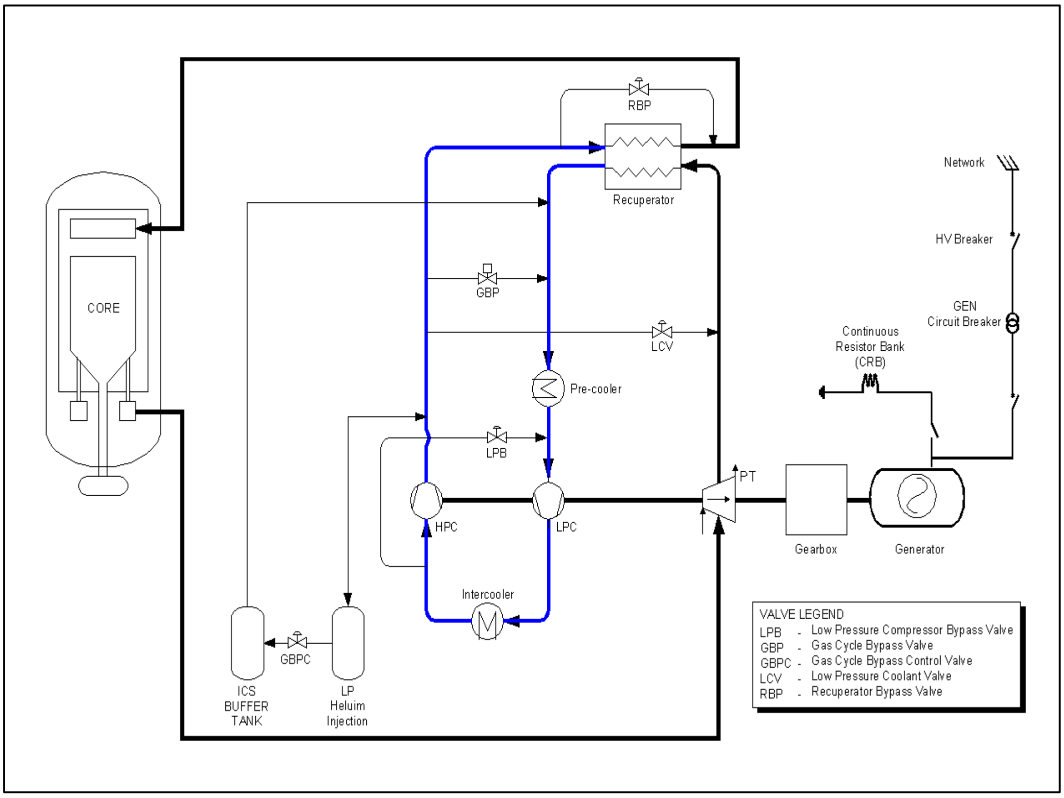


Figure 4-2: Schematic Diagram of the PBMR Main Power System

The PBMR fuel consists of particles of enriched uranium dioxide coated with silicon carbide and carbon. The particles are encased in graphite to form a fuel sphere or pebble about the size of a billiard ball. When fully loaded, the core would contain approximately 452 000 fuel spheres.

A nuclear fission reaction within the silicon carbon particles encased in the fuel spheres generates heat, which is emitted into the space between the fuel pebbles in the reactor core. To remove the heat generated by the nuclear fission reaction, helium coolant enters the reactor vessel at a temperature of about 500 °C and a pressure of 9 MPa. The gas flows down between the hot fuel spheres, after which it leaves the bottom of the vessel, having been heated to a temperature of about 900 °C. The hot helium drives a closed cycle gas turbine-compressor and generator system in a similar fashion as steam would drive the turbine in a coal fired power station. Pease refer to Figure 4-3 for reference.

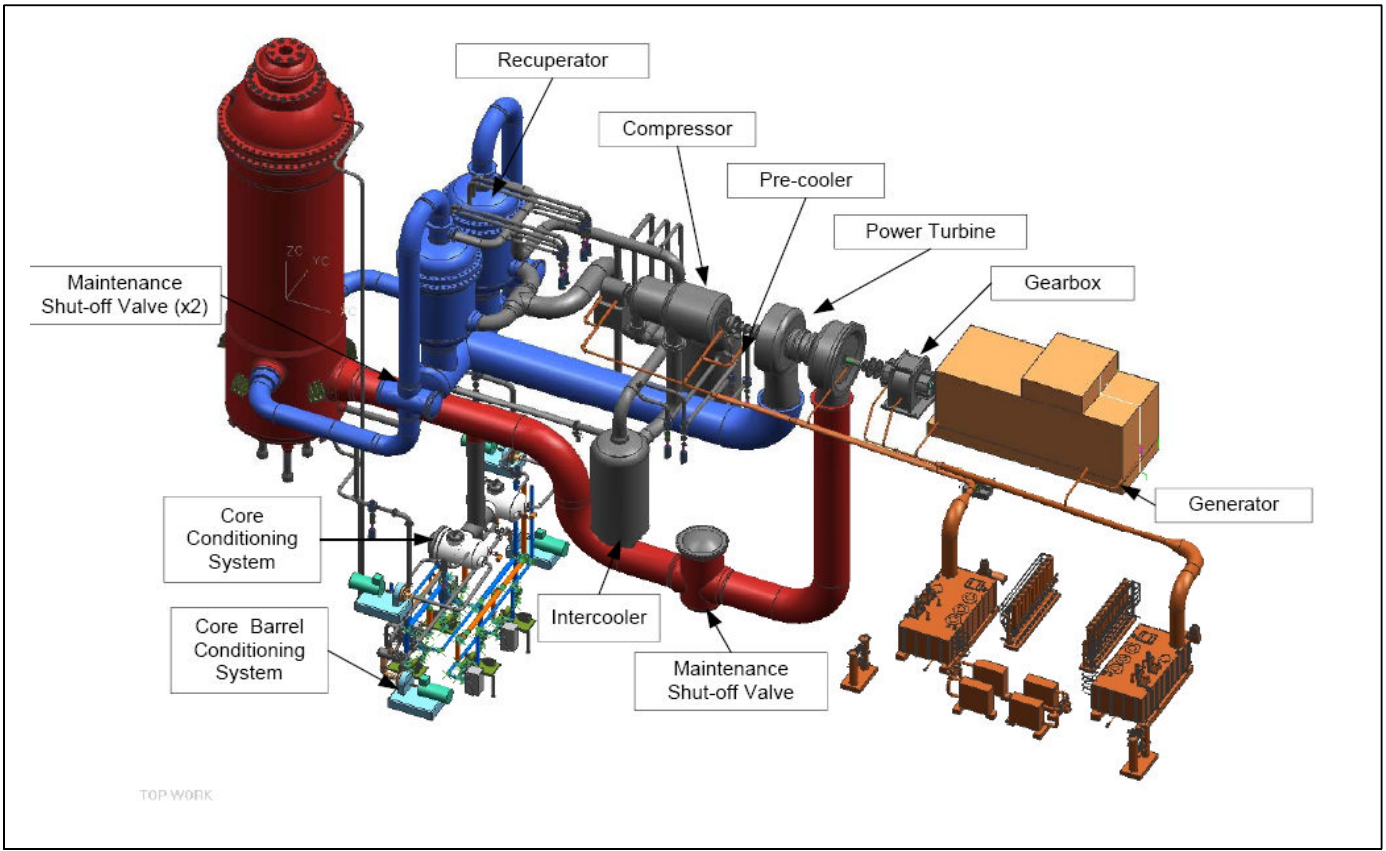


Figure 4-3: Physical layout of the PBMR main power system.

After it has passed through the turbine the hot helium passes through a series of intercoolers (cool the helium), heat recuperators (recovers heat from the helium in order to increase the efficiency of the system), and compressors (maintain pressure in the system). The coolers are cooled by water in a closed circuit, and the closed circuit, in turn, is cooled by the seawater through a secondary heat exchanger. At full operation, Koeberg Nuclear Power Station (KNPS) extracts 80 cubic meters (m^3) of water per second from the ocean. The proposed PBMR DPP would require an additional 2,5 m^3 of water per second to be extracted from the ocean. This water is chlorinated to 1 part per million (ppm) before reaching the condensers, where the water temperature increases to an average of about 10°C above ambient temperature.

This water, warmed and chlorinated, is then returned into relatively shallow seawater via the outfall structure, causing the water to be jetted in a south-westerly direction at a speed of between 2 and 3 m/s at the outlet of the outfall structure. As the warm water is more buoyant, a warm water plume is formed. In the Koeberg, the surf-zone temperature standard deviation is in the order of 0.46°C. Additional water from the PBMR DPP is approximately 3% of the current outflow.

Online refuelling is another key feature of the PBMR. In other words the reactor is not taken out of service for refuelling. The fuel is introduced at the top of the reactor while used fuel is removed at the bottom to keep the reactor at full power. Figure 4-4 is a schematic diagram of the fuel handling system during normal operation.

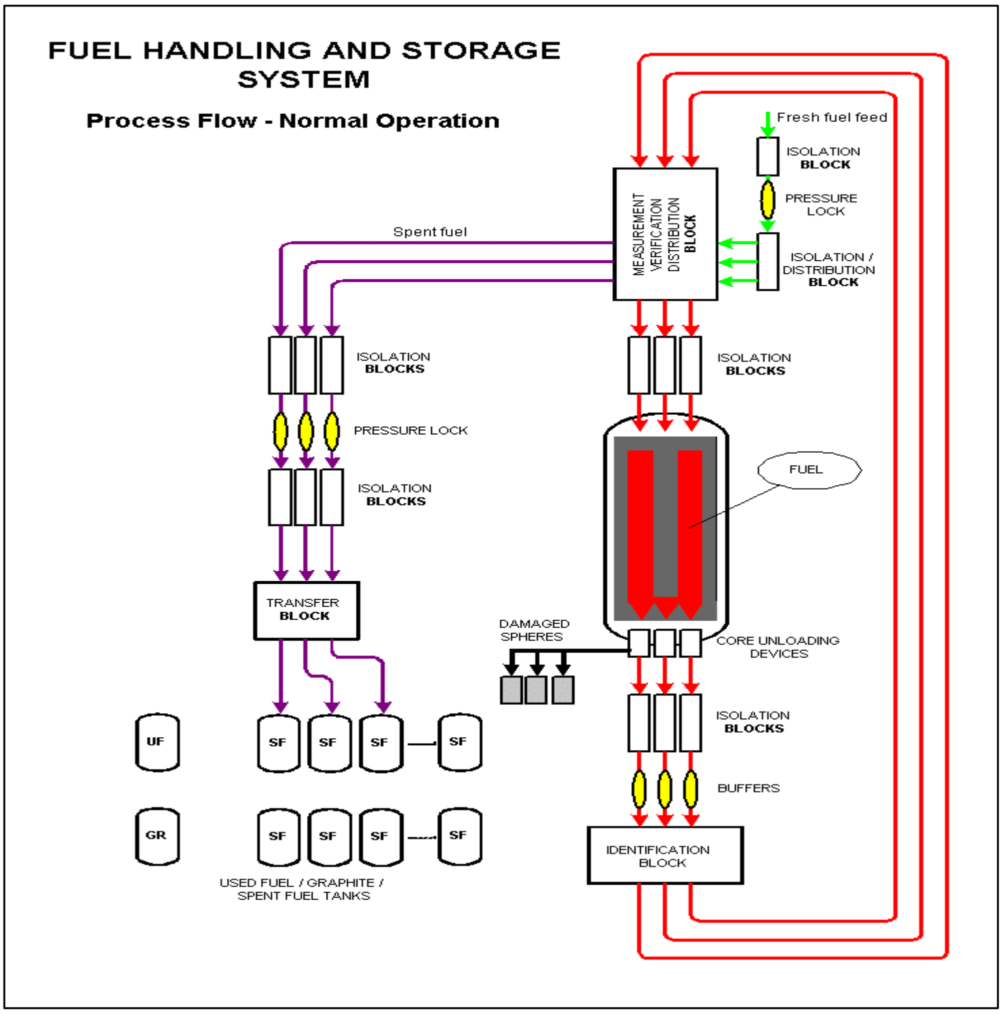


Figure 4-4: Schematic Layout of the PBMR Fuel Handling and Storage System

Fuel pebbles continuously move through the core from the top to the bottom during the normal operation of the plant. Once a pebble exits the bottom of the reactor it is measured and tested to ensure that it conforms to the physical integrity specifications. It also evaluated for burn – up. Pebbles that are physically in good order and have not reached the target burn up are returned to the top of the reactor for re-introduction into the core.

Rejected pebbles are transferred to the spent fuel tanks in the basement of the plant for storage. The tanks are designed to have sufficient capacity to store the full spent fuel inventory of the expected 40 year life cycle of the PBMR DPP.

The radioactivity of the spent fuel results in heating in the tanks. Thermal cooling of the spent fuel storage vessels is required. This is done by means of passive cooling and a naturally ventilated chimney system.

The aim is to operate uninterrupted for six years before the reactor is shut down for scheduled maintenance. However, for the demonstration module, a number of interim shutdowns will be required for planned evaluation of component and system performance. During shutdown the reactor fuel inventory can be stored if required in a storage tank, and recovered for refuelling of the reactor once the shutdown is complete.

Shutdown will be done by inserting the control rods. The reactor is made critical by withdrawing the control rods. Then, by using the nuclear heat generated in the core and initially turning the turbine generator system by using the generator as a mixer gas circulation is initiated by the compressors mounted on the same shaft as the turbine generator. The Brayton cycle (consisting of reactor, turbine, coolers, recuperators, and compressors) will initiate and become self-sustaining at a certain helium temperature.

4.4 DESCRIPTION OF THE PBMR FUEL

4.4.1 NOMINAL CHARACTERISTICS

Fuel for the proposed PBMR DPP would consist of spherical pebbles (approximately 60 mm in diameter) that contain Triso coated Uranium Oxide kernels (up to 10% enriched), which are embedded in a pure graphite matrix.

The spherical PBMR fuel pebble is cold pressed from matrix graphite, which is a mixture of natural graphite, electrographite, and a phenolic resin that acts as binder. It consists of an inner region that contains fuel in the form of spherical coated particles embedded in the matrix graphite. A shell of matrix graphite that does not contain any fuel surrounds the inner region.

4.4.2 COATED PARTICLES

A coated particle consists of a spherical uranium dioxide kernel surrounded by four concentric coating layers. The first layer surrounding the kernel is a porous pyrocarbon layer, known as the buffer layer. This is followed by an inner high-density pyrocarbon layer, a silicon carbide layer, and an outer high-density pyrocarbon layer.

The layers are deposited sequentially by dissociation of gaseous chemical compounds in a continuous process in a fluidized bed furnace. The image below indicates the design of the PBMR fuel sphere.

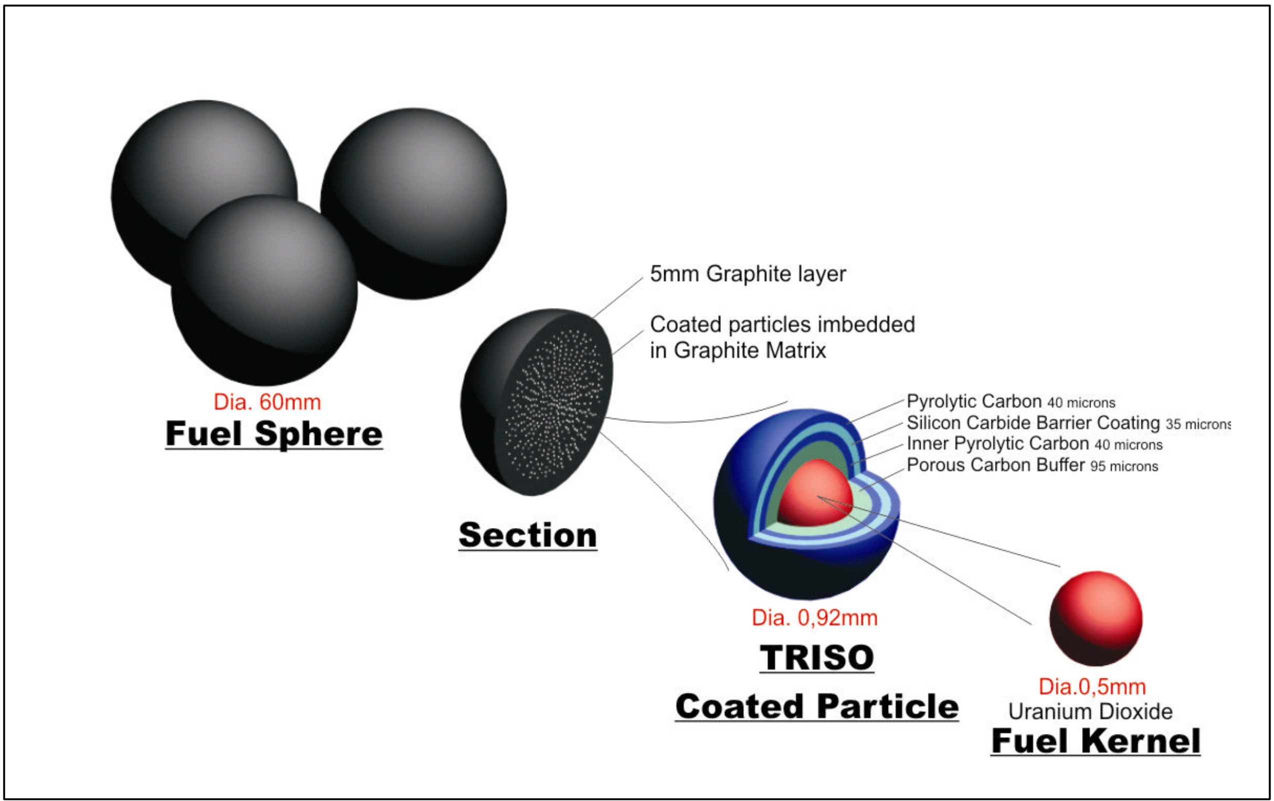


Figure 4-5: PBMR Fuel Sphere Design

4.4.3 FUEL SPHERE

The coated particles are embedded in a graphite fuel sphere. The function of the matrix graphite is to form the main structure of the fuel sphere and to contain the coated particles and to provide a heat conduction path between the coated particles and the reactor coolant. The matrix graphite also acts as the moderator for neutrons in the PBMR core.

4.5 SAFETY FEATURES OF THE PBMR TECHNOLOGY

In all existing power reactors, safety objectives are achieved by means of an engineered, active safety systems. In contrast, the PBMR is inherently safe as a result of the design, the materials used, the fuel characteristics, the physics involved and the geometrical arrangement of the reactor unit components. This means that should a worst-case accident scenario occur, no human intervention would be required in the short or medium term.

Nuclear accidents are principally driven by the residual power generated by the fuel after the chain reaction is stopped. This residual power (decay heat) is caused by radioactive decay of fission products. If this decay heat is not removed, it will heat up the nuclear fuel until its fission product retention capability is degraded and its radioactivity is released.

In 'conventional' reactors, the heat removal is achieved by active cooling systems (such as pumps), which rely on the presence of the heat transfer fluid (e.g. water). Because of the potential for failure in these systems, they are duplicated to provide redundancy. Other systems, such as a containment building, are provided to mitigate the consequences of failure and to act as a further barrier to radioactive release.

In the PBMR, the removal of the decay heat is independent of the reactor coolant conditions. The combination of the very low power density of the core (one-twentieth of the power density of a Pressurized Water Reactor), and the resistance to high temperature of fuel in billions of independent particles, underpins the inherent and advanced safety characteristics of this type of reactor.

The helium, which is used to transfer heat from the core to the power-generating gas turbines, is chemically inert. It cannot combine with other chemicals and is non-combustible. The probability of air entering the primary circuit and corroding the high temperature core and graphite core structures is extremely low due to the positive pressure in the helium circuit system.

The peak temperature that can be reached in the core of the reactor (1 600 °C under the most severe conditions) is well below the temperature that may cause damage to the fuel. This is because the radio nuclides, which are the potentially harmful products of the nuclear reaction, are contained by two layers of pyrocarbon and a layer of silicon carbide that are extremely robust at withstanding high temperatures.

Even if there is a failure of the active systems that are designed to shut down the nuclear reaction and remove core decay heat, the reactor itself will inherently shut down and eventually cool down naturally. Unlike the Chernobyl type of reactor, which during the accident produced more energy the hotter it became (known as 'a positive temperature coefficient of reactivity'), the pebble bed reactor has a strong negative temperature coefficient of reactivity, which stops the chain reaction. It also cools naturally by heat transport to the environment.

The size and form of the PBMR core ensures a high surface area to volume ratio. This means that the high heat capacity of the core and core structures, together with the heat loss characteristics of the core (via the same process that allows a cup of tea to cool down) and the characteristics of the heat generated by the decay of fission products in the core, will limit the fuel temperature to below that value at which significant degradation of the activity retention capability can occur. The maximum expected temperatures and duration of maximum temperatures are within the safe operating envelope of the fuel. In other words the fuel will remain stable in the maximum temperature ranges of the reactor.

This inherently safe design of the PBMR renders obsolete the need for the typical safety backup systems and most aspects of the off-site emergency plans required for conventional nuclear reactors. It is also fundamental to the cost reduction achieved over other nuclear designs. Although emergency plans related to aspects such as the transport of fuel will still be required, they will be modified to suit the specific characteristics of the fuel and the transport mode.

The reactor core concept is based on the well-tried and proven German AVR power plant, which ran for 21 years. This safe design was proven during a public and filmed plant safety test, when the flow of coolant through the reactor core was stopped and the control rods were left withdrawn just as if the plant were in normal power generation mode. It was demonstrated that the nuclear reactor core shut itself down inherently within a few minutes. This proved that a reactor core meltdown was not credible, and that an inherently safe nuclear reactor design had been achieved.

The reactor is housed in a building, part of which is a strengthened enclosure around the main power system. The module building, which comprises the entire structure that houses the power plant (excluding the generator), is designed to withstand significant external forces such as aircraft impacts, tornadoes or explosions caused by saboteurs.

The thickness of the reinforced concrete roof and walls (above ground level) of this structure is 1 m. Within the module building is the reinforced concrete containment or citadel that encloses the reactor pressure vessel and the power conversion unit (excluding the generator). The walls surrounding the reactor pressure vessel are 2.2 m thick reinforced concrete.

4.6 EVOLUTION OF THE SOUTH AFRICAN PBMR DPP DESIGN

Since 1997 the PBMR design has evolved through three power ranges.

These ranges are 268 MW(t) to 302 MW(t) to 400 MW(t). The 400 MW(t) design is the result of extensive technical and economic analysis taking into account a number of key factors. Principle amongst these key factors are the following:

- target market plant size preferences;
- world wide availability of proven engineered components that could be utilized;
- the overall project life cycle cost; and
- improved passive and engineered safety in terms of nuclear design principles.

The progression to 400 MW(t) included several significant design changes. These design changes resulted in equipment modifications which will substantially enhance plant operability and maintainability. These design changes include:

- a single shaft turbo machine with oil lubricated bearings and dry gas seals;
- a standardized gearbox between the turbine and the generator;
- the inclusion of a solid graphite central reflector in the reactor core; and
- engineered reactivity control.

The target markets for the PBMR include electric power generation and process heat applications. The 400 MW(t) module is well suited to both markets.

For electric power generation the use of multiple units suits markets where large increments of power are not possible and allows for a staged introduction of nuclear power generating capacity.

4.7 BUILDINGS AND INFRASTRUCTURE REQUIREMENTS

The proposed PBMR Demonstration Power Plant (DPP) consists of a number of buildings Please refer to Figure 4-6 for a site layout drawing. These buildings include:

4.7.1 AN INTEGRATED REACTOR BUILDING AND GENERATOR BUILDING

The nuclear reactor and associated components are housed in the reactor building. The reactor building structure is constructed of reinforced concrete. The reactor building foundation comprises an approximately 3 m thick raft, founded on bedrock approximately 26 m below surface level. The surface level around the reactor building at the proposed site is at an elevation of approximately +13.5 m above mean sea level.

4.7.2 THE GENERATOR AND ASSOCIATED ELECTRICAL AND AUXILIARY POWER PLANT

The generator and associated electrical and auxiliary power plant are located in a generator building, located adjacent to the northern gable of the reactor building. The generator house comprises a conventional framed structure, constructed of conventional reinforced concrete to 3 m above the generator floor, located approximately +10 m above surface. Above this level a structural steel support system, covered with aluminium sheeting, is proposed.

4.7.3 A SERVICES BUILDING

The services building houses the main control room and the waste handling and storage system and also provides the controlled access to the reactor building.

4.7.4 AN ANCILLARY BUILDING

The ancillary building is located to the east of the reactor building and north of the services building and houses the medium and low voltage switchgear, the diesel generators, and other systems associated with the operation of the PBMR DPP. Underground tunnels interconnect the reactor building with the services and ancillary buildings.

4.7.5 A COOLING WATER PLANT BUILDING

The helium gas that cycles through the reactor and drives the turbine is cooled with sea water. A cooling water plant building is located to the west of the generator building and houses the cooling water pumps and heat exchangers. Piping between the cooling water plant building and the reactor building is routed via an underground tunnel.

4.7.6 AN ADMINISTRATION OFFICE BUILDING

An administration office building on the south west corner of the terrace will house the PBMR DPP staff. The services building, ancillary building, administration building and cooling water plant building are likely to be constructed using conventional beam column frames supporting reinforced concrete floors and structural steel clad roofs.

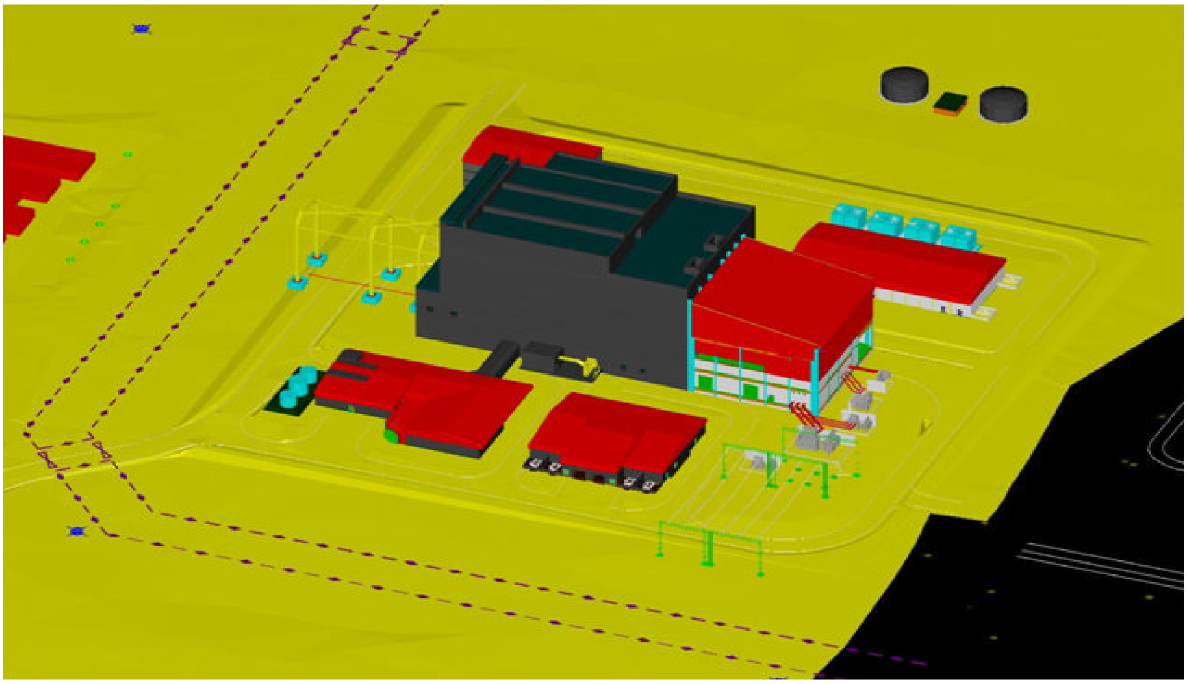


Figure 4-6: Site Layout Drawing

4.7.7 EXISTING KOEBERG INFRASTRUCTURE

The proposed PBMR DPP would to a large extent make use of existing Koeberg auxiliary infrastructure and services. These include:

- potable water supply - Raw water for the intermediate cooling system and domestic use in the station;
- cooling water from the sea - Marine cooling water intake basin and outflow structures;
- low and intermediate level radioactive waste management and storage structures and systems for the processing of such waste that will be disposed of at Vaalputs;

- transmission network including substations;
- sewage treatment facilities;
- certain roads; and
- security.

4.7.8 ADDITIONAL INFRASTRUCTURE REQUIREMENTS

- A 132 kV transmission line, including transmission pylons, will be constructed between the proposed PBMR DPP and the Koeberg substation. This transmission line links the proposed PBMR DPP to the national transmission network.
- Widening of a portion of the road to the Koeberg power station from the R27 turnoff, and the construction of the internal roads on the Koeberg power station site for access to the PBMR DPP site is also proposed.
- Deviations on the road from Saldanha harbour to the preferred KNPS site, for the purpose of the transportation of extra-heavy loads (200 up to 1000 tons plus). Saldanha harbour and exit infrastructure proved to be the preferred port of entry and transport to the Koeberg site for such heavy equipment/loads. The road will require deviation in specific short portions to avoid existing infrastructure that can be damaged by the height (overhead lines) or the mass (bridge structures) of the loads
- These deviations will be around the Modder River bridge, a conveyor that cross the road close to Saldanha, and the Eskom transmission line near the Koeberg site. The deviations will, however, be temporary in nature. Rehabilitation of the deviated portions will be addressed in the Environmental Management Plan of the EIR for the proposed activity.
- Contractor yard for the lay down of materials and heavy equipment east of the R27 turnoff to KNPS site.
- Construction village to house around 800 construction workers.

4.8 THE MEANING OF A DEMONSTRATION PLANT

The White Paper on the National Energy Policy provides two definitions under the heading of Research, Development and Demonstration projects, namely:

- a pilot plant that serves to test and prove the technology on a small scale; and
- a demonstration plant that serves to demonstrate the techno-economics of an integrated design on a commercial (full) scale.

The PBMR DPP falls into the second class, since the PBMR technology (including the reactor and fuel design and configuration) has been pilot proven in a number of plants internationally, e.g. Germany, Japan, China, USA and the UK. The Brayton cycle technology is commercially applied internationally and the PBMR DPP combines the PBMR technology with the Brayton cycle technology.

The purpose off the PBMR DPP is to demonstrate the integration of these two principle technologies on a commercial scale and within highly competitive cost figures

4.8.1 WHAT REQUIRES DEMONSTRATION

The proposed project consists of a construction/commissioning period during which constructability and the achievement of operational acceptance parameters has to be demonstrated as a precondition to taking the plant into commercial operation for the remainder of its 40 year lifespan. Typical plant features that have not been tested as an integrated system are part of the scope of components (as listed below) that require demonstration.

The two main components of demonstration are:

a) Demonstration of the functional integrity

The demonstration of the functional integrity will test the operability, safety and the maintainability of the integrated plant system. Eskom is interested in the total plant availability, age management, online maintenance for critical equipment, and the ease of achieving the 6-yearly maintenance intervals between the general overhauls.

The operational modes and states including consistent and predictable base load operation, load following, transient management, equipment protection and load rejection will be demonstrated. Overall cycle efficiency, including that of the direct cycle power conversion unit (PCU) and fuel handling system will be demonstrated.

The ability to retain helium within the pressure boundary and the performance, under different conditions, of key mechanical components such as the graphite structures, reactor pressure vessel, valves, heat exchangers, turbine, compressors, seals, gearbox and generator will be demonstrated.

The dynamics of the reactor core will be monitored to ensure consistent and predictable operation under different operational regimes.

b) Demonstration of the commercial performance

The demonstration of the key commercial performance parameters of the PBMR DPP such as construction costs, plant availability and efficiency, operational and maintenance costs and mid-life upgrade requirements will be demonstrated during various stages of the project.

The time line for demonstration of the various integrated components, which initiate from fuel loading, will include:

- safety systems availability / reliability (years 1 to 7);

- direct cycle power conversion unit efficiency (years 2 to 7);
- helium leakage verification (years 1 to 7);
- operational modes and states (years 1 to 2);
- reactor unit integrity (years 1 to 7);
- main power system integrity (years 1 to 7);
- generator integrity (years 1 to 7);
- maintenance procedures on prototype (years 1 to 7);
- plant availability (years 3 to 7);
- reliability of prototype (years 1 to 7);
- plant efficiency and sustainability (years 3 to 7);
- operational and maintenance cost (years 3 to 7); and
- first outage (years 3 to 6).

c) Generation IV aspirations in the South African context.

The criteria that will be used to measure performance and determine that the demonstration has met the design objectives will be addressed in the EIR

4.9 CONSTRUCTION ACTIVITIES

During construction the proposed PBMR DPP is no different from any other major construction project. Major activities such as site preparation, earthworks, civil works and mechanical installation will occur. Support activities such as material/equipment storage in a stock yard, and mechanical maintenance and servicing will also be performed.

The construction phase activities and aspects are given hereunder, namely:

- Staff as well as material/equipment import and transport to site and consequent management of traffic;
- site preparation;
- construction equipment repair and maintenance;
- material storage onsite (Koeberg) and off site on an ex-Eskom property (turn-in to the Koeberg site from the R 27);
- earthworks (inclusive of footprint excavations), trenching and civil works;
- dewatering activities;
- erecting/installation of plant;
- road deviations;
- temporary and permanent illumination;
- noise;

- water use;
- waste and spoil management; and
- construction labour village.

4.10 COMMISSIONING ACTIVITIES

Commissioning of the PBMR DPP will be done in two phases, i.e.:

- Cold commissioning – Testing of systems and equipment without any nuclear fuel in the reactor. During this phase, nitrogen will be used as the energy carrier rather than helium due to its lower cost. The nitrogen will be recouped at the end of the cold commissioning phase and sent back to the manufacturer.
- Hot commissioning – Loading of the reactor with the pebble fuel, bringing the reactor into critical operation at a low power range and operating the reactor at full loads.

Once the plant complies with commissioning assessment parameters, it will be operated in the demonstration mode.

4.11 SHAREHOLDING AND ESKOM'S ROLE

4.11.1 SHAREHOLDING IN THE PBMR DPP

A shareholders agreement is currently being drafted for signature by the participating entities. Indications are that Westinghouse(ex British Nuclear Fuels Ltd), Eskom and its South African partner, the Industrial Development Corporation (IDC), jointly have over 50% shareholding in the project. With the exception of a 10% stake, which is reserved for an empowerment company, the available shareholding has now been taken up. Contracts between Eskom, the PBMR (Pty) Ltd and other partners are proprietary information.

4.11.2 ESKOM'S ROLES IN THE PBMR PROJECT

a) The investor role

Eskom initiated the project and found partners to take it beyond feasibility. PBMR (Pty) Ltd was incorporated as a separate legal entity. Thereafter the care-taking / management function of the project was transferred to the Department of Trade and Industry and now to the Department of Public Enterprises.

A Shareholder Agreement has been concluded by the partners but is not effective yet due to non-fulfilment of some preceding conditions. Once it becomes effective, other parties will be allotted shares and Eskom's shareholding will dilute with time.

b) The applicant/user role

Eskom will become the buyer of the DPP on the signing of a contract for its supply.

A contract for the supply of the DPP is currently being negotiated between PBMR (Pty) Ltd and Eskom. The terms and conditions of the contract follow normal commercial principles for a project of this nature, and contain performance terms for acceptance and take over by Eskom who will ultimately be the owner and operator of the DPP.

As future owner and operator, Eskom is the applicant for the nuclear license. Once granted, Eskom will hold the nuclear license for the facility and be responsible for its nuclear safety in accordance with the provisions of the National Nuclear Regulator Act.

Furthermore, Eskom is the applicant for the EIA, since it owns the land and will be responsible for the activities carried out on it. Eskom will enforce compliance related to legal, contractual, and environmental requirements by PBMR, and other contractors involved.

c) Accountability for environmental liabilities

Eskom's accountability includes not only decommissioning but also rehabilitation (if and when required). Decommissioning of the plant could take one of two forms, premature decommissioning or normal end of life decommissioning. Funds are set aside for both eventualities. A special arrangement will be in place for premature decommissioning should this be required, and the normal funding arrangement for a nuclear plant will apply to end of life decommissioning.

CHAPTER 5: DESCRIPTION OF THE AFFECTED ENVIRONMENT

5.1 INTRODUCTION

In order to conduct a detailed assessment, it is necessary to describe the existing state of the environment that would be potentially affected by the proposed development. That description is presented in this chapter with a strong focus on particular sensitivities, vulnerabilities or opportunities in either the biophysical or social environment.

5.2 LOCATION

The Koeberg Nuclear Power Station site is the preferred site for the establishment of the proposed PBMR DPP. The specific proposed siting is located within the Eskom Controlled Area of the Koeberg Nuclear Power Station (KNPS) on the farm Duynefontein (Farm No 34) on the Cape West Coast (please refer to Map 5-1). The KPNS site is approximately 2 km from the Duynefontein residential area, 30 km north of Cape Town and 10 km south of Atlantis, within the Cape Metropolitan Council jurisdiction. The PBMR DPP is proposed to be located some 400 m southeast of the existing Koeberg power station, inside the access control 1 security fence of the Koeberg power station site (please refer to Figure 5-1). Once constructed, the proposed PBMR DPP would require in the order of 9 hectares of the KNPS site which is approximately 125 Ha in size.

The KNPS site is located within a proclaimed nature reserve of 3 000 ha. The site and surrounding nature reserve are managed according to a formal integrated environmental management system (IEMS).

Map 5-1: Locality map indicating Koeberg Nuclear Power Station

Photo: Courtesy of Bjorn Rudner

Figure 5-1: Approximate location of the proposed PBMR DPP on the site

5.3 BIOPHYSICAL DESCRIPTION

5.3.1 GEOMORPHOLOGY

The KNPS site lies within the coastal plain of the Western Cape. This area is known as the "Sandveld" and consists of ancient dunes stabilised by vegetation and recent unconsolidated dunes. The "Sandveld" rises gently towards the east and south-east to an elevation of between 100 m and 200 m some 20 km east of Koeberg.

The closest prominent river to the proposed site is the Sout River which flows into the Atlantic Ocean north of Melkbosstrand, some 10 km from the proposed site.

Three geological faults are located at 4.5 km and 3.5 km towards the south of the site and one approximately 5 km to the north of the KNPS site. All of these faults are stable and conform to suitability criteria for the siting and operation of nuclear facilities.

5.3.2 FAUNA AND FLORA

The controlled area of the KNPS is a brownfield site without any significant fauna and flora. The Koeberg Private Nature Reserve contains fauna and flora typical of the

Renosterveldt. The Renosterveldt has conservation value and the proposed PBMR DPP will not impact on the conserved land.

5.3.3 MARINE BIOPHYSICAL ENVIRONMENT

The coastline in the area of the KNPS comprises of a high percentage of fine to medium quartz sand particles, shells and organic material. The coastline is completely exposed and subjected to vigorous pounding by the Atlantic Ocean and has an extensive surf zone due to the shallow seabed gradient. The average sea temperature in the region is 13°C with the minimum below 10°C and the maximum approaching 20°C.

5.3.4 DEMOGRAPHY AND LAND USE

a) Land use

Koeberg Nuclear Power Station and the proposed PBMR site is located on the boundary between Duynefontein (Cape Farm No. 34) and Kleine Springfontein (Cape Farm No. 33). Please refer to Figure 5-2 for an indication of Koeberg in relation to the Cape Town area. Duynefontein measures 1 257 ha, stretching 4,4 km along the coast and 3,5 km inland. Kleine Springfontein, which also belongs to Eskom, measures 1 590 ha, stretching 3,6 km along the coast and 3,75 km inland.

A residential area known as Duynefontein is situated to the south of the above properties. The Melkbosstrand and Van Riebeeckstrand urban areas further along the coast dominate the land use within a 5 km radius. Wheat and dairy farms are found within the north-eastern to east-south-eastern sectors bordering the Eskom properties. The farms Duynefontein and Kleine Springfontein were proclaimed as the Koeberg private nature reserve in 1991.

The Atlantis industrial and residential areas form the most significant urban development to the north of Koeberg Power Station and are situated approximately 10 km to the northeast of the Koeberg site. The estimated population of the residential town of Atlantis is approximately 50,000 people. The economic growth of the industrial area is relatively stagnant. The area between Atlantis and the coastline has been identified for inclusion in the proposed West Coast biosphere reserve.

The land-use pattern within a 20 km radius of the Koeberg Nuclear Power Station (KNPS) can be classified in the following categories: cultivated land; uncultivated land; residential development; industrial development; dune areas; vlei areas and river valleys. The Melkbosstrand urban strip, which lies along the coast, is the dominant land-use within a 5km radius of Koeberg. The area to the immediate east of KNPS is largely uncultivated as it consists of sandy soil of low agricultural value. The northern area consists of Strandveld Coastal Shrub lands. Poorly vegetated sands occur in the dune areas along the coast and further inland to the north-north-west of KNPS.

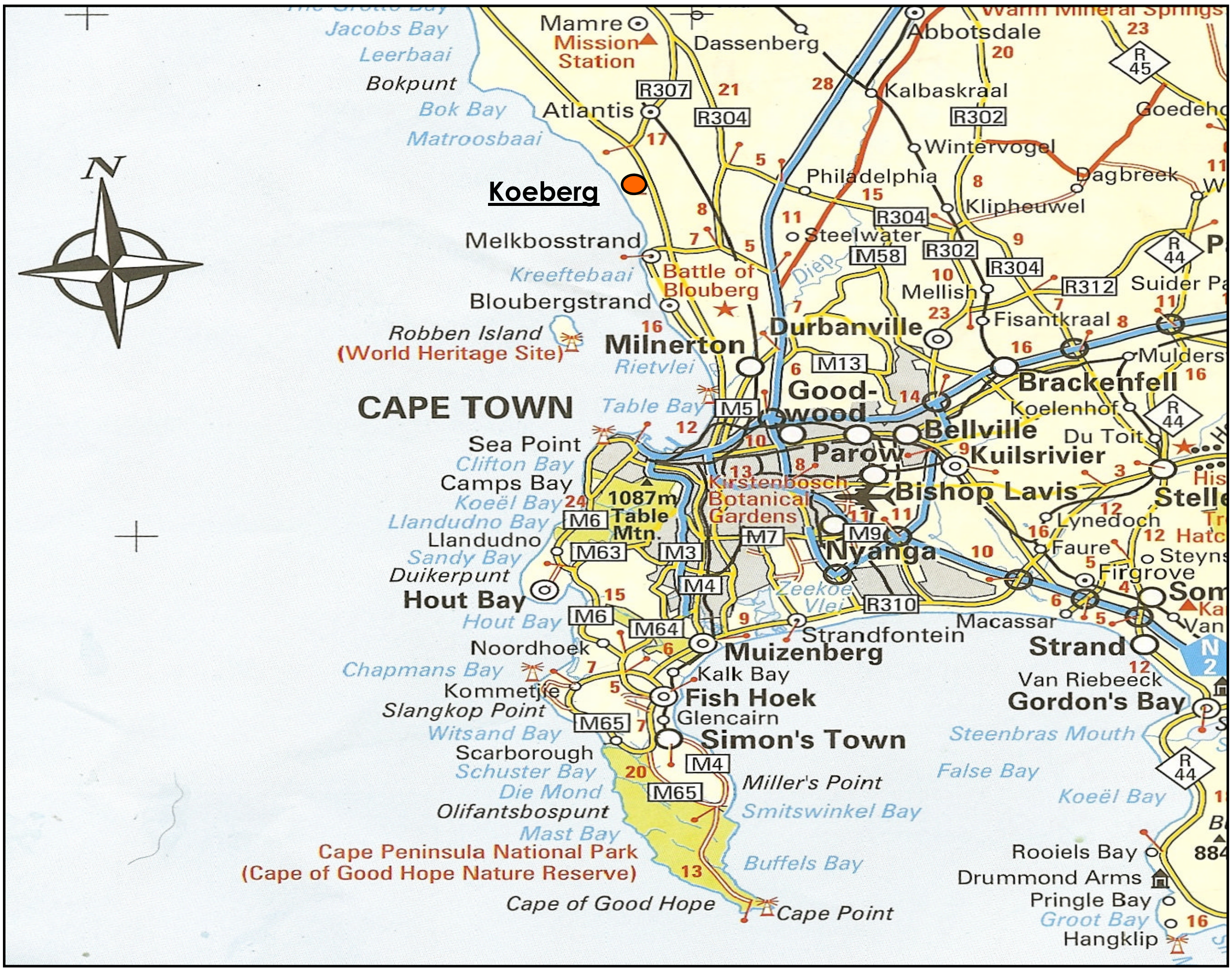


Figure 5-2: The Cape Town Area

The soil quality generally improves outwards towards the 20 km radius and this is reflected in the intensity and quality of the agricultural output. The farming is typically Swartland with wheat and fodder crop cultivation dominating agricultural activities. Dairy farming is also popular. Poultry farming occurs mainly in the north-eastern sector, particularly in the area of smallholdings east of Atlantis.

There is metropolitan growth in the area north of Milnerton (south-south-east and south-east of KNPS). The area immediately north of Table View is exhibiting rapid growth. Residential development in this area is still beyond the 10 km radius from KNPS.

Scattered industries in the form of brickfields and waste sites also occur in the SE and SSE sectors. Extensions of industrial areas south of the Diep River characterize the SE sector around the 20 km radius.

b) Site zoning

The Koeberg NPS site, as well as the proposed site for the PBMR DPP is currently zoned for agricultural use. The rezoning forms part of this application.

c) Socio-demographic profile

The KPNS site is located in ward 2 of the Cape Town Metropolitan Area. This ward accounts for 1.5% of the city's population. With an area of 555 km^2, it has a population density of 70 people per kilometre. Almost 36% of the population of ward 2 is between the ages of 15-34 years. This can be indicative of a large potential work force residing in this area. The population under the age of 14 comprises 28% which may point to an increased need for education and training in the future. The male population accounts for 48% in comparison to the female population of 52%.

In 1995, the City of Cape Town had the largest core of formal housing in South Africa (75.1% as opposed to 64.9% in SA). The housing backlog has steadily increased with the estimated backlog for 1998 at 150,000 houses and for 2000 at 240,000 houses.

About 13% of the households in ward 2 are in informal settlements. The average size of the houses is just over 4 rooms.

Educational progress in the Western Cape is good with the proportion of adults in the WC with no formal education substantially lower than the national level. The number of pupils per teacher is smallest in the WC with literacy levels significantly higher compared to the national figure.

According to the Census 2001 figures, the unemployment rate for ward 2 is 23%. Approximately 28% labour is employed in elementary occupations while 11% is employed in craft and trade related occupations. Professionals account for 7% of the labour force. In ward 2, 54% of the households earn less than R3, 200 per month.

As a result of the limited potential of the soil, there is no agricultural production of significance within the 5 km radius of KNPS. The 5 - 7.5 km band reflects the first intensive agricultural use between the NE and SSE sectors. Cultivated land is dominant in this area with wheat, fodder crops and dairy farming the main agricultural products. There is much chicken farming activity in the NE sector.

There are no major fishing activities within a 15 nautical mile (27 km) radius from the proposed PBMR site. The closest commercial activity in the Atlantic Ocean is at Robben Island, approximately 15 km south-southwest of the Koeberg site.

As a result of urban development and proximity to the sea, there is a decrease in agriculture towards the south. Most of the land north of Table View is owned in large tracts by property development companies and is destined for future urban development.

The city of Cape Town contributes 11% to South Africa's GDP and 75% to the Western Cape's economy. Its economy has on average grown faster than the national economy by almost 1% between 1991 and 2000.

The performance of the economic sectors measured by percentage contribution to real gross geographic product for Cape Town is as follows. The manufacturing sector makes the largest contribution at 25% followed by trade (23%); finance (19%); services (17%); transport (9%); construction (4%) and other (3%).

5.3.5 TRANSPORT

Within the 35 km zone around KNPS the major roads include: the West Coast Road (R27); N7; Otto du Plessis Drive and Blaauwberg Drive (M14); The Mamre-Darling Road (R304); the Melkbosstrand Road (M19); the Brakfontein road and the Dassenberg Road. Other significant roads with regard to KNPS are: the Klein Dassenberg Road; Philadelphia Road and Old Malmesbury Road. Other significant roads in Blaauwberg include: Bosmansdam Road (M8); Omuramba Drive/ Ratanga Road; Koeberg Road (M); Race Course Road and Parklands Main Road.

There are two north-south railway lines within the 35 km zone. These are the line to Namaqualand, which runs past Kalbaskraal and Malmesbury (approximately 24 km east of the KNPS site) and the Atlantis goods line (which runs approximately 6 km east of the KNPS site, connecting with the suburban line system at Champed Station).

Cape Town International Airport is the main centre for air traffic control in the area and the KNPS falls within its control area.

Aeronautic Properties cc owns a private airfield situated on portion 6 of the farm Brakkefontein no. 32 approximately 4.5 km NE of KNPS. It is located 2 km east of the West Coast Road. The airfield is currently used for light aircraft pilot training. The airfield is located within the Cape Town general flying zone and flying to and from the airfield is outside the Koeberg restricted zone.

5.3.6 INDUSTRIAL INSTALLATIONS AND OTHER URBAN INFRASTRUCTURE

a) Industrial areas

There are a large number and range of comparatively smaller industrial areas in the CMA. Many have a relatively low occupancy level. Over the past ten years there has been a distinct shift of the industrial growth momentum from the older areas close to the inner city to the north-west (Montagu Gardens) and north-east (Parow, Bellville South and Brackenfell). There has also been expansion to a lesser degree in the Ottery and Retreat areas of the southern metropolitan area. There has been little momentum in the Mitchell's Plain, Phillippi and Blackheath areas.

The Atlantis industrial area (10km north-north-east of the KNPS) consists of 964 ha of developable land of which 606 ha is currently undeveloped. Atlantis Diesel Engines and Foundries represented the largest concern in the area but has recently shut down its diesel engine manufacturing component. Other activities in the area include textiles, paper and packaging, engineering services and chinaware.

The main source of building material in the CMA is 3 active quarries in the northwest Tygerberg region. South of Dassenberg road are sand mining activities, which are managed by Atlantis Foundries. Kilos lime works is located along the coastal stretch between Melkbosstrand and Bloomberg. Clay brick enterprises run their brick works at Vissershoek (13.5 km SE). This is also the site for the Cape Town city councils evaporation depot and the Wastetech Treatment works. Other brickworks are dispersed through the area north of the Tygerberg hills and at Fisantekraal, Durbanville.

b) Energy generation

The City of Cape Town no longer runs any standby generators in the area. Several private companies in Atlantis and Montague Gardens industrial areas run their own standby generators that vary in capacity from 100 kVA to 400 kVA. There is also an open cycle gas turbine (OCGT) plant under construction in the Atlantis Area and an operating OCGT in Acacia. Both these installations belong to ESKOM. ESKOM is the main electricity supplier in the region.

c) Telecommunication

Telkom has microwave towers at Atlantis (M-1) and Melkbosstrand (M-2). There are no radio and television transmitters connected to the Telkom infrastructure within 16 km of KNPS. Telkom's South Atlantic Submarine Cable is located at Melkbosstrand 6 km to the south of KNPS. The Melkbosstrand station has to be permanently manned and falls under the jurisdiction of Telkom. Sentech (Pty) Ltd controls all radio and television transmitters in the region (none of which are within the specified 6 km radius of KNPS).

5.3.7 NATIONAL MONUMENTS

Several national monuments are named in the Blaauwberg Spatial development framework: 3rd draft, 2001. These include: the Old Municipal Hall; the wooden bridge over the lagoon at Milnerton; Klein Zoar in Milnerton; Ons Huisie in Bloubergstrand and the mission station and water mill in Mamre.

CHAPTER 6: ALTERNATIVES

6.1 INTRODUCTION

A key element of any environmental assessment is the process of exploring alternative means of addressing the project that potentially may have a lesser impact on the environment. It is also important to acknowledge the investigation of alternatives as one of the key issues to be raised by participating stakeholders. In this chapter the alternatives to the proposed PBMR DPP are presented. This is done by firstly describing the regulatory requirements for alternatives and then presenting possible technology and siting alternatives to the proposed PBMR DPP.

6.2 REGULATORY REQUIREMENTS REGARDING ALTERNATIVES

The ECA and NEMA and associated EIA regulations highlight the importance of investigating alternatives in the EIA process. The basis for investigating alternatives is unambiguously with a view to reducing the potential impacts on the environment of the proposed activity, through an alternative way of meeting the same project need and purpose for which the original activity was proposed. Alternatives are defined in GN R 1183 (the ECA EIA regulations) as to imply: *"in relation to an activity , means any other possible course of action, including the option not to act;"*. This definition is then supplemented in the DEAT guideline document on the ECA EIA regulations as being a "a possible course of action, in place of another; that would meet the same purpose and need (of proposal)". The key element of these definitions is the requirement that alternatives must meet the 'same purpose or need' as the activity originally proposed.

The NEMA EIA regulations define alternatives to a proposed activity as 'different means of meeting the general purpose and requirements of the activity'. This implies alternatives to -

- the property on which or location where it is proposed to undertake the activity;
- the type of activity to be undertaken;
- the design or layout of the activity;
- the technology to be used in the activity; and
- the operational aspects of the activity;

It is important to emphasis that the NEMA EIA regulations also limit alternatives to those which meet the "general purpose and requirements" of the originally proposed activity, so retaining and upholding the broad principle that alternatives should be feasible and serve the same principal purpose as the originally proposed activity. This is an extremely important consideration in the discussion on alternatives to the proposed PBMR DPP.

To complete the description of the regulatory requirements it is necessary to highlight that the description of alternatives is an important requirement of the scoping report.

6.3 TYPES OF ALTERNATIVES

As indicated, stakeholders have raised the issue of alternatives to the proposed PBMR DPP consistently and strongly. The types of alternatives that have been highlighted by stakeholders, and others can be summarised as follows:

- **Activity alternatives:** Is the construction and operation of a demonstration PBMR DPP the best mechanism for the demonstration of the technology?
- **Location alternatives:** Are there alternative sites to the KNPS site for the siting of the PBMR DPP?
- **Technology alternatives:** Is the PBMR technology an appropriate technology to consider for future electricity generation?
- **Scale alternatives:** Is the demonstration of a 400 MW(t) plant the best option, or should the demonstration be done with a smaller plant?
- **No-go alternative:** For an assessment of this alternative it is assumed that the activity does not proceed. In terms of the above categories, only three types of alternatives are deemed to be meaningful within the context of the regulatory requirements defined earlier and these are technology alternatives, location alternatives and the no-go alternative. Each of these types of alternatives is now presented together with an assessment of the feasibility of each.

6.4 TECHNOLOGY ALTERNATIVES

6.4.1 BACKGROUND

Eskom is responding to the growing electricity demand and need to establish new generation capacity in South Africa over the next few years. The capital expansion has a projected cost of R97 billion over five years (this has increased from the original projection of R84 billion following the acceleration of certain projects, and higher national growth levels). Generation capacity can be met by harnessing different energy sources and applying different technologies. These technologies differ markedly in their generation costs, performance and utilisation characteristics, suitability for the South African environment and state of commercial development. The choice of generation technology is multi-faceted and complicated and has to be conducted within the context of the South African policy framework, and legal and regulatory framework Please refer to Table 6-1 for a cost comparison between the various technologies.

Table 6-1: Summary of cost and performance data of new supply-side options (Department of Minerals and Energy)

	Type of Station	No of Units	Station sent	unit size (sent out)	Lifetime	Overnight Capital		PV Capital (10 %)	EPC Lead Time	Fixed O&M	Variable O&M	Fuel price	Efficiency (1-IFIV)
			MW capacity	MW	Years	Rm	R/ kW	discount rate) R/kW	Years	RlkW/a	R/MWh		%
New Coal-Fired Plants												Rlton	
CF Dry + FGD	Non-peaking	6	3850	642	30	37723	9799	12324	4	125.28	7.51	60	34.59%
Pumped Storage													
Pumped Storage (Braamhoek public data)	Peaking	4	1330	333	40	4200	3158	5179	7	90.00	9.00		76.00%
Pumped Storage (generic)	Peaking	3	998	333	40	7182	7200	8857	7	90.00	9.00		76.00%
Gas Turbines												R/GJ	
CCGT (Without Trans benefits) pipe	Non-peaking	5	1935	387	25	9797	5063	5659	3.0	175.26	10.58	20	47.04%
CCGT (With Trans benefits) pipe	Non-peaking	5	1935	387	25		4405	4925	3.0	156.48	9.45	20	47.04%
CCGT (Without Trans benefits) LNG	Non-peaking	5	1935	387	25	9797	5063	5659	3.0	175.26	10.58	32	47.04%
CCGT (With Trans benefits) LNG	Non-peaking	5	1935	387	25		4405	4925	3.0	156.48	9.45	32	47.04%
GT-Open Cycle (kerosene)	Peaking	2	240	120	25	920	3833	3949	2.0	79.80	65.88	72	32.26%
GT-Open Cycle (LNG)	Peaking	2	240	120	25	920	3833	3949	2.0	79.80	65.88	32	32.26%
GT-Open Cycle (Local syngas)	Peaking	2	240	120	25	920	3833	3949	2.0	79.80	65.88	28	32.26%
GT-Open Cycle (LPG)	Peaking	2	240	120	25	920	3833	3949	2.0	79.80	65.88	56	32.26%
New FBC												Rlton	
Greenfield FBC	Non-peaking	2	466	233	30	4508	9669	11511	4.0	204.61	19.54	10	36.65%
Imports													
Imported hydro	Non-peaking	4	1200	300	30	17044	14203	19948	6.5	204.88	0.00	n/a	n/a
Renewables													
Solar Thermal	Peaking	3	300	100	30	10043	33477	34589	3.0	147.29	0.13	0	n/a
Wind	Peaking	20	20.00	1	20	154	7714	7768	2.0	167.02	0.00	0	n/a
Nuclear												R/MWh	
PBMR (1st MM incl. trans benefits)	Non-peaking	8	1320	165	40		16533	17340	4	157.65	6.75	45	40.54%
PBMR (1st MM excl. trans benefits)	Non-peaking	8	1320	165	40	24693	18707	19651	4	157.65	6.75	45	40.54%
PBMR (Series MM excl. trans benefits)	Non-peaking	8	1364	171	40	14678	10761	10853	4	161.20	6.75	45	44.50%
PWR (incl. trans benefits)	Non-peaking	2	1747	874	40	27944	15995	15139	4	507.22	0.00	45	31.48%
PWR (excl. trans benefits)	Non-peaking	2	1747	874	40	25389	14532	15290	4	507.22	0.00	45	31.48%

Eskom uses a modelling tool called integrated strategic electricity planning (ISEP) to plan its future capacity strategy. By analysing usage patterns and growth trends in the economy, and matching these with the performance features of various generation technologies and demand side management options, ISEP identifies the timing, quantity and type (base load or peaking) of new capacity required over the next 20 years. It also provides the framework to investigate a wide range of new supply-side and demand-side technologies, while optimising investments and returns.

The plan is reviewed annually as part of Eskom's strategic and business planning process. The most recent plan (ISEP10) was approved in October 2005. The focus was to provide a robust plan that considers all the variables of Eskom and its shareholder. Sustainability issues continue to be integrated into the ISEP process including the assessment and internalisation, where possible, of relevant externalities.

6.4.2 RENEWABLE ENERGY

Renewable energy technologies are among the supply-side options being considered by Eskom. The organization has developed a renewable energy strategy which outlines a number of focus areas, including research and development, investigating investment and clean development mechanism opportunities and regional considerations such as the development of hydro resources.

Renewable energy sources which have been evaluated are wind, solar, wave, tidal, ocean current, biomass and hydro. Through the South African Bulk Renewable Energy Generation (SABRE-Gen) programme, a vehicle was established to enable the evaluation of multi-MW, grid connected generation. The initiatives all follow the same functional structure: namely the identification of promising options, an assessment of the financial and economic viability as well as resource potential in the country, the implementation of demonstration projects to conduct operational research and the provision of strategies for the uptake and sustainable deployment of the technologies where feasible.

The bio-energy and wave initiatives are still in the early stages of project development. Eskom participated in a pilot project by the Department of Minerals and Energy which investigates green power trading. Eskom contributed to the development of draft market rules and will act as the independent market operator for the duration of the project. A number of pilot projects on solar water heating are under way in residential and commercial buildings, with an additional pilot at an industrial site under investigation.

a) Biomass

Biopower is the use of biomass to generate electricity. There are three major types of biopower systems. They are:

- direct-firing plants that burn 100% biomass fuel;
- co-firing power plants that uses biomass as an adjunct to coal; and
- gasification-based power plants that convert biomass to a low- or medium-heating value gaseous fuel, usually for combustion in a gas turbine or engine.

As far as Eskom's renewable energy research programme is concerned, the programme has directed efforts at developing solutions for rural communities, while striving to assess the role that bio-energy can play as a MW-scale grid supply option.

In an effort to utilise small waste streams in the vicinity of rural communities the System Johannsen Gasifier has been constructed in conjunction with Eskom's research department and is currently under demonstration in Johannesburg.

The System Johannsen Gasifier makes use of wood and other biomass as a fuel source to produce a virtually "tar free" gas, which is then used to power a generator set for the generation of electricity. The Johannsen Gasifier system consists of a gasifier, cooling and cleaning system and finally the generator set. To determine the feasibility in a commercial environment, Eskom will pilot the first non-research unit in the Eastern Cape in 2006/7. Initial discussions started with the affected community and the University of Fort Hare in 2003. It is projected that the system will generate 100 kW of energy. The pilot project will be implemented in conjunction with the University of Fort Hare and will also involve a local sawmill and rural community.

Grid supply options stem mainly from the waste generated in the Pulp & Paper and Sugarcane industries. This waste is burned in boilers and the process heat used to drive a turbine. Eskom's efforts are aimed at assessing the waste volumes available to determine where these options can be exploited for large-scale power generation. Two projects, focussing on these industries, are currently underway.

b) Wind

The Klipheuwel wind energy-demonstration facility was commissioned in February 2003 and has delivered significant operational and research-related information. A total of 12,2GWh has been generated since commissioning, and the wind turbines are operating at an average availability of 90%. Research has focused on how the technology interacts with the South African environment and has highlighted unique factors that can impact its performance. One of the inherent problems associated with imbedded generation, such as wind turbines, is that this energy is lost if load is shed in large areas. The wind turbines are not designed to endure many emergency shut downs when there is no electricity supply. For this reason, the turbines were manually shut down for extended periods during February 2006.

c) Solar

The research and demonstration for the solar dish stirling system has confirmed that the dish is not yet a commercially viable option. Improvements in technology will be monitored. Due to damage sustained in 2004, the engine had to be sent to Sweden for repairs. It has been recommended that the system be moved to an academic institute for skills development.

d) Concentrating solar thermal plant

The concentrating solar power project is assessing the feasibility of constructing a 100 MW central receiver-type power plant in the Northern Cape. The feasibility study focuses on addressing technology risk issues, while refining the financial scenario facing such a development. Previous environmental and technical feasibility studies have identified the Upington area in Northern Cape as a viable site for establishing a concentrating solar thermal power plant. In addition, Upington has one of the highest solar resource values in the world.

Eskom will proceed with the next engineering phase of the project. This phase will concentrate on risk reduction efforts and updating the business case for the proposed pilot plant. Discussions with technology partners have been initiated and a draft project plan completed.

e) Ocean energy

Eskom is investigating the feasibility of ocean energy as a future primary energy source. Current research is monitoring and evaluating various international initiatives. Once these studies have been completed, Eskom will assess the feasibility of different technologies for applicability under South African conditions.

f) Fuel cell

Eskom and the University of the Western Cape have collaborated on fuel cell research for the past three years. This research was mainly for the development of skills in this field. The primary objective of the project is to develop potentially commercial components for direct methanol fuel cells. A variety of commercial and internally produced proton conductive membranes, catalyst and membrane electrode assemblies were produced. Production methods were improved to gain maximum power output from the direct methanol fuel cell.

6.4.3 STATUS AND APPLICATION OF RENEWABLE TECHNOLOGIES

Despite their potential to generate electricity with a lower environmental burden, renewable technologies cannot be readily used to meet growing electricity demand. Wave technology is generally immature and requires considerable additional development to make it commercially viable. Biomass has been used successfully where there are large quantities of biomass available such as in the sugar cane industry, but is limited by the volumes of biomass required to generate adequate supply. Wind technology is a mature technology and used successfully elsewhere in the world but it is a relatively expensive form of electricity and has limited availability (periods in which power is generated). South Africa also has limited wind energy potential resulting in current wind generators having an availability of some 18%. Solar thermal plants are also a mature technology but have a relatively high cost per kilowatt hour. Because the heat can be stored on solar thermal plants they have a higher availability than wind generators but they require large areas of mirrors to adequately concentrate the solar energy to generate power.

6.4.4 WHAT ALTERNATIVES ARE FEASIBLE IN SOUTH/SOUTHERN AFRICA

Given South Africa's resources and geography only certain electricity generation technologies are commercially viable. The range of viable technologies that Eskom can consider is limited and listed in Table 6-2, together with the broad development phases of each.

Table 6-2: Summary of electricity generation technologies that are available to Eskom.

Technology development phase	Technology
Proven (base load)	Conventional coal (pulverised fuel)
	New coal-based technologies - Fluidised bed combustion - Supercritical coal stations
	Combined cycle gas turbine
	Imported hydro
	Nuclear (Koeberg)
Proven (peak load)	Conventional and new coal based
	Pumped storage schemes
	Open cycle gas turbine
Demonstration	Nuclear (PBMR)
	Solar (photovoltaic and concentrated solar thermal)
	Wind
Research	Tidal and ocean current
	Biomass
	Underground coal gasification

6.4.5 RESPONDING TO THE GROWING DEMAND FOR ELECTRICITY

The purpose of this project is to assess and demonstrate the integrated technological, environmental and economic viability of the PBMR technology with a view to a potential role in meeting the growing electricity demand both in South Africa and elsewhere in the world.

a) Need for generation capacity

South Africa is in need of generation capacity, especially in the coastal regions. Most of South Africa's coal-fired electricity is generated by large-scale plants that are located near the pitheads of two extensive coal-producing areas, both of them far inland on the eastern side of the country. This requires long power lines from the coal-rich areas to load centres away from the pitheads, which in turn implies high capital costs and transmission losses. This uneven distribution of power stations, as well as the fact that additional generation capacity is urgently required, prompted ESKOM to investigate alternative generation technologies. This is especially applicable to base load generation technology. Within this context it is also necessary to consider technologies that can supply peak load. While renewable forms of electricity generation are obviously highly desirable from the point of view of minimising the impact on the environment, none of these are able to adequately respond to the need to generate base and peak load on demand.

b) Base and peak demand

As electricity cannot be stored it must be used as it is generated. Therefore, electricity must be generated in response to supply and demand requirements. The demand for electricity arises from a number of sectors with different requirements. Some sectors require electricity on a continuous (24-hour) basis; others require it mainly during working hours, while others may require electricity at specific times of the day. Therefore, the demand for electricity fluctuates through any 24-hour period, the week, and also seasonally. This means that of the electricity that is supplied there is a sustained minimum requirement (so-called 'base load') and a highly variable requirement (so-called 'peak load'). Most electricity generating technologies work best when they are supplying a consistent stream of electricity and tend to become less efficient as the stream varies.

At the same time in terms of cost-effectiveness it generally makes sense to invest in very large facilities, and Eskom is characterised by large-scale power stations (typically generating some 3600 MW each). Although these large facilities tend to be more cost-effective they cannot easily be switched between base load and peak load. This means that Eskom needs to ensure that within their generation facilities they have technologies that are good for providing cost effective base load and those that provide cost effective peak load. A key technology for supplying the latter is the use of pumped storage schemes where electricity generated by base load is used during low demand periods to pump water into storage areas. During peak load periods the water can then be discharged to generate electricity. This can be regarded as a mechanism to "store the energy".

c) Supplying electricity

In sensibly investigating alternatives to the proposed PBMR, it is necessary also to describe the different roles that are played by different technologies in supplying electricity to a grid. In the previous section the differences between base and peak load were described, where quite different technologies are required to optimise the response to peak load compared to those required for peak load. A large coal fired power station, for example, is well suited to supplying base load because it can supply a large quantity of power consistently and relatively cost effectively over a long time. However, a power station of that type cannot readily be used to respond to peak loading or rapid changes in demand. For peak loads or rapid changes in demand, gas turbine power stations or diesel generators can supply power very quickly from start-up but they are relatively very expensive to operate. Such technologies are thus well suited to peak loads, but are less appropriate for base load.

Another important challenge in supply electricity is getting generating capacity as close to the users as possible.

The large fuel volumes required to operate large-scale fossil fuelled power stations, where the ideal is to locate the power stations at the source of the fuel, complicate this requirement. Transmission loss (essentially the energy required to transmit electricity along power lines) is another significant consideration in supplying power over long distances.

This is why most of Eskom's coal fired power stations are located on the Highveld, where they have direct access to coal. Fuel sources are not readily available in the coastal regions of South Africa and so supplying power becomes a more expensive undertaking if the electricity has to be transported over long distances. The establishment of the Koeberg Power Station was in response to these challenges, where the large demand for electricity in the Western Cape was most cost effectively served by establishing a nuclear power station in close proximity that does not require the transportation of large volumes of fuel.

6.4.6 THE POTENTIAL MERITS OF THE PBMR TECHNOLOGY

PBMR as a technology responds directly to these various needs. Due to the unique characteristics of the PBMR technology it can serve as a mid merit or base load. This means that PBMR technology because of its ability to rapidly increase and decrease load is an ideal way in which to respond to the need to provide base and peak load. Furthermore the reported advantage of the PBMR technology lies in the fact that as a '4th generation nuclear technology' it has reduced the potential risks to the environment of earlier generation nuclear technologies. These features include low power density, passive safety systems (fuel design, slender core, convection cooling), temperature efficiency and highly negative reactivity co-efficient, i.e. the reactor cool down by itself and does not require active engineered cooling.

The modular design of the PBMR, and the fact that it is helium-cooled (thus negating the need to be close to a large water source like the sea) means that power could be generated in close proximity to the where the electricity is required. This would improve the efficiency and thus the cost effectiveness of the supply. Given that the PBMR could supply a base load (continually supply power) regardless of weather conditions, access to cooling water, access to fuel and access to large tracts of land means that the technology provides a supply option to a utility that is not directly paralleled by other technologies.

In these terms it is not sensible to compare renewable forms of electricity generation to technologies that can supply mid merit and base load on demand. Renewable electricity generation technologies such as wind and solar technologies, do not provide a viable option for meeting the need and purpose of the proposed PBMR DPP. Technologies like solar and wind power are at best intermittent supplementary contributors to an electricity grid and always require a reliable base load technology to be feeding the grid. PBMR Technology is potentially a base load generation technology with a high load following ability. This does not mean at all that renewable forms of electricity generation should not be pursued (the ways in which Eskom is pursuing these technologies will be described later), simply that they are not viable alternatives to the requirement for a technology like the proposed PBMR. A technology like the PBMR offers almost unique attributes in supplying electricity consistently and cost-effectively to users.

6.4.7 ALTERNATIVE WAYS OF RESPONDING TO BASE AND PEAK DEMAND

Given that renewable technologies cannot be used as meaningfully alternatives to a technology like PBMR, attention now turns to technologies that are more comparable in terms of potential role and attributes. Technologies that fall into this category

- coal fired power stations; and
- conventional pressurised water nuclear reactors.

These technologies are compared qualitatively in Table 6-3. This highlights the relative merits and demerits as viable alternatives to the proposed PBMR technology.

Table 6-3: Comparative technology table

Technology Characteristic	PBMR technology	Pressurised water technology	Coal fired power station technology
1. Fuel.	Smallest inventory of fuel of the three technologies per KW(h). Fuel specific and limited number of potential suppliers internationally.	Larger inventory per KW(h) than PBMR, smaller than Coal technology.	Largest inventory of fuel per KW(h) of the three technologies.
2. Waste.	Small volumes, specific treatment and management required to prevent environmental pollution. Liquid radiological waste dose to public < 5μSv.y^{-1} Gaseous radiological waste dose to public < 20 μSv.y^{-1} Solid radiological waste volumes (m^3/annum): Low level: < 100 $m^3.y^{-1}$ Medium level: < 20 $m^3.y^{-1}$ High level: 20 to 30 $m^3.y^{-1}$ (spent fuel)	Mid volumes, specific treatment and management required to prevent environmental pollution. Liquid radiological waste dose to public 5.5 μSv.y^{-1} (2005) Gaseous radiological waste dose to public 0.48 μSv.y^{-1} (2005) Solid radiological waste volumes (m^3/annum): Low level: 29.4 $m^3.y^{-1}$ (2005) Medium level 33.6 $m^3.y^{-1}$ (2005) High level	Large volumes, specific treatment and management required to prevent environmental pollution.
3. Track record.	No commercial track record.	Proven commercial track record. Became undesirable, however, desirability is currently on the increase in European countries.	Proven commercial track record.
4. Generation capacity.	Proposed in combinations of one to six modules with generation capacity between 165 MW(e) to 990 MW(e).	Sets of two with capacities of ± 1 800 MW(e).	Sets of six with capacities of ± 3 800 MW(e).
5. Dependence on site characteristics.	Low dependency can be dry cooled.	High dependency requires large volumes of cooling water.	High dependency requires source of coal close by.
6. Application.	Base load supplier close to demand centre.	Base load supplier to national grid.	Base load supplier to national grid.

Technology Characteristic	PBMR technology	Pressurised water technology	Coal fired power station technology
7. Life cycle footprint.	Station footprint, relative to other technologies small. Uranium mine, localised footprint, medium extent.	Footprint of station medium compared to other technologies. Uranium mine, localised footprint, medium extent.	Footprint of station large compared to other three technologies. Coal mine extended footprint compared to uranium mine.
8. Emissions – Greenhouse gases (CO_2)	None from operation.	None from operation.	Major source of CO_2. and other greenhouse gasses
9. Emissions – radio activity	Regulated to NNR emissions limits.	Regulated to NNR emissions limits.	Radon gas from coal unregulated.
10. Emissions particulates	None.	None.	Major source.
11. Emission - SO_s	None from operation.	None from operation.	Major source.
12. Safety features	Passive safety features.	Engineering safety system.	N/A.
13. Efficiency	Greater than 40%	33-37%	37-40%
14. Co-generation.	Hydrogen and desalination	None	None

In the comparison offered in Table 6-3, the key element for which the PBMR is seen to be less advantageous than the other two technologies is in terms of track record or commercial maturity of the technology. In principle at least, the PBMR technology offers a number of potential advantages over the other forms of electricity generation in terms of a potentially safer operation (relatively to pressurised water technology), and a lower pollution burden compared to a conventional coal fired power station. In these terms it is presented that the proposal to build and operate a demonstration plant with the specific purpose of evaluating and demonstrating the commercial viability of the technology, cannot be directly met by the further exploration of alternative technologies.

6.4.8 THE BROADER PURSUIT OF ALTERNATIVE TECHNOLOGIES

As indicated earlier, the fact that renewable forms of electricity generation do not present direct alternatives to the base and peak load generating capability of the proposed PBMR, does not mean they have no further relevance. Eskom is in the process of exploring a number of different ways in which to generate electricity and is investing in the further development of renewable technologies. ESKOM manages the development of generating options by means of a process known as the 'Project Funnel'. Please refer to Figure 6-1 for an illustration of the project funnel.

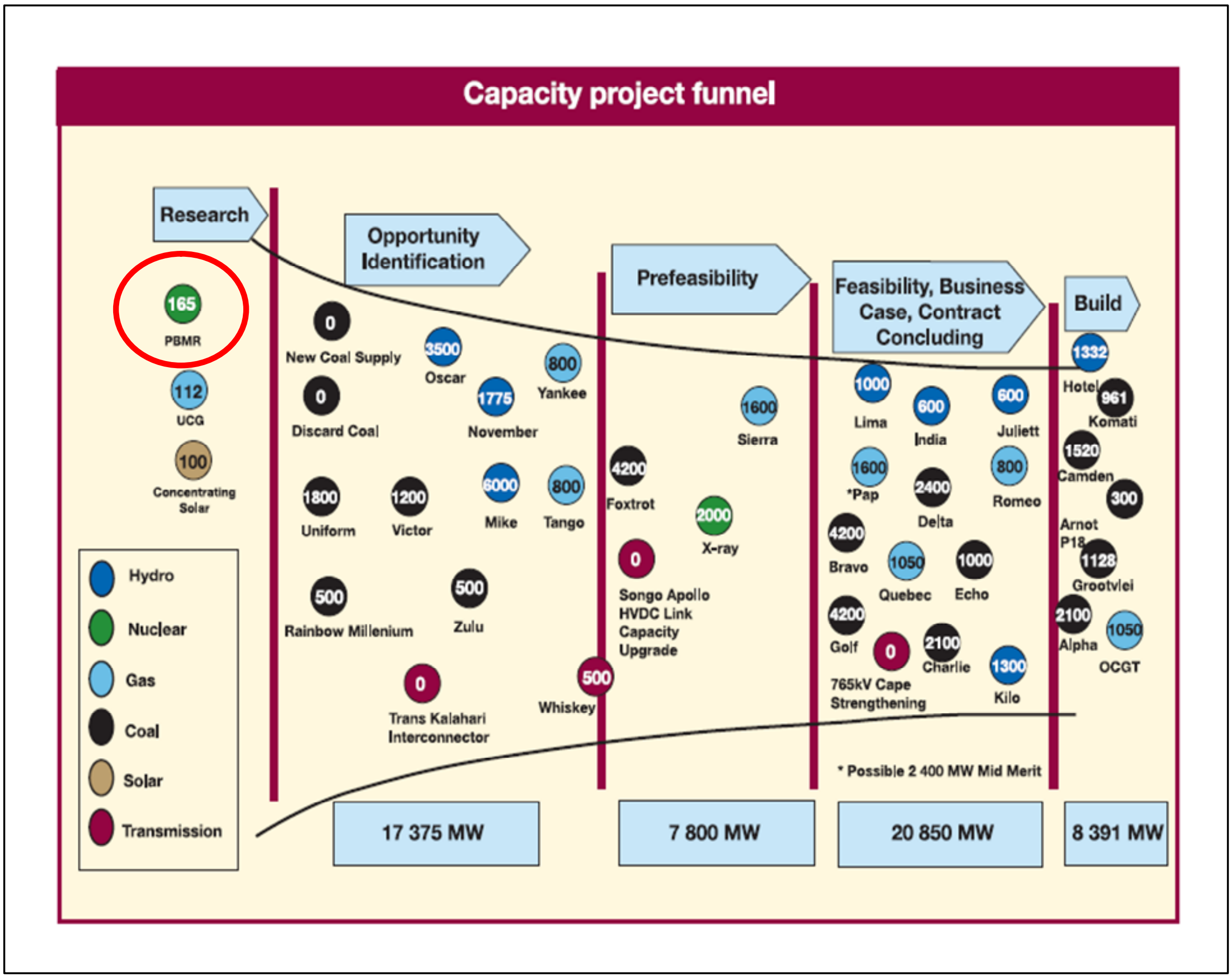


Figure 6-1: Project funnel

The project funnel refers to a broad array of potential projects that are based on different technologies and that can be seen collectively to address the need for increased generation capacity.

A key element of the funnel is that it reflects where the different projects (and associated technologies) are in the commercialisation process (i.e. the stage of the development of these technologies). This is a key consideration for Eskom as the operating costs, and security of supply are essential elements of any power utility's operation. Individual projects cannot be identified here for commercial regions – should this information become public knowledge it would potentially cause distortions in property and fuel prices. However, the project funnel provides a broad indication of the array of technologies that Eskom is pursuing, and where these are relative to the point of commercial operation.

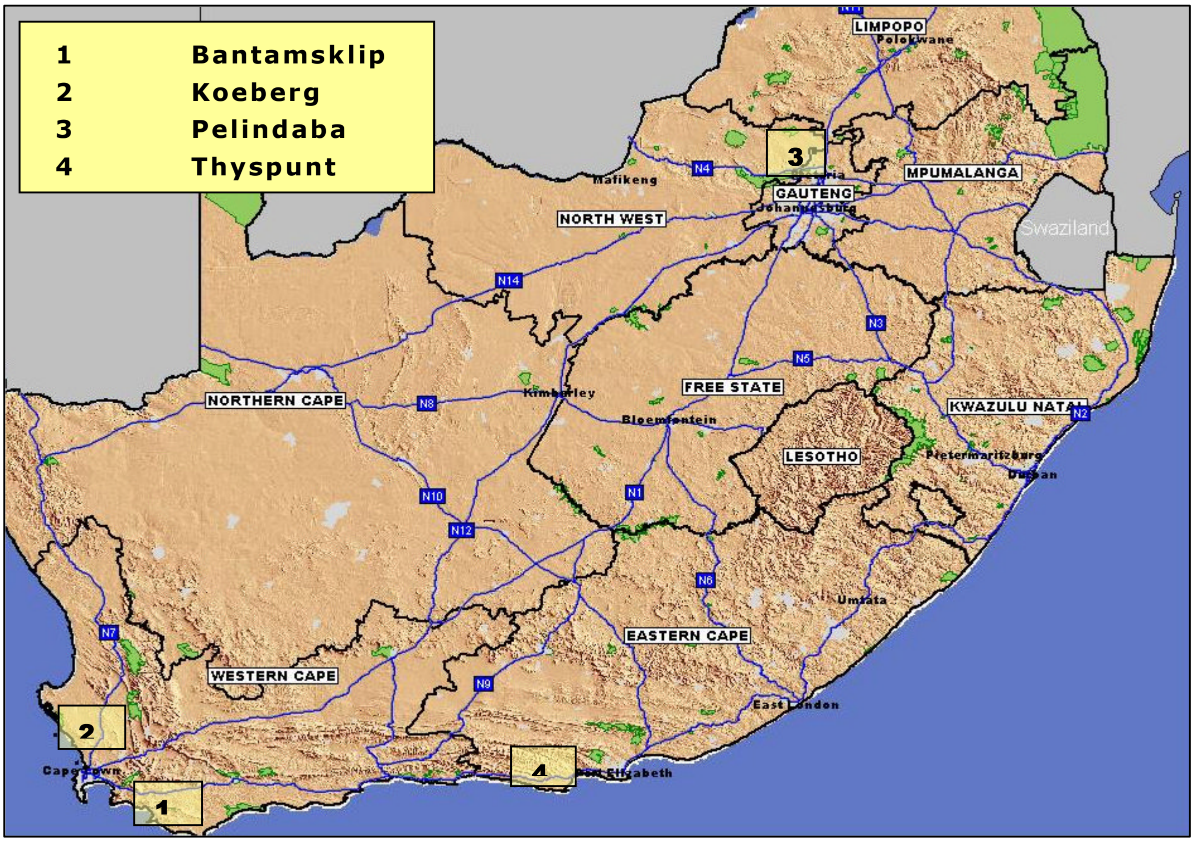
There are currently 34 projects in the Project Funnel including base load -, peaking-, and mid merit options. To provide a better indication of the range of projects being considered currently the following projects, which are included in the project funnel, can be briefly described. These are:

- Project Alpha is a new 2100 MW (first phase) but is likely to increase to 4800 MW during the second phase, base load coal-fired power station in the Lephalale area, for which approval has been obtained from both Government and the ESKOM Board in terms of the Public Finance Management Act (PFMA) and a positive Record of Decision obtained from DEAT.
- Project Hotel is a peaking pumped-storage scheme on the escarpment located close to Ladysmith for which a positive RoD was received.
- In addition to the above 8 391 MW of new generating capacity is at present under construction. This includes the return to service of three previously mothballed power stations at Camden, Komati, and Grootvlei, as well as two Open Cycle Gas Turbines at Atlantis and Mosselbay respectively.
- Project X-ray refers to a conventional nuclear power station. ESKOM is currently doing a feasibility study into building a conventional nuclear power station at the coast. Possible sites on the Southern Cape coast, Cape West coast, and Northern Cape coast are under consideration. EIA studies will commence should the above study indicate that the option is feasible.
- Demonstration plants to determine the Techno-economic performance of PBMR technology, wind technology and solar technology are in various stages of completion. Of the mentioned options the wind demonstration plant is complete, while the PBMR and Solar Demonstration plants are in the EIA and final design stages respectively.

In these terms it can be argued that whereas there are limited direct alternative technologies to the proposed PBMR technology, it is necessary to recognise that when considering simply the need to generate electricity, that Eskom is currently investigating a broad array of alternative technologies to maintain and grow their generation capacity. These alternative technologies offer differing merits in that pursuit including attributes such as base and peak load ability, cost–effectiveness and the ability to reduce the resource and pollution burden of generating electricity. It is thus presented that Eskom is investigating a broad range of alternative forms of electricity generation options of which the proposed PBMR technology is one.

6.5 LOCATION ALTERNATIVES

Given that there are no direct technology alternatives to the specific function and attributes of the proposed PBMR, attention now turns to the possibility of alternative locations for the proposed PBMR DPP. Comprehensive site alternative assessments and public participation processes were implemented during the 302 MW(t) PBMR DPP environmental impact assessment (PBMR EIA Consortium, 2001). The information from this previous process was evaluated and is still considered valid and has been used in developing the section that follows. Alterative possible sites for the proposed PBMR DPP, are **Bantamsklip, Pelindaba, Thyspunt** and the Koeberg Nuclear Power Plant (KNPS) site. These sites are shown in Map 1. The value of these various sites lies in the fact that bar the Pelindaba site, all have all been identified as potentially suitable for the establishment of a conventional nuclear power station. Existing nuclear related activities at Pelindaba also imply a potentially feasible site.



Map 6-1: Alternative site locations

As part of the assessment of these potential sites, a detailed description has been prepared of the biophysical, social and service and infrastructure characteristics of each. However, a key requirement for the establishment of the DPP is the availability of existing services. It is important to understand that this requirement, more than any other dictates a preference for the Koeberg site. Nevertheless for the sake of completeness the attributes of the other sites are briefly presented in the sections that follow.

6.5.1 BANTAMSKLIP (INDICATED AS 1 ON MAP 1)

a) Location

The Bantamsklip site is located approximately 10 km south-east of Pearly Beach and *approximately* 50 km north-west of Cape Agulhas, in the southern Overberg sub-region.

b) Biophysical description

The site consists of semi-consolidated dunes underlain by Peninsula Formation quartzitic sandstone with minor green-to-grey shale bonds. The basement topography at the site is mostly below the 4 metres above mean sea level contour. The overburden thickness is essentially determined by the dunes and rises gently to 9 m in the north-east. The Bantamsklip site is at least 3 km away from a possible capable fault. Foundation conditions are suitable for the construction of a PBMR DPP.

Two vegetation communities occur on the site, namely dune asteraceous fynbos and secondary dune fynbos/acacia. The dune asteraceous fynbos community has a distinctive and high endemic dune flora. It is likely that there are 3 – 9 threatened species in this community. Although the conservation status of this community is not critical, very little of the dune asteraceous fynbos is formally conserved.

One of South Africa's rarest endemic coastal breeding bird species, the African black oystercatcher (H*aematopus moquini*), is found on the Bantamsklip site. These birds have been seen to breed on the site. Due to the quality of the fynbos on the site some bird species endemic to the fynbos were observed on the site, i.e. Cape sugarbird (*Promerops cafer)* and the orangebreasted sunbird (*Nectarinia violacea)*. The bird life on the site has conservation value and should be considered as significant.

c) Infrastructure, demography and archaeology

The archaeological sites at Bantamsklip are chiefly shell middens of the Late Stone-age period. Shell middens are mostly covered with sand and vegetation and with organic material less well preserved. Although these sites are of archaeological importance, their research potential is not high. A fish trap constructed by the Khoi-Khoi about 2 000 years ago is located north-west of the Bantamsklip site. These fish traps should not be affected by the construction of a PBMR DPP on the site.

The Buffelsjagt campsite to the east falls within a five-kilometre radius from the centre of the Bantamsklip site. The campsite has accepted as many as 3 200 people during the High Holiday season. The 16-km radius includes both the Pearly Beach holiday population and the Buffelsjagt population, which could exceed 13 000 people. Access to the Bantamsklip site is via the R43 beyond Gansbaai en route to Stanford. From Stanford the route follows the R43 via Gansbaai. The route is entirely on paved roads, with the R43 passing the Bantamsklip site approximately two kilometres to the north. An access road could therefore be constructed without significant environmental impact.

The area obtains almost all of its water from underground aquifers or runoff captured in the more mountainous areas. These water resources are insufficient during the holiday season periods. Water supply for construction and operation of a PBMR could prove to be problematic, and may require the construction of a bulk supply pipeline. Such a pipeline may be associated with significant environmental impacts.

Connection to the national transmission grid can be made at the Bacchus substation. To achieve this, transmission lines would have to be constructed across the Kleinrivierberge to Bot River, a distance of about 90 km from Bot River. It is assumed that the lines will follow the existing lines from Palmiet pumped storage scheme to the national grid, via the Bacchus Substation, a distance of about 40 km. The lines would cross over sensitive environments and therefore possibly adversely impact on these environments.

d) Socio-economic characteristics

Economic activity in the area is associated with the tourism and fishing industries. The tourism industry centres on the Buffelsjagt and Pearly Beach holiday facilities. The total number of visitors may exceed 13 000 during peak holiday season.

The Buffelsjagt community, which consists of about 20 households, has engaged in commercial fishing since the 1920s. Although the community has no legal title to the land they occupy, they retained the traditional rights to the land when it was taken over by the Department of Community Development. The community depends on the marine environment for income. Income is supplemented by picking wildflowers on neighbouring farms and occasional contact work. The community's education levels are low, emphasising the population's dependence on marine harvesting and limited ability to compete in the outside job market.

6.5.2 PELINDABA (INDICATED AS 3 ON MAP 1)

a) Location

The proposed Pelindaba site is located in the North Western Province to the west of Pretoria, and is currently owned by the South African Nuclear Energy Corporation. This is an operational site for nuclear related activities.

b) Biophysical

The aquifer beneath the Pelindaba site can be classed as a secondary aquifer with the majority of groundwater occurring within faults, fracture zones associated with diabase intrusions, and along geological contacts. The perennial Crocodile River, the

Hartbeespoort Dam and the seasonal Moganwe stream are the only nearby bodies of surface water. Rainwater from the site drains in an easterly direction into a tributary of the Moganwe stream. Water of the Crocodile River is used for recreation and agricultural purposes, while water of the Hartbeespoort Dam is used for recreation. Boreholes are utilised for domestic (which includes drinking purposes) and agricultural purposes. No water from the seasonal Moganwe Stream is used for recreation, domestic or agricultural purposes.

Pelindaba lies within the Savanna Biome within the veld-type that was characterized as Bankenveld. The Pelindaba site is on the transition between the grassland (veld type 34) and the Savanna biome (veld type 18). The site is probably more characteristic of Rocky Highveld Grasslands (RHG). The area of the RHG biome is 240 633 km^2; ± 65% of which is transformed, and 1.38% conserved. In the Gauteng area the vegetation is highly threatened by urbanisation, industrialisation and mining, and, to a lesser degree, agriculture. Two rare bird species, namely the Cape vulture and the peregrine falcon *(Falcon peregrinus)* occur in the Magaliesberg area although neither are known to visit the Pelindaba site.

c) Infrastructure

The public roads in the area consist of the R512 (from Johannesburg via Lanseria to Rustenburg and Brits) and the R511 (from Johannesburg via Hennops River to Brits). These roads bypass the site at distances of 3,6 and 6,6 km respectively. Overhead air traffic is a function of the flying patterns in the area that depend on factors such as the proximity of airports, positioning of general flight training areas, established air traffic routes and military testing ranges.

The airports nearest to Pelindaba are Lanseria, Wonderboom, Waterkloof and Swartkops in Pretoria. Lanseria is the largest airport training facility in South Africa. There are no military testing ranges in the region. The Johannesburg general flying area is located to the northwest of the Pelindaba site. A height of 7000 feet above sea level is enforced by the Civil Aviation Authority. Electronic beacons for aircraft are located in the close vicinity of Pelindaba.

There are adequate fire and emergency service facilities and equipment on site (staffing levels are however low but have been supplemented recently) and a nuclear emergency plan is in place at Pelindaba. A 5 km radius around SAFARI reactor has been determined for the nuclear licence as the emergency planning zone (EPZ).

d) Land use and Demographics

Currently the number of personnel on site amounts to 1100 employed by NECSA and 1300 employed by lessees. The area surrounding the site comprises mostly rural and agricultural land use. To the northwest, however, a number of small towns are located around the Hartbeespoort Dam, namely Kosmos, Melodie, Schoemansville, Ifafi, Meerhof and Magaliesburg. A higher population density is also seen to the east where the western outskirts of Pretoria (Atteridgeville) lie.

A high-density population mode is developing at Diepsloot, more than 15 km to the south of the site. The nearest hospitals, namely Kalafong and Santa Tshepong hospitals, are situated 17 km from the site. There are no old-age homes or institutions for mentally handicapped persons situated within the 5 km EPZ of Pelindaba. According to the Gauteng spatial development framework, agriculture is a significant component of the economy, but it has experienced a decline.

The Gauteng spatial development framework states that the natural environment in the Western Gauteng Services Council, particularly in the north, could support substantial tourism. The areas of southern Crocodile River, Magaliesburg and Magalies Mountain Range have been included as important resources. The Cradle of Humankind world heritage site forms an integral part of this area. The node has a market area drawing mainly from Gauteng.

6.5.3 THYSPUNT (INDICATED AS 4 ON MAP 1)

a) Location

Thyspunt is situated west of Port Elizabeth, close to Cape St. Francis.

b) Biophysical description

The vegetation cover is undisturbed along the coastline of the site, with only a small area of exposed sands and pioneer species at the eastern end. The large mammal population of the site is typical of this part of the coast and the species recorded are not among those considered to be at risk, i.e. endangered or rare. Fauna and flora on this site is not considered to be of high conservation significance.

A large portion of the site lies below the 20 m contour, and is covered by vegetated hummocked sand dunes. Bedrock elevation rises gently inland and is on average 4 m to 6 m above sea level. However, the Klippepunt Fault, 5 km to the south of the site, must be regarded as seismically active, until proven otherwise. None of the fish species that occur at the site are threatened or rare.

c) Infrastructure, land use, demography, history and archaeology

The Thyspunt site is situated in an area where socio-economic development has been limited almost exclusively to recreation and agriculture activities. Access to the site is from both the west and east via a low-order gravel track. The N2 national road runs in an east-west direction, approximately 20 km to the north. The remoteness and absence of suitable access roads would require the construction of extensive new roads, with the associated environmental impact.

Oyster Bay is the nearest settlement, and consists mainly of holiday houses. Sea Vista and Humansdorp are 11 km to the north-east and 19 km to the north respectively. Several farms exist west and north-west of the site. Demographic requirements in terms of nuclear licence requirements can be complied with. No shipwrecks occur at the site. However, the wreck of the Cromatyshire (1901) is known to be in Thysbaai, approximately one kilometre west of the site. Two series of fish traps with archaeological significance occur at the site. These would be severely affected by the construction of a cooling water intake bay.

d) Socio-economic aspects

The principal farming activities in the area consists predominately of sheep and dairy farming. Wheat is also cultivated in this region. The construction of a PBMR should not have any significant impact on the economic activities in the immediate vicinity of the site.

6.5.4 AN ASSESSMENT OF THE ALTERNATIVE SITES FOR THE PROPOSED PBMR DPP

The desirability assessment of the alternative sites compared to the preferred site is given in Table 6-4.

The KNPS site, and the three alternative sites, Pelindaba, Thyspunt and Bantamsklip, were evaluated against a set of technical site criteria. The detail of these criteria points are indicated in the table in the column with the heading: PBMR DPP site criteria. The selected assessment criteria relates to some basic infrastructure requirements of the PBMR DPP, as well as a set of criteria established to identify and assess certain environmental sensitivities that may be associated with each site. The purpose of the assessment is to determine whether any of the alternative sites are more suitable and/or desirable than the KNPS site for a PBMR DPP.

This assessment focused on the possible construction of a **PBMR Demonstration Power Plant,** and has **no relevance** on the construction of further PBMR units, PWR Power Stations or any other future proposed development at any of the sites assessed.

Environmental sensitivities of each site and the results of the site assessment are indicated in Table 6-4.

Table 6-4: Results of the Assessment of Alternative Sites

PBMR DPP Site Criteria		KNPS Site	Bantamsklip Site	Thyspunt Site	Pelindaba Site
1.	**Supporting infrastructure**				
1.1.	Still water bay housing the cooling water inlet	Existing infrastructure	Non-existent, undeveloped site, construction activities in tidal zone.	Non-existent, undeveloped site, construction activities in tidal zone.	Inland site. Cooling water would most likely be obtained from the Hartebeespoortdam. Alternatively, dry cooling may be used at significant additional expense. Impact on surrounding properties.
1.2.	Cooling water outlet system	Existing infrastructure	Non-existent, undeveloped site, construction activities in tidal zone.	Non-existent, undeveloped site, construction activities in tidal zone.	Will require some further modification at additional expense. Impact on surrounding properties.
1.3.	Access roads designed to handle Nicolas horse and trailer. Width 8.0 m, radius and curves 30 m minimum	Existing infrastructure. Minor upgrading of some roads.	Non-existent, undeveloped site Approximately 2 km of new road to be developed	Non-existent, undeveloped site. Approximately 20 km of new road to be developed	Will require upgrading of some off-site feeder roads.
1.4.	Storm water systems – clean, dirty	Existing infrastructure, minor modifications required	Non-existent, undeveloped site	Non-existent, undeveloped site	Will require upgrading of existing infrastructure
1.5.	Sewage system	Existing infrastructure	Non-existent, undeveloped site	Non-existent, undeveloped site	Will require addition
1.6.	Security fences/access control	Existing infrastructure	Non-existent, undeveloped site.	Non-existent, undeveloped site	Will require addition.
1.7.	Potable water supply	Existing infrastructure	Non-existent, undeveloped site.	Non-existent, undeveloped site	Will require addition
1.8.	High voltage yard and buildings	Existing infrastructure, construction of a 132 kV power line on the Koeberg site required	Non-existent, undeveloped site.	Non-existent, undeveloped site	Will need modification and addition

PBMR DPP Site Criteria		KNPS Site	Bantamsklip Site	Thyspunt Site	Pelindaba Site
1.9.	Connection to the national electricity transmission and distribution grid	Existing infrastructure	Non-existent, undeveloped site. In addition to onsite infrastructure development the construction of 40 km of transmission line would be required	Non-existent, undeveloped site Environmental impacts associated with the construction of 20 km access road. Transmission line, and onsite infrastructure	Will need addition.
2	**SITE SENSITIVITIES**				
2.1.	Biophysical	No fauna and flora related sensitivities since this is going to be on a brownfields area Geological faults within 5 km of the site	Possible occurrence of threatened flora species of the dune fynbos Occurrence of highly localised endemic flora of the proteoid fynbos Occurrence of bird life with conservation value. At least three km away from a possible capable fault	Virgin biological environment Anticipated seismically active Klippepunt fault 5 km south of the site	No Fauna and flora related sensitivities since this is going to be on a brownfields area
2.2.	Marine biophysical	No sensitivities	Viable commercially fished abalone stock Sustainable line fish population	Healthy/ sustainable fish population in the area	Not applicable to this site
2.3.	Land use	Sensitivity. Cape Town Metropolitan Council Spatial development plan.	Remote site, future tourism related land use patterns expected.	Remote site, future tourism related land use patterns expected.	Rapidly expanding residential areas in proximity of the site
2.4.	Demography for PBMR requirements	Sensitive, Melkbosstrand, van Riebeeckstrand urban areas within 5 km	Sensitive, Buffelsjagt campsite within 5 km	Limited sensitivities, holiday developments 11 km from the site	Sensitive. Rapidly expanding residential areas in proximity of the site – Hartebeespoortdam and Atteridgeville
2.5.	History/Archae ology	No sensitivities	No sensitivities on the terrace	Archaeological significant fish traps on the site	Archaeological resources in the surrounding

PBMR DPP Site Criteria		KNPS Site	Bantamsklip Site	Thyspunt Site	Pelindaba Site
					environment, none on site itself
2.6.	Socio-economic	No sensitivities	Buffelsjagt fishing community is sensitive to social and environmental changes, especially as this community is dependent on the marine resources of the area	No sensitivities	No sensitivities
3.	PROCESS ISSUES.				
3.1.	National generation requirements. The national grid is currently under pressure and requires additional generation capacity as soon as possible.	Site accessible, no program delays.	Site accessibility restricted. Access infrastructure to be constructed as well as infrastructure already in place at KNPS site. Delays in availability of technology should it be proven to be a future generation option.	Site accessibility restricted. Access infrastructure to be constructed as well as infrastructure already in place at KNPS site. Delays in availability of technology should it be proven to be a future generation option.	Site accessibility restricted. Access infrastructure to be constructed as well as infrastructure already in place at KNPS site. Delays in availability of technology should it be proven to be a future generation option.

6.5.5 DISCUSSION OF THE ASSESSMENT

a) Still water bay housing the cooling water inlet and Cooling water outlet system:

A still water bay and cooling water inlet/outlet exists at the KNPS. It will require minor modification to the water reticulation system to also provide cooling water for the proposed PBMR DPP. No such facilities exist at the two coastal alternative sites, and cooling water at the Pelindaba site may be sourced from the Hartebeespoortdam. In all of the mentioned cases extensive construction will be required, with associated environmental and financial costs.

b) Supporting infrastructure such as roads, storm water handling system, potable water, security, high voltage yard, connectivity to the national grid:

In the case of the Bantamsklip and Thyspunt sites all of the mentioned infrastructure will have to be established on Greenfield sites. At Pelindaba some of the infrastructure do exist, however significant modifications and additions will be necessary to accommodate a PBMR DPP on this site. At the KNPS Site some upgrading of the access roads from the west coast road onto the site will be required, and a 132 kV power line from the PBMR DPP to the high voltage yard on the KPNS Site will have to be constructed. The modifications at the KPNS Site is minor, would be significantly less costly than that required at any of the alternative sites and will clearly have significantly less environmental impact.

c) Site sensitivities

The preferred KNPS Site is a brownfields site, with the proposed siting of the PBMR DPP within the footprint of the existing KNPS. Environmental impacts associated with construction and of a localised nature will therefore be on an existing brownfields site. The above is to a large extent also true for the Pelindaba site. For the two greenfield sites, Thyspunt and Bantamsklip, the environmental impacts will clearly be more significant.

d) Land use, services and demography

Demographically all three the sites are suitable for the development of the PBMR DPP. However, the Pelindaba and KNPS sites are more under pressure from surrounding populations than the other two sites. Services such as security, support industries, health, and education, are more developed at the KNPS Site than at any of the alternative sites. Development does act as catalysts for the establishment of social services and structures, and therefore may be beneficial to isolated areas such as those of the Bantamsklip and Thyspunt sites. However, in the case of the construction of a PBMR Demonstration Power Plant these opportunities will be limited and more than likely of too small an order of magnitude to be of any sustainable advantage to the surrounding community. A sensitivity regarding future land use exists at the proposed preferred site of the KNPS. This issue relates to a potential conflict between the current land use at the KNPS site and the aspirations of the Cape Town Metropolitan Council as contained in the special development plan for the region.

e) Environmental sensitivities

The environmental sensitivities indicated in Table 6-4 at the undeveloped Bantamsklip and Thyspunt sites, and partially developed Pelindaba site, suggest that for the purposes of a PBMR DPP these sites are less desirable than the Koeberg site.

f) Absence of sub-regional infrastructure

The construction of access infrastructure, roads and grid connection, as well as the additional infrastructure already in place at KNPS site, would cause delays in the demonstration of the technology. This may be so severe that one of the initially attractive aspects, i.e. short lead times to construction, of the technology is lost.

6.5.6 CONCLUSIONS REGARDING LOCATION ALTERNATIVES

The application made by Eskom is for the construction and operation of a PBMR Demonstration Power Plant (PBMR DPP) at the preferred site of the Koeberg nuclear power station (KNPS). Although all the assessed sites may be suitable for the siting of commercial nuclear power stations the assessment results as discussed above, indicate that the KNPS is a more suitable site for a PBMR DPP than the Pelindaba -, Bantamsklip - or Thyspunt sites. The establishment of infrastructure on the alternative sites that already exists at the KPNS site results in the alternative sites being less desirable than the KNPS site for the construction of a PBMR DPP. This is not only because of the significantly higher financial costs associated with the establishment of the mentioned infrastructure, but also because of the associated environmental impact.

In summary the PBMR DPP can be established more economically, and at a lower environmental cost at the preferred KNPS site compared to any of the alternative sites.

IAPS have raised the point that a PBMR DPP at KNPS site will not result in a credible demonstration of the technology because certain costs, such as establishment of infrastructure and maintenance of support systems, will not be included in the demonstration since these will be shared and/or sourced from the KNPS. Although this point may be valid in some respects, the costs and feasibility of the PBMR demonstration will be adapted to provide for costs that were avoided by placing the PBMR DPP at KNPS site. The benefit of avoiding these known costs as part of a demonstration plant outweigh the establishment of these known and quantified infrastructure elements and services just for the sake of completeness. Furthermore the fact that the establishment of the above will lead to additional environmental impacts at the alternative sites clearly indicates that the KNPS Site is the most desirable and suitable site.

The purpose and need for the proposed activity is for a commercial scale demonstration plant. This is not an application for a test or pilot plant that would test certain principles and technologies and later on be up scaled during commercialisation. As indicated earlier in this report all test and pilot work is complete, and a commercial scale plant that would demonstrate the techno-economic performance of the plat is now required in order to finalise the evaluation process of the technology and advance it to commercialisation.

6.6 NO-GO ALTERNATIVE

Against the background of the arguments presented above, there are a number of stakeholders who strongly believe that nuclear power is not an environmentally acceptable technology for the generation of electricity. These views are several and varied and highlight concerns about accidental releases of radiation and attendant public safety and environmental risk. These stakeholders also have concerns about the safe disposal of radioactive waste. These stakeholders present strongly that alternative forms of generation technology should be pursued. The arguments have been presented earlier about the difficulties in sourcing technologies that can provide for base and peak loading but these arguments do not respond adequately perhaps to the concerns expressed. In these terms the final alterative that must be considered is the so-called 'no go alternative'. The no-go alternative is one where the proposal to develop the PBMR DPP is simply abandoned and no development takes place at all in response to the project need.

This is a viable alternative that must be considered in the detailed assessment that follows the scoping phase. It is not easy to present the details of the no-go alterative in the Scoping Report as these will be a direct function of many of the impacts that are identified and assessed in the assessment phase. As such the no-go alterative will be carried forward to the detailed assessment phase and will be presented as a component of the Environmental Impact Report.

6.7 SUMMARY AND CONCLUSIONS

The investigation of alternatives is an important element of any environmental assessment process. The requirement to consider alternatives is contained within the regulatory framework that governs the EIA, but is focussed strongly on feasible and reasonable alternatives that meet the same need and purpose as the originally proposed project. Given the importance of generating base and peak load for which the proposed PBMR technology is suitable, there are no feasible alternative technologies that reduce the impact on the environment in meeting that need.

There are location alternatives which could see the PBMR DPP being established on a site other then the preferred site of the Koeberg Nuclear Power Plant. However, the need to have access to existing infrastructure is a key consideration in siting the proposed PBMR DPP and this significantly reduces the viability of at least two alternative sites. A more detailed assessment indicates that the PBMR DPP can be established more economically, and at a lower financial and environmental cost at the preferred KNPS site.

Box 6-1: Conclusions on alternatives

> This means that neither alternative technologies nor alterative sites will be assessed in any further detail in the assessment that follows. However, in recognition of the stakeholders who are concerned about the suitability of nuclear power for generating electricity, the no-go alternative will be considered in the assessment phase of the EIA.

CHAPTER 7: SCOPE OF THE DETAILED ASSESSMENT

7.1 INTRODUCTION

On the basis of the information presented, the scope of the detailed assessment is presented in this Chapter. The scope is based on a categorisation of issues raised by stakeholders participating in the EIA, resultant issues to be addressed in the detailed assessment, the method that will be used to identify impacts and the assessment of their significance and finally, the individual specialist studies that will be conducted and broad terms of reference for the same. Before presenting that information it is necessary to highlight that issues presented below have been drawn from the EIA processes for both the 302 MW(t) PBMR DPP (undertaken in 2001 and 2002) and the 400 MW(t) PBMR DPP (current process).

7.2 CATEGORIES OF ISSUES

Issues in the issues register are grouped together under one of the following categories (note that these issues are recorded in the issues register, which is attached as an Annexure to this report):

- environmental and allied issues;
- data accuracy issues;
- health, safety and security Issues;
- emergency issues;
- technical issues;
- legislative and regulatory issues;
- issues related to the rationale for the PBMR DPP;
- issues regarding the scope of the PBMR analysis;
- alternatives, technology and related aspects;
- economic and financial issues;
- location considerations;
- management related issues;
- local government matters;
- comments in support of the PBMR;
- comments in opposition to the PBMR;
- background to the PBMR and questions related to the existing Koeberg reactors;
- waste;

- public participation, transparency and credibility issues;
- process issues; and
- general.

The mentioned issues register indicates which issues will be taken up in the EIR. These issues are reflected in the following list, indicating the aspects to be included in the assessment phase of the EIA. The references provided in the issues register refer back to this list.

7.3 KEY ISSUES TO BE INCLUDED IN THE TERMS OF REFERENCE FOR THE EIR.

7.3.1 SOCIAL ASPECTS

1) Social impact assessment to be included in the EIR.

   Aspects to be considered include crime, environmental awareness, health, benefits to communities, transport, quality of life, employment opportunities, perception on risk, communication, job creation and local/regional benefits during construction and operation and related aspects. Impacts on spatial development in the KNPS region to be assessed and reported on in the EIR.

2) Issues such as the extension of the nuclear legacy in the Koeberg area, land use rights, zoning, spatial planning, roads and related aspects will be included.
3) Visual impact assessment in the EIR to address the visual impact on surrounding land.
4) Noise due to construction and plant operation.
5) Security issues both radiological and non radiological.
6) Illumination during construction and operation.

7.3.2 ECONOMIC ASPECTS

7) Tourism Impact Assessment
8) Assessment of the No-go option will be done during the EIA phase and reported on in the EIR.
9) Decommissioning/dismantling as activities will be assessed and reported on.

7.3.3 FINANCIAL ASPECTS

10) Financial investment sources for the proposed PBMR DPP.
11) Financial and other provisions in the event that the demonstration indicates that the PBMR DPP is not feasible, will be assessed and reported in the EIR.

12) Financial sources and funding instruments used for the development and future operation of the PBMR DPP will be investigated and reported in the EIR.

7.3.4 BIOPHYSICAL ASPECTS

13) Assessment of the possible impact of the PBMR DPP on marine and terrestrial life.

14) Impact of the associated power lines to be constructed will be assessed and included in the EIR.

15) Impact on possible archaeological resources on the proposed site will be assessed and reported in the EIR.

7.3.5 TECHNICAL ASPECTS

16) Assessment of the risk associated with a marine disaster on the PBMR DPP, specifically a Tsunami, and/or seiches, to be included in the EIR.

17) Assessment of the impact of possible changes in sea levels on the PBMR DPP to be included in the EIR.

18) Seismo-tectonics to be assessed.

19) Traffic impact assessment during construction.

20) Helium supply. The global availability and sustainability will be assessed.

21) Meteorological conditions and emission dispersion.

22) Groundwater characteristics and impacts on the sub-region.

7.3.6 RADIOLOGICAL ASPECTS

23) Radiation emissions of PBMR DPP and possible effects on the environment.

24) Waste (Solid, liquid and gaseous) management and disposal.

25) On-site storage, national strategy for long-term storage, reprocessing, possible unauthorised use by terrorists of waste, and related aspects will be included.

26) Emergency response requirements and the impact on the surrounding communities will be assessed.

27) Aspects such as adequacy of infrastructure, population density around the site, communication structures, support structures and emergency exercises will be included.

28) Safety aspects of the proposed plant, with reference to excessive heating of the fuel, affect of ambient temperature, rainfall and wind, saboteurs, carbon fires, aircraft collisions, air emissions, safe operation, environmental monitoring, epidemiological studies, walk away safety, creditable failure scenarios, effluent treatment, geohydrology, loss of coolant, occupational health and safety, will be

assessed and included in the EIR. An assessment of the experience with similar technologies and the safety performance of these plants will be included in the EIR.

29) Radiological safety/health. The EIA phase will include an assessment of the principle radiological safety/health aspects of the PBMR DPP. A baseline survey will be conducted on the incidence of childhood leukaemia in the Cape Town.

7.3.7 CONVENTIONAL WASTE ASPECTS

30) Construction and operational waste.

7.3.8 LEGAL ASPECTS

31) The legal and other implication of changing from a demonstration plant to a commercial power generation plant.

32) Conformance of the PBMR DPP to the NEMA principles.

7.3.9 INSTITUTIONAL ASPECTS

33) International acceptability of the NNR assessment process will be described.

34) The mechanisms and structure of the NNR process will be clearly described.

35) The legal mandates of authorities involved will be researched and included.

36) Cumulative/Linked/synergistic aspects.

37) Transport to and disposal of nuclear waste at Vaalputs.

38) Supply of fuel and transport of nuclear materials.

7.4 STRATEGIC ISSUES

In addition to the key issues listed above, certain issues of a strategic nature were also identified during the Scoping Phase. Although these issues are not site and activity specific they need to be addressed due to their interrelatedness to the proposed PBMR DPP. These issues are as follows:

7.4.1 STRATEGIC ISSUES FOR CONSIDERATION AND ASSESSMENT IN THE EIR

- Final deposition and management of high level radioactive waste.
- Non-proliferation of Nuclear Weapons.
- Radiological Safety/Health/Environmental Issues.
- Epidemiological Studies.
- Impact on Eskom's generation mix, both current and future.

- Commercialization and Potential import/export impact of the proposed PBMR.
- International trends and policies related to nuclear will be surveyed and reported on .

7.4.2 STRATEGIC ISSUES THAT ARE SCOPED OUT OF THE EIR

- Alternatives in terms of energy (fuel) and technology(ies) for electricity generation and supply.
- Location alternatives.

These issues were comprehensively addressed in the RFSR and it is concluded that there is no need for further investigation or assessment in the EIA phase.

7.5 ASSESSMENT APPROACH AND METHODOLOGY

Each issue listed in this section of the report, both Key Issues and Strategic Issues will be described and assessed in the EIA phase. These issues will be described and discussed in the EIR with regards to the following:

- a brief description of the issue;
- an evaluation of the impact/issue on the environmental parameter (following a life cycle approach as needed);
- an assessment of the significance of the impact; and
- conclusions/recommendations on the mitigation of impacts.

The **significance** of environmental impacts will be assessed in accordance with the following method:

Table 7-1: Defining probability and severity

	Significance = probability x severity. Where	
1.	Probability describes the likelihood of the impact actually occurring, and is rated as follows:	
•	Improbable	Low possibility of impact to occur either because of design or historic experience. Rating =2
•	Probable	Distinct possibility that impact will occur. Rating = 3
•	Highly probable	Most likely that impact will occur. Rating =4
•	Definite	Impact will occur regardless of any prevention measures. Rating =5

2.	Severity factor = intensity (factor) x duration(factor).	
	The Severity factor	= Intensity factor X Duration factor
		= 2 x 3
		= 6

A severity factor of six (6) equals a Severity Rating of Medium severity (Rating 3) as per table below:

Table 7-2: Severity Ratings

Rating	Factor
Low Severity (Rating 2)	Calculated values 2 to 4
Medium Severity (Rating 3)	Calculated values 5 to 8
High Severity (Rating 4)	Calculated values 9 to 12
Very High severity (Rating 5)	Calculated values 13 to 16
Severity factors below 3 indicate no significant impact	

Table 7-3: Intensity rating methodology

3.	The Intensity factor is awarded to each impact according to the following method:	
•	Low intensity -	nature and/or man made functions not affected Factor 1
•	Medium intensity -	environment affected but natural and/or man made functions and processes continue (Some process damage or human/wildlife injury may have occurred). Factor 2
•	High intensity -	environment affected to the extent that natural and/or man made functions are altered to the extent that it will temporarily or permanently cease (Major process damage or human/wildlife injury may have occurred). **Factor 4**

Table 7-4: Duration assessment methodology

4.	Duration is assessed and a *factor* awarded in accordance with the following:

•	Short term -	≤1 to 5 years Factor 2
•	Medium term -	5 to 15 years Factor 3
•	Long term -	impact will only cease after the operational life of the activity, either because of natural process or by human intervention Factor 4.
•	Permanent	mitigation, either by natural process or by human intervention, will not occur in such a way or in such a time span that the impact can be considered transient Factor 5.

Table 7-5: Significance rating methodology

5.	A Significance Rating is calculated by multiplying the Severity Rating with the Probability Rating (Severity Rating x Probability Rating).
	The significance rating should influence the development project as described below:
•	Low significance (calculated Significance Rating 4 to 6)
	– Beneficial impact and Adverse impact of low significance with sufficient inherent mitigation.
•	Medium significance (calculated Significance Rating ≥ 7 to 12)
	– Beneficial impact: Activity proceeds. – Adverse impact: Should be mitigated to a low significance before activity can proceed.
•	High significance (calculated Significance Rating ≥ 13 to 18
	– Beneficial impact: Should weigh towards a decision to continue. – Adverse impact: Should weigh towards a decision to redesign the activity and/or mitigation should be performed to reduce significance to at least low significance rating.
•	Very High significance (calculated Significance Rating ≥ 19 to 25)
	– Beneficial impact: Continue. – Adverse impact: If mitigation or redesign cannot be effectively implemented, activity/proposal may have to be terminated

Table 7-6: Geographical extent

6.	Geographical Extent - Once the significance rating of an impact has been assessed, the impacts are then categorised in terms of their geographical extent, namely:	
•	Site Specific/Local	Impacts will not continue beyond the boundaries of the site.
•	Regional	Impacts will have an influence on the region or sub-region
•	National	Impacts will have an influence on a national level
•	International	Impacts will have an influence on cross border states

In calculating the impact, a significance assessment is done in respect of each one of the identified impacts as per the example in Table 7-7: Example of a Significance Assessment below.

Table 7-7: Example of a Significance Assessment

Impact Description:	Extreme oceanographic, e.g. Tsunami , Seische conditions may affect the safety and operation of the plant.					
Consequence description:	Adverse impact. Loss of cooling water supply, flooding of plant terrace.					
Probability Description:	The design of the cooling water intake basin would limit this occurrence, PBMR terrace is at +13.5 meter AMSL.					
	Assessment Criteria					Significance Rating a: Adverse b: Beneficial
	Extent	Duration	Intensity	Severity (Factor) Rating	Probability	
	Local to sub regional	A few days (worst) 2	Intensity 4	(8) 3	Improbable 2	(a): 6 (low)
Influence on the project:	Adverse impact of low significance with sufficient inherent mitigation.					

Identified issues are assessed quantitatively and qualitatively based on the level of available data.

7.6 EIA FOR FUEL MANUFACTURE/SUPPLY FOR THE PBMR DPP

This issue warrants clarification in view of the question raised by a number of IAPs on whether fuel supply (manufacture of fuel and the transport of nuclear material) is integral to the EIA for the PBMR DPP.

To answer this question, one firstly has to look at the options of supply, namely:

- international suppliers, their capacity to supply, quality and price; and
- local supply under the same criteria.

During the EIA for the manufacture and supply of fuel for the PBMR DPP, these options were considered and based on socio-economic factors, commercial, risk and technical criteria, Eskom/PBMR/government concluded that local manufacture and supply is the preferred option.

The conclusion was further strengthened by the desire of government to expand and promote technology and sciences to broaden the high technology base of the country.

There is however nothing in the applicable regulations that requires the applicant to have submitted a single application in respect of the authorisation sought, as apposed to two separate applications. This separation is considered acceptable due to the fact that the manufacture of nuclear fuel and transportation of materials is not dependent on the development of PBMR DPP. Similarly, the PBMR DPP could go ahead using an alternative supplier of fuel.

The activities must be dealt with as separate applications, since Eskom will not be the fuel manufacturer/transporter. In addition, it will not perform the fuel manufacture or transport activities on any of its current (Koeberg) or potential nuclear sites (coastal sites) for the PBMR DPP.

Therefore a separate EIA for a Fuel Manufacturing Plant at NECSA Pelindaba, and the associated transport of raw materials and fuel was submitted to DEAT. The EIA was done in parallel to the 302MW(t) PBMR EIA. A ROD to proceed with the proposed development was issued by DEAT. Subsequently the appeals against the ROD were submitted by various parties to the Minister. These appeals are still under deliberation by the Minister.

7.7 SPECIALIST STUDIES REQUIRED FOR EIA PHASE

All of the studies (i.e. for construction, commission and operation) will have to be conducted during the EIA phase inclusive of the strategic issues. The term study(ies) is used in the context of either verification/update of existing information or the initiation of new studies to provide the required information.

7.7.1 CONSTRUCTION RELATED STUDIES

a) Traffic Impact Assessment

To determine current road use densities/patterns to assess the impact of the following:

- additional commuter traffic (30 buses from Cape Town and Atlantis and environs);
- material delivery;
- heavy loads (200 – 500 tons for ~ 20 loads) from Saldanha harbour;
- extra heavy traffic (500 - ±1000 tons for ~5 loads); and
- road deviations from Saldanha to the PBMR site.

b) Groundwater

Study of the quality of the groundwater that will be abstracted during the dewatering of the PBMR footprint excavations and options for the release of such water.

c) Potable water requirements

Assessment of additional water requirements for workforce and concrete making on existing water supply capacity of City of Cape Town (Require 1500m^3/day for 6 months of construction)

d) Local government capability and capacity

The capacity of local government infrastructure to accommodate a workforce of ±2900 during the peak of construction will be assessed. This will have implications on schools, policing, health services, municipal services, etc.

e) Construction Yard

Assessment of the impact of a construction yard (on the ex-Eskom property opposite the R27 turn-in to Koeberg NPS) on fauna and flora and land-use zoning,

f) Excavated spoil

Assessment of excavated material balances from PBMR DPP footprint and other buildings, cooling water conduit, etc. and disposal options for remaining spoil.

g) Construction village

Assessment of construction village (800 special labourers) impacts on social and physical infrastructure. The construction village may be located in Atlantis.

7.7.2 COMMISSIONING RELATED STUDIES

a) Nitrogen

Assessment of the accidental release of large qualities of nitrogen to the atmosphere during cold commissioning.

7.7.3 CONSTRUCTION WASTE

Assessment of types, qualities and management of waste in the construction waste stream.

7.7.4 OPERATION RELATED STUDIES

a) Social aspects

i. Study to assess the impact of PBMR DPP on the local and regional economy.
ii. A social impact assessment.
iii. Study to assess impact on spatial development planning at provincial and local level, including the legal implication of rezoning of the land.
iv. Visual Impact Assessment inclusive of illumination impacts.
v. Noise baseline studies and assessment of additional noise levels generated during operation.
vi. Security studies to determine adequacy of proposed security measures.
vii. Assessment of the impact of construction noise on nearest receptors i.e. Koeberg staff and Duynefontein residents.
viii. Assessment of illumination impacts during construction on residents of Duynefontein.

b) Economic aspects

i. Tourism impact assessment.
ii. Study to determine the impact of the No-go option on the economic and commercialization (opportunity) loss due to the forfeit of the technology for base load electricity application in the RSA, institutional implications, and cost of alternatives as well as the “savings” to radiological waste.
iii. Decommissioning/dismantling studies to determine the main issues and impacts.

c) Financial aspects

i. Financial investment and funding instruments for the PBMR from various shareholders.
ii. Financial provisions for decommissioning and dismantling of the PBMR DPP for both the ‘end of life’ and ‘early retirement’ scenarios.

d) Biophysical aspects

i. Study of the impact of additional cooling water abstraction and releases on marine fauna and flora as well as the release of ground water from the excavation of the PBMR DPP footprint.

ii. Study of the impact of 132KV power lines on land fauna and flora.

iii. Study of the potential to impact on archaeological resources.

e) Technical aspects

i. Study of the impact of extreme marine conditions on the PBMR DPP, e.g. tsunamis, seiches, etc.

ii. The seismo-tectonic characteristics of the site will be assessed to determine earthquake potential and assess adequacy of the aseismic design standards.

iii. Study of the availability and sustainability of the helium supply.

iv. Meteorological conditions and emission dispersion and plume tracking during operational and accidental radiological releases.

v. Groundwater (geohydrological) characteristics of site to determine the pathway of accidental spills and release.

f) Radiological aspects

i. Study of the radiation releases (gaseous and liquid) and impact on the environment.

ii. Study of the radiological waste for disposal inclusive of spent fuel and HLW.

iii. Study of the emergency response plan and assessment of impact on Koeberg NPS or vice versa.

iv. Studies on the safety and health aspects of the plant. This study will assess the impact on the health and safety of employees and members of the public due to exposures to emissions from the proposed plant during the operational phase.

g) Conventional waste

Study of the waste quantities and types for the PBMR during operations and maintenance.

h) Legal aspects

i. Legal investigation into the change of the proposed PBMR DPP from demonstration to commercial mode.

ii. Conformance of the PBMR DPP process and operations to NEMA principles.

i) Institutional Aspects

i. Comparative assessment of the NNR standards to that of the regulating bodies in other countries as well as international norms, including IAEA minimum standards

ii. The legal mandates of the affected authorities, i.e. Dept of Minerals and Energy, Trade and Industry, Science and Technology, western Cape Provincial Planning Authority and the City of Cape Town.

j) Cumulative, Linked and Synergistic Aspects

i. Study of the additional radiological waste volumes to Vaalputs and the capacity of the site to accommodate the waste for the demonstration phase and thereafter.

ii. Study of the options of pebble fuel suppliers.

7.7.5 STRATEGIC ISSUES

i. Study of the international status of high level waste management and final deposition.

ii. Mechanisms for the conformance of the PBMR DPP to the Nuclear Non-proliferation treaty.

iii. Study of the international status of epidemiological study findings, particularly on cancer prevalence in receptor populations, around nuclear facilities.

iv. A baseline survey of the incidence of childhood leukaemia in the greater Cape Town and Atlantis areas.

v. Study of the potential impact of the proposed PBMR DPP on Eskom's future generation mix.

vi. Study of the potential economic impact of a local based PBMR industry.

vii. International trends on the use of nuclear electricity generation and the available technologies.

CHAPTER 8: APPENDICES

8.1 APPENDIX 1: ADVERTISEMENTS

8.1.1 AFRIKAANS ADVERTISEMENT

KENNISGEWING VAN 'N OMGEWINGSIMPAKSTUDIE (OIS) VIR DIE VOORGESTELDE 400 MW(t) MODULÊRE KORRELBEDREAKTOR (MKBR) DEMONSTRASIE KRAGSTASIE

VOORGESTELDE AKTIWITEIT

Ingevolge Regulasie 4(6) van die regulasie soos bekend gemaak in staatskennisgewing no. R 1183 in terme van Artikel 26 van die Wet op Omgewingsbewaring (Wet 73 van 1989), word hiermee kennis gegee van die voorneme van Eskom Holdings Bpk, om die volgende aktiwiteit uit te voer:

'n Aansoek om omgewingsmagtiging vir die voorgestelde Modulêre Korrelbedreaktor (MKBR) demonstrasie kragstasie met 'n nominale kapasiteit van 400 MW (t) by die Koeberg kragstasie terrein in die Wes-Kaap.

Die aansoek om die voorgestelde aktiwiteit is by die nasionale Departement van Omgewingsake en Toerisme ingehandig.

'n OIS en publieke deelnameproses sal onderneem word om belanghebbende en geaffekteerde partye (BGPs) van die voorgestelde 400 MW (t) MKBR demonstrasie kragstasie in te lig en om insae tot die OIS proses te bied. 'n Omgewingsbestekopname en 'n omgewingsinvloed verslag vir die voorgestelde MKBR demonstrasie kragstasie sal voorberei word en aan BGPs voorgelê word vir kommentaar.

DIE APPLIKANT EN DIE KONSULTANT:

Eskom Holdings Bpk is die applikant en het MAWATSAN as die omgewingskonsultant aangestel om die OIS vir die 400 MW(t) MKBR demonstrasie kragstasie te behartig.

REGISTRASIE VIR BGPS:

BGPs word vriendelik genooi om te registreer by MAWATSAN om aan die proses deel te neem:

MAWATSAN

Aandag: Ian MacFadyen

Posbus 13540, Hatfield, Pretoria, 0028

Faks: +27 12 362 2463 en Tel: +27 12 362 2908

Fokusgroep- en publiekevergaderings word beoog om sodoende inligting oor die voorgestelde projek aan BGPs te verskaf. Die publieke vergaderings sal op die volgende datums plaasvind:

Kaapstad: 9 November 2005 **– Milnerton Sport Klub, Theo Marais Park, Koebergstraat, Milnerton,** om **18h30**

Atlantis: 10 November 2005 **– Hartebeeskraal Veeldoelige Gemeenskapsentrum, Nottinghamstraat,** om **18h30**

Midrand: 15 November 2005 **– Eskom Konferensiesentrum, Dalestraat, Halfway House,** om **18h30**

Durban: 17 November 2005 **– Durban Uitstalsentrum,** 11 Walnutstraat, om **18h30.**

'n Agtergrondinligtingsbrosure is beskikbaar op aanvraag en projek inligting sal ook beskikbaar wees gedurende die duur van die OIS op die webwerf www.pbmr-EIA.co.za.

8.1.2 ENGLISH ADVERTISEMENT

NOTICE OF AN ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED 400 MW(T) PEBBLE BED MODULAR REACTOR DEMONSTRATION POWER PLANT

THE PROPOSED ACTIVITY

in terms of regulation 4(6) of the regulations published in government notice no. r. 1183 under section 26 of the environment conservation act (act no. 73 of 1989) notice is hereby given of Eskom Holdings Limited's intent to carry out the following listed activity:

An application for the environmental authorization for a proposed Pebble Bed Modular Reactor PBMR) Demonstration Power Plant (DPP) with a nominal capacity of 400 MW(tl) located on the Koeberg Power Station Site in the western cape.

The application for this proposed activity has been submitted to the national department of environmental affairs and tourism.

An EIA and public participation process will be conducted to inform Interested and Affected parties (IAPs) of the proposed 400 MW(t) PBMR DPP and to invite input into the EIA process. A scoping report and an Environmental Impact Report (EIR) for the proposed 400 MW(t) PBMR DPP will be prepared and submitted to IAPs for comment.

THE APPLICANT & CONSULTANT

Eskom Holdings Limited is the applicant and has appointed Mawatsan as the consultant to conduct the EIA for the 400 MW(t) PBMR DPP.

IAP REGISTRATION AND PUBLIC PARTICIPATION

IAPs are cordially invited to register with Mawatsan to participate in the process as outlined in the notice.

MAWATSAN

Attention : *Ian MacFadyen*

PO Box 13540, Hatfield ,Pretoria, 0028

Fax +27-12-362-2463 and Tel +27-12-362-2908

In order to inform IAPs of the proposed PBMR DPP project, focus group and public meetings will be held. The public meetings will take place at the following locations and times:

Cape Town: **9 November 2005** - Milnerton Sports Club, Theo Marais Park, Koeberg Road, Milnerton, At 18h30

Atlantis: **10 November 2005 -** Hartebeeskraal Multi Purpose Community Center**,** Nottingham Street, At 18h30

Midrand: **15 November 2005** - Eskom Convention Centre, Dale Road, Halfway House, At 18h30

Durban: **17 November 2005 -** Durban Exhibition Center, 11 Walnut Road, At 18h30

A background information document is available on request and project information will also be available on the website (www.pbmr-eia.co.za), for the duration of the EIA.

8.2 APPENDIX 2: BACKGROUND INFORMATION DOCUMENT

Environmental Impact Assessment for the Proposed 400 MW(t) Pebble Bed Modular Reactor Demonstration Power Plant (PBMR DPP) on the Koeberg Power Station site in the Western Cape

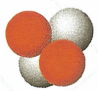
MAWATSAN

INTRODUCTION

Eskom proposes to construct, commission, operate, maintain and decommission a Pebble Bed Modular Reactor (PBMR) Demonstration Power Plant (DPP) with a nominal thermal output of 400 MW to assess the technological, environmental and socio-economic viability of the technology.

The proposed project is in response to:

- Assessments of the projected electricity demand and supply in South Africa: The Department of Minerals and Energy performs Integrated Energy Planning to identify future energy demand and supply requirements. The National Electricity Regulator (NER) performs National Integrated Resource Planning to identify the future electricity demand and supply requirements. Similarly Eskom assesses the projected electricity demand and supply through a process called the Integrated Strategic Electricity Plan. Through these processes, the most likely future electricity demand is forecast based on long-term Southern African economic scenarios. This information provides the framework for Eskom and South Africa to investigate a wide range of supply and demand-side technologies and options. This planning process identified that South Africa will require additional "peaking electricity generating capacity" by 2007 and additional "base load electricity generating capacity" by 2010.
- In the longer term (2020 and beyond), the existing power stations will start to come to the end of their useful life, hence replacement power stations will be required over and above those required to cater for growth in demand. As part of an ongoing effort to evaluate the viability of all supply-side options, a number of power generation technologies, not yet implemented in South Africa on a commercial basis, are being evaluated in terms of technical, socio-economic and environmental aspects. These research, development and demonstration investigations include:
    - Underground high head pumped storage (hydro) schemes using worked out mines.
    - Underground coal gasification.
    - Ultra Fines coal.
    - Wind energy.
    - Pebble Bed Modular Reactor (PBMR) technology.
    - A solar thermal power plant.
    - Photovoltaic and biomass gasification applications as part of the Government's Integrated Rural Development Programme.



PBMR DPP

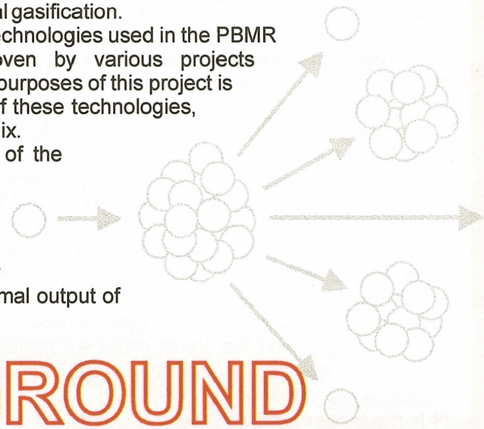
INTRODUCTION (Continues)

Preliminary results of these studies indicate that it is necessary to validate the assumptions and modelling of some of these options through demonstration/ pilot plants. The research and demonstration period for new technologies may take a number of years to consider the long-term technical, operational and socio-economic aspects. A demonstration/ pilot plant would provide sufficient information to make a decision on the commercial use of a technology.

The proposed PBMR DPP is one of these demonstrations. Other demonstration/pilot plants either already in operation or in the feasibility planning stage include large-scale solar thermal technology, a wind demonstration facility, biomass gasification and underground coal gasification.

While individual aspects of the technologies used in the PBMR DPP have already been proven by various projects throughout the world, one of the purposes of this project is to demonstrate the integration of these technologies, within the South African energy mix.

The proposed activity consists of the construction, commissioning, operation and maintenance and decommissioning of a Pebble Bed Modular Reactor (PBMR) Demonstration Power Plant (DPP) with a nominal thermal output of 400 MW(t).



BACKGROUND INFORMATION

A comprehensive EIA has already been conducted for a similar project. The following paragraphs provide information on the previous EIA, as well as on its relationship to the current process.

The original intention of Eskom was to build a 302 MW(t) PBMR Demonstration Plant on the Koeberg Site. An environmental impact assessment for this plant commenced in 1999 when Eskom appointed a consortium of independent consultants to perform the EIA. An extensive scoping and special study programme was undertaken, including comprehensive public participation through numerous interactions (focus group meetings, open days and public meetings), with periods for comment being provided during the Scoping and EIA phases. This culminated in the submission of the Final Environmental Impact Report to the Department of Environmental Affairs and Tourism (DEAT) in October 2002. The evaluation of the Final EIR by DEAT and an International Review Panel appointed by DEAT was undertaken, leading to the issuing of a positive Record of Decision by the DEAT Director-General in June 2003. Appeals against the Record of Decision were submitted to the DEAT Minister during July and August 2003.

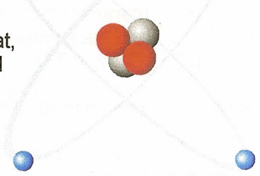
2

An application was brought before the Cape High Court on behalf of Earthlife Africa (Cape Town) in September 2003 to have the Record of Decision issued by the DEAT DG reviewed and set aside. The Court judgement was handed down in January 2005. In this judgement the Cape High Court ruled in favour of the application, set aside the Record of Decision, and required the DEAT DG "…. to afford the applicant and other interested parties an opportunity of addressing further written submissions to him along the lines as set out in this judgment and within such period as he may determine and to consider such submissions before making a decision anew on the second respondent's application."

Since the completion of this EIA, the decision was made to increase the power output of the DPP from 302 MW(t) to 400 MW(t). This change in output requires that a new application be launched. All the environmental impacts of the 400 MW(t) PBMR DPP will be identified and assessed. Information sourced during the "302MW(t) PBMR EIA" will be considered where relevant and appropriate. All relevant information will be included into the scoping process. All issues and comments raised during the public participation process will be noted, incorporated into an issues and response register and incorporated into the scoping report. I&APs will have the opportunity to review the scoping report to verify the accuracy and completeness of the issues.

THE PROPOSED ACTIVITY

The proposed PBMR DPP is a graphite moderated, helium cooled, nuclear reactor, configured as an electricity generating power station. The PBMR DPP uses a direct gas turbine cycle to convert the heat, generated by nuclear fission in the reactor and transferred to the helium coolant, into electrical energy by means of a horizontally configured turbo-generator.



Fuel for the proposed PBMR DPP will consist of spherical pebbles (approximately 60 mm in diameter) that contain Triso coated Uranium Oxide kernels (up to 10% enriched), which a embedded in a pure graphite matrix.

Provision will be made to accommodate all spent fuel on the site for the 40 year design l of the plant subject to statutory prescription. Radioactive waste (excluding spent fuel) v be managed on site, and disposed of at the Vaalputs repository, as in the case of tl current Koeberg nuclear power plant and in accordance with statutory prescription.

The proposed PBMR DPP will be connected to the Eskom national transmission netwc within the Koeberg power station site. A widening of a portion of the road to the Koebe power station from the R27 turnoff and the construction of the internal roads on tl Koeberg power station site for access to the PBMR DPP site are also proposed. Tl proposed PBMR DPP would to a large extent make use of existing Koeberg infrastructu and services.

3

THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

Mawatsan is the appointed independent consultant to implement the EIA process. The following sections provide more detailed information on this process.

Environmental impact assessment regulations

In terms of the EIA regulations (Government Notice no's R1182,R1183 and R1184 o 1997 in terms of the Environment Conservation Act, 1989 (Act No. 73 of 1989), there are a number of listed activities that could potentially have substantial detrimental effects or the environment and which are required to be subjected to Environmental Impac Assessment (EIA) processes.

The proposed 400 MW(t) PBMR Demonstration Power Plant includes activities that fal within the ambit of the following listed activities:

Activity 1. The construction, erection or upgrading of-
- (a) facilities for commercial electricity generation with an output of at least 10 megawatts and infrastructure for bulk supply;
- (b) nuclear reactors and facilities for the production, enrichment, processing, reprocessing, storage or disposal of nuclear fuels and wastes;
- (c) with regard to any substance which is dangerous or hazardous and is controlled by national legislation-
- (ii) manufacturing, storage, handling, treatment or processing facilities for any such substance;
- (d) roads, railways, airfields and associated structures;

Activity 2. The change of land use from-
- (c) agricultural or zoned undetermined use or an equivalent zoning to any other land use;

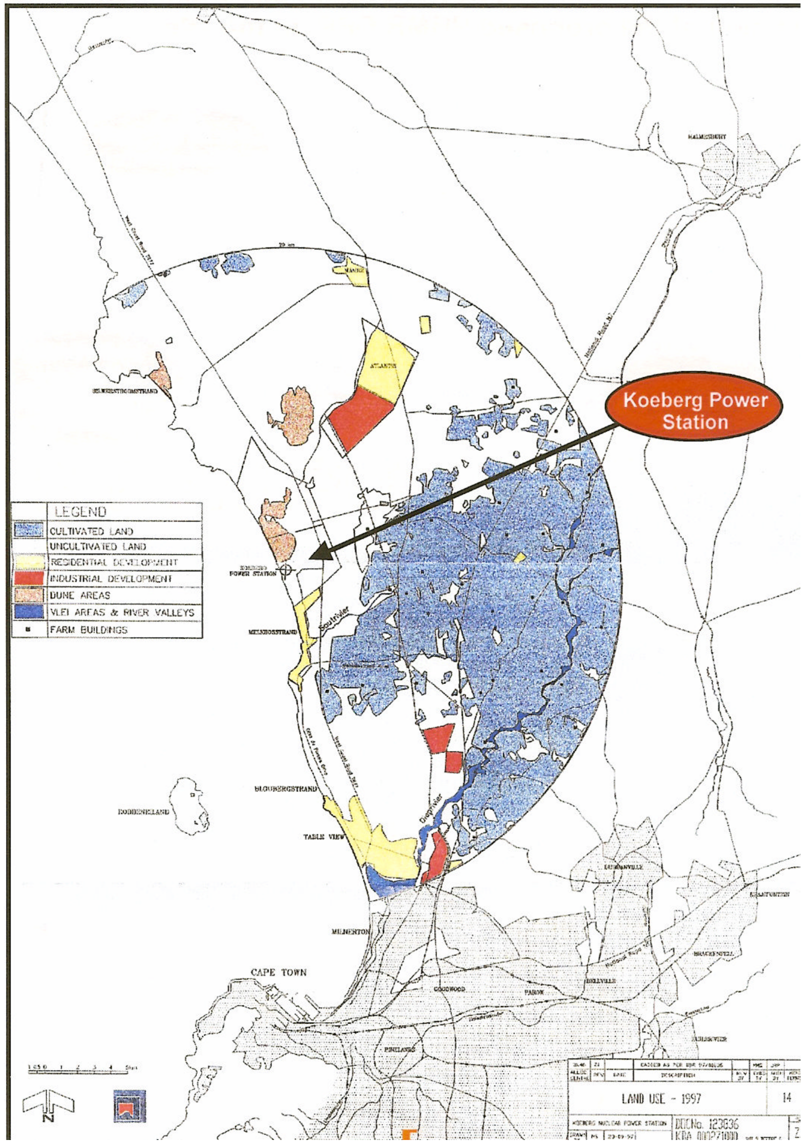
Activity 9. Scheduled processes listed in the Second Schedule to the Atmospheric Pollution Prevention Act, 1965 (Act No. 45 of 1965):
- 29. Power generation processes: That is to say, processes in which-
- (c) any fuel burning appliance is used that is not controlled in terms of Part III of this Act, excluding appliances in private dwellings. This activity is related to the D-generator, which is used as an auxiliary source and for a short term only. It is not related to the primary generation of electricity.

The study area

The proposed PBMR DPP will be located at the Koeberg Power Station site in the Western Cape. The Koeberg nuclear power station is situated north of Ouskip, Var Riebeeckstrand and Melkbosstrand and to the east of the R27 on the farm Duynefonteir 34. The site is located about 2 km from the Duynefontein residential area, 30 km north o Cape Town and 10 km south of Atlantis. The proposed PBMR DPP site will be situatec within the existing Access Control 1 security fence of the Koeberg nuclear power statior site. It will therefore be on land currently used for nuclear power generation.

4

Locality of Koeberg power station site



Locality of the Koeberg power station site & the approximat location of the proposed PBMR DPP on the site

THE PUBLIC PARTICIPATION PROCESS ACTIVITIES

A comprehensive public participation process will be implemented during the Scoping and EIA phases of the project. The focus will be on informing interested and affected parties (I&APs) of the proposed development and of the significant differences between the 302 MW(t) and 400 MW(t) PBMR DPPs. Issues and comments raised during the previous public participation process will be collated and incorporated into the Scoping and EIA phases of the current process.

Aims of the Public Participation Process

Mawatsan will be responsible for the Public Participation Process. The Public Participation Process is structured to:

- Enable early involvement of I&APs in the environmental assessment process through a variety of mechanisms, adapted as required in response to issues, concerns and challenges. This involvement will be ongoing until a decision is reached by the authorities;
- Provide I&APs with ongoing information regarding the proposed project and related impacts;
- Ensure continuous transparency and informed decision-making;
- Promote communication with I&APs;
- Ensure that the I&APs' viewpoints are addressed and considered by the regulating authorities; and
- Facilitate a constructive process that enables I&APs and stakeholders such as the authorities, project proponents and specialists to work together to enhance the positive benefits of the project and limit the negative impacts associated with the project.

Components of the public participation process

The public participation process will consist of the following activities:

- Notification of I&APs regarding the EIA process, consultation activities and availability of reports and decisions by the authorities, using a variety of mechanisms.
- Interviews with a variety of I&APs in respect of the PBMR demonstration plant.
- Focus Group Meetings with relevant sectoral groups (groups of role-players with similar interests, such as the business sector, tourism, agriculture, local government, etc.).
- Public Meetings that will be widely advertised. These will provide I&APs with information and opportunities to record concerns, issues and suggestions, as well as to identify other I&APs.
- A website (**www.pbmr-eia.co.za**) is available. This contains relevant project documentation, links to appropriate documentation as well as an opportunity to make comments and register as I&APs.

Contact: Mr Ian MacFadyen: (01)2 362 2908/Fax(012) 362 2463
pbmr@mawatsan.co.za

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Why is your participation important?

Everyone has the right to be involved in decisions that may affect their lives. Participation by Interested and Affected Parties is in everyone's best interest because:

- It provides opportunities for I&APs and the authorities to obtain clear, accurate and understandable information about the proposed project;
- It provides members of the public with the opportunity to provide comments (both positive and negative) regarding the environmental impacts of the proposed project;
- It provides affected parties with the opportunity to suggest ways for reducing or mitigating any negative impacts of the project, or for enhancing its benefits;
- It will enable the project proponent to incorporate the needs, preferences and values of I&APs into their decisions;
- It contributes toward maintaining a healthy, vibrant democracy.

Registering as an Interested and Affected Party

In order to register as an I&AP you are requested to:-

- Respond to the relevant newspaper advertisements;
- Complete and submit the registration sheet included in the Background Information Document;
- Attend public events; and
- Provide Mawatsan with your contact details.

As a registered I&AP you are entitled to be informed about public events, to receive project documentation, and to be afforded the opportunity to comment and raise issues and concerns throughout the process. You will also receive notifications to inform you of the availability of the Scoping and EIA reports and the opportunity to comment thereon. On completion of the environmental specialist studies, the Draft Environmental Impact Report (EIR) will be compiled and made available for public comment. All registered I&APs will be informed of the availability of this document and the public meetings to discuss the draft EIR.
If you consider yourself an I&AP for the proposed project, we urge you to make use of the opportunities created by the Public Participation Process to become involved.

Public meeting

A number of Public Meetings are scheduled to introduce the proposed project to I&APs. These events are as follows:

Milnerton	**9 November 2005**	**Milnerton Sport Centre at 18h30**
Atlantis	**10 November 2005**	**Hartebeeskraal Multi Purpose Centre at 18h30**
Midrand	**15 November 2005**	**Eskom Convention Centre at 18h30**
Durban	**17 November 2005**	**Durban Exhibition Centre at 18h30**

The main aim of the public meeting is to provide I&APs with more information on the proposed project and to explain the process to be followed, note their issues and concerns and answer questions. We invite you to attend the public meetings to ensure that you are kept informed of the project and that your issues and concerns can be formally recorded and addressed.

8.3 APPENDIX 3: COMMENTS AND REGISTRATION SHEET

REGISTRATION & COMMENTS

Please complete this form and return it to Mawatsan:

Mr. Ian MacFadyen
P.O. Box 13540, Hatfield, 0028
Tel: (012) 362 2908 Fax: (012) 362 2463
E-mail: pbmr@mawatsan.co.za
www.pbmr-eia.co.za

PERSONAL DETAILS

Title:______________Initials______________Surname:______________________________

Organisation/ Firm (if applicable):____

Position/ Nature of involvement (e.g. property owner): _____________________________

Street address:____

Postal address: ____

Tel and area code: (Work) __________________ (Home) ___________________________

(Cell) _______________________(Fax) _________________________

(E-mail) ____

COMMENTS / QUESTIONS:

1. What potential impacts do you foresee?

____
____
____
____
____
____
____
____

2. What issues and concerns would you like to raise with regard to these anticipated impacts?

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____

3. Are there any stakeholders that you feel we should consult with (please state their names and contact info)?

____
____
____
____

8.4 APPENDIX 4: FOCUS GROUP MINUTES

8.4.1 FOCUS GROUP MEETING: AFRIKAANS HANDELS INSTITUUT

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED 400 MW(T) PEBBLE BED MODULAR REACTOR DEMONSTRATION POWER PLANT (PBMR DPP) ON THE KOEBERG POWER STATION SITE IN THE WESTERN CAPE[8]

Date: 29 November 2005

Time: 11:00

Venue : AHI Office Pretoria

DRAFT MINUTES

WELCOME

Dr. D de Waal thanked Mr. J de Villiers for making time available for the briefing.

ATTENDANCE

Mr. J de Villiers, Dr. D de Waal, Mr. I MacFadyen.

PRESENTATION

Dr. D de Waal explained the background of the project and indicated the core aspects of the PBMR DPP, the EIA process and the consultation process.

A background information documents was supplied to Mr. J de Villiers for his information and distribution. Mr. J de Villiers indicated that the AHI and others including Sasol had, had a meeting in the past where they expressed support for the whole concept of the PBMR.

He did however say that there was concern expressed at the time regarding the storage of the spent fuel.

Mr. de Villiers asked where the spent fuel would be stored. Dr. D de Waal responded by saying that the legislation setting out Government Policy on the storage of radio active material had gone before parliament the previous week. At present the spent fuel of the KNPS is stored on site. It is intended to store the PBMR DPP spent fuel on the site as well. Low level and intermediate levels radioactive waste is disposed in Vaalputs.

8 Note: This is not a verbatim reflection of the meeting, but an attempt to reflect the presentations and discussion session in a clear and concise manner.

Mr. de Villiers enquired on the size of the proposed PBMR DPP compared to Koeberg. The response was that the area set aside at Koeberg for the PBMR is very small in relation to the total area of the power station.

Mr. J de Villiers indicated that the AHI has already indicated that they support the process in principle, as it was their opinion that the technology was clean and safe with few problems.

CONCLUSION

Dr. D de Waal thanked Mr. J de Villiers for his time and inputs and closed the meeting at 11h30.

8.4.2 FOCUS GROUP MEETING: PELINDABA WORKING GROUP

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED 400MW(t) PBMR DPP AT KOEBERG NPS SITE IN THE WESTERN CAPE

Date: 1 DECEMBER 2005

Time: 16:00

Venue: Professional Aviation Lanseria

DRAFT MINUTES

WELCOME AND INTRODUCTION

The meeting was opened by Mr. R Garbett who thanked everyone for attending. He indicated that more people had been invited to the meeting but had unfortunately not been able to attend. He requested Mr. W Lombaard to proceed with his presentation.

PRESENTATION AND DISCUSSION

Mr. W Lombaard explained the purpose of the focus group meeting as to provide information and to provide the attendees the opportunity to ask questions and raise issues. He set out the procedure to be followed from the pre scoping phase through to the Record of Decision.

Mr. R Garbett asked if they wished to appeal who the appeal should be directed to. Mr. W Lombaard confirmed that the appeal should be directed to the Minister of the Department of Environmental Affairs and Tourism. He landed out Background Information Documents and said if more information was required it should be requested.

Mr. W Lombaard explained the back ground to the previous process and indicated that Earthlife Africa had brought a court action against the PBMR process as the authorities had not given the public the opportunity in the final stages to comment. The court upheld Earthlife Africa's submission.

Ms. C Garbett asked how Eskom had prepared without a demonstration plant and how the procedures were tested. Mr. W Lombaard explained how the components making up the PBMR were tested.

Ms. C Garbett asked who hears the submissions and judges if the process can proceed. Mr. W Lombaard indicated that it was the Minister of Environmental Affairs and Tourism. He asked Ms. C Garbett if their main interest was the fuel plant at Pelindaba. Ms. Garbett indicated that Pelindaba was not their main interest, but that the whole PBMR aspect was of concern to them.

Mr. M Phalane asked which government department was responsible for the PBMR DPP. Mr. W Lombaard confirmed that it was the Department of Mineral and Energy, but that the DEAT was responsible for the EIA..

Mr. G Sayce asked how Pelindaba fits into the process. Mr. W Lombaard indicated that Pelindaba would manufacture the fuel pebbles.

Mr. G Sayce confirmed that his main area of concern was the impact that the process would have on the safety of Lanseria airport.

Mr. R Garbett said his concern was that if a nuclear related accident occurred no aircraft owner or property owner would be covered by insurance.

Mr. W Lombaard asked if they had lodged an appeal with the Minister regarding the Pelindaba Fuel plant. Ms. C Garbett confirmed that they had but had not received a response.

Mr. G Sayce said he was at the meeting as an observer and would report back to his board. Mr. W Lombaard suggested that they make contact with DEAT and update them regarding the insurance implications.

Mr. R Garbett expressed the view that the government would have to take responsibility for any insurance related claim not covered as a result of a nuclear related accident.

Mr. M Phalane said Earthlife Africa would take it further and would if necessary caucus the Minister of Environmental Affairs and Tourism.

Mr. G Sayce indicated that the flight path of aircraft arriving or leaving Pelindaba at present was over Pelindaba.

Mr. W Lombaard set out the time frames for the process. The scoping report to the authorities would be submitted in March 2006. Ms. C Garbett expressed the view that the process was very technical and the time available was not enough. Mr. W Lombaard said that if they wished to comment now it would be acceptable and their submission to DEAT could request more than 30 days to study the report. He said the draft Environmental Impact Report would be submitted for comment between June – July 2006. The final Impact Report would start in August 2006.

Ms. C Garbett asked why the process was being rushed and where the public could participate? Mr. W Lombaard said the public would have an opportunity to submit issues. He said that exemptions for two issues had been applied for, namely alternative energy sources and not for alternative sites.

Mr. M Phalane said the government needs to make an effort to look at alternatives.

Mr. R Garbett asked if this EIA is for a demonstration model PBMR will a further EIA be required if the process goes beyond a demonstration model. Mr. W Lombaard confirmed that it would be the case.

Ms. C Garbett asked why it could not be built at Vaalputs? Mr. W Lombaard replied that it needs water, and therefore needs to be built next to the coast or near a dam.

Mr. R Garbett asked why the demonstration model had to be so large? Mr. W Lombaard explained that it was necessary to prove the technology economics.

Mr. R Garbett asked if the PBMR in Germany was approximately the same size. This was confirmed by Mr. W Lombaard.

Ms. C Garbett said the one in Germany had, had an accident. Mr. W Lombaard said he was unaware of it. It was agreed by Messrs R Garbett and M Phalane that a copy of the accident report would be supplied to Mr. W Lombaard

Mr. W Lombaard said he has a record of all nuclear accidents that have taken place but he has no record of any PBMR accident. He asked for the information to be supplied to him.

Mr. R Garbett stated that he would accept that Mr. W Lombaard would be balanced in terms of his approach to EIA.

Mr. W Lombaard stated that Dr. D de Waal was due to have a meeting with Earthlife Africa in Cape Town and he would request him to take the issue of the PBMR accident up with them to obtain further information.

Ms. C Garbett asked if South Africa imported uranium. Mr. W Lombaard confirmed that South Africa imported enriched uranium

Mr. M Phalane commented on the fact that there had been a visit to South Africa by Iranian Officials.

Ms. C Garbett made the point that she believes the process is flawed because of the lack of independence of the consultants. Mr. W Lombaard said he had commented at one stage to DEAT that the applicant should pay money into a fund and the fund then pays for independent consultants.

Mr. R Garbett asked about the way forward. Mr. W Lombard spelt out the process to be followed. He said the draft minutes would be sent back for comment. He stated that it must be remembered that sensitive and private information of the applicant cannot be supplied to the general public. He made the comment that if there was something that was not in the public domain then one could apply for it to be made available in terms of the Access to Information Act.

Mr. R Garbett asked about the containment of the fuel. Mr. W Lombaard explained about the fuel and the reactor control process. He made mention of a small PBMR operating in China.

Mr. R Garbett asked how long the fuel balls would be contained. Mr. W Lombaard explained for 40 years at the reactor and this could be extended by another 40 years, effectively for the life of the plant.

Mr. M Phalane said if the German company holds the patent what protection would the tax payers of South Africa have that the Germans wont withdraw the patent.

Ms. C Garbett asked if we export PBMR technology who must take back the used fuel? Mr. W Lombaard said it should be remembered that Eskom is the client and that the PBMR company holds the license.

Mr. K Nair said it must be remembered that Eskom does not develop technology. He said that various technologies were being tested by Eskom including wind.

Ms. C Garbett asked why Eskom does not try other forms of technology and "drop" nuclear. Mr. W Lombaard asked that everything be checked carefully in the scoping report and if any of the issues that have been mentioned are not recorded to please add. He also said that at some point in the process the PBMR Company would have to transfer capacity to Eskom .

CLOSURE

Mr. R Garbett asked if there were any other questions or issues. Mr. R Garbett thanked everyone for coming and thanked Mr. W Lombaard for the balanced and professional manner in which he had presented the presentation and answered issues and questions in an informative way.

The meeting closed at 17h30.

ATTENDANCE REGISTER

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8.4.3 WESSA NGO ENVIRONMENTAL FORUM FOCUS GROUP

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED 400 MW(t) PBMR DPP AT KOEBERG NPS SITE IN THE WESTERN CAPE

DATE: 2 DECEMBER 2005

TIME: 10:00

VENUE: WILDLIFE AND ENVIRONMENTAL SOCIETY OF SOUTH AFRICA – JHB OFFICES FOCUS GROUP MEETING: NGO ENVIRONMENTAL FORUM

DRAFT MINUTES

WELCOME AND INTRODUCTION

Mawatsan received an opportunity for a presentation in a NGO Forum meeting that had been organised by WESSA and various other NGO environmental organizations.

Ms. Carla Hudson introduced Dr. D de Waal and Ian MacFadyen to the attendees. She then requested Dr. D de Waal to present his presentation regarding the PBMR.

PRESENTATION

Dr. D de Waal explained the EIA process. He confirmed that we have had public meetings and identified where they had taken place. The meeting was informed that Focus Group Meetings were in the process of taking place and this was one of them. It was confirmed that two exemptions had been applied for from DEAT. The one exemption was the need to identify alternative energy sources and the other was for the public participation process to identify alternative sites i.e. Thyspunt and Bantamsklip. Once the presentation had been completed Dr. D de Waal asked if there were any questions or comments.

DISCUSSION

An attendee asked how the waste would be dealt with. Dr. D de Waal replied that the spent fuel would be stored at Koeberg for a period of 40 years and this could if necessary be extended for another 40 years. He commented that certain low level waste would be transported to Vaalputs and stored there. He explained the role of DEAT and certain other government departments in the process.

An attendee asked what the energy requirement and waste production per kilogram would be. Dr. D de Waal stated 165 KW per day. He said additional information would be available in the scoping report.

An attendee asked how other technologies were being assessed. Dr. D de Waal indicated that Eskom was in the processes of assessing a variety of technologies, wind and gas being amongst them. He said that the issue would be dealt with in more detail in the information document that was in the process of being developed. He added further that one of the arguments being presented was why the same amount of money was not being spent on other forms of technology. He explained that the different forms of technology were at different levels of development.

Attendee asked if the process was totally "locked" into the use of uranium or was their potential to use other forms of fuel.

Dr. D de Waal responded by saying that at this stage the focus was on the use of uranium. He explained that it must be remembered that the proposed reactor was not a commercial reactor. Should the technology prove viable it would only become commercial around 2015.

Ms. C Hudson asked if the proposed PBMR was to be the only one or one of many. Dr. D de Waal said if the technology proved economically viable it would be one of many.

MS I Waidje said there could be a potential problem from a neurological point of view with the accumulation of uranium in the body as a chemical.

Dr. D de Waal said a response would be formulated and he would come back to her.

Mr. Caveney asked about the transport of the fuel and the potential for environmental pollution. Dr. D de Waal explained where the fuel would come from, its transportation to Pelindaba and its subsequent move to Koeberg.

Ms. C Hudson asked if there were any further questions and then adjourned the meeting.

CONCLUSION

Ms. C Hudson thanked Dr. D de Waal for his presentation. Dr. D de Waal distributed BID's to the attendees and left additional copies with Ms. C Hudson.

ATTENDANCE REGISTER WESSA NGO FORUM

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Leon Demper	WESSA			Tel: Fax: Cell:
M P Rath	DWAF			Tel: (051)405-9289 Fax:(051)430-8146 Cell: (082)808-2735
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				Cell: (082) 715-9383
Ian MacFadyen	Mawatsan		Mathilda@mawtsan.co.za	Tel: (012) 362-2908
				Fax: (012) 362-2463
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Dr. D de Waal	Mawatsan		ddw@lantic.net	Tel: (012) 362-2908
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8.4.4 DEPARTMENT OF MINERALS AND ENERGY - FOCUS GROUP

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED 400MW(t) PBMR DPP AT KOEBERG NPS SITE IN THE WESTERN CAPE

Date: 11 January 2006

Time: 09h00

Venue: DME offices-Pretoria

WELCOME

Mr. W A Lombaard thanks the DME officials for their time and willingness to attend a meeting.

OVERVIEW OF THE EIA PROCESS

Mr. Lombaard gives the meeting an overview of the EIA process followed, as well as of the issues raised by IAPs to date. The presentation used at the public meetings is used as the basis for this overview. Mr. Maqubella of the DME thanks Mr. Lombaard for the overview.

WASTE MANAGEMENT PROCESS FOR SPENT FUELS.

Mr. Maqubella informs the consultants that DME will in communication with the NNR determine the requirements for the management of the spent fuel at the PBMR DPP, and that these requirements will form part of the licence requirements of the said plant.

APPROVAL OF THE PBMR DPP SAFETY CASE.

In response to a question from the consultants on the process to approve the safety case of the proposed PBMR DPP Mr. Maqubella responds that this is a phased and protracted process. The process should be sufficiently advanced at the submission of the EIR to the authorities to enable the NRR to support the DEAT in their decision making process.

DETAILED FEASIBILITY REPORT.

The consultants put forward their approach to this issue raised by IAPs. In terms of this approach the consultants view the detailed feasibility of the proposed PBMR DPP as part of the strategic issues related to the proposed plant that falls outside of the EIA for the demonstration plant and that this issue will only be noted but not assessed by the consultants in the EIR. Mr. Maqubella agrees with the approach and states that the consultants have to focus on the demonstration plant and its associated site specific environmental impacts. Feasibility will be handled as part of the decision to apply the PBMR technology as generating technology at a later stage. This consideration will be done by DME, NRR, DEAT, ESKOM and Government at the stage where a decision has to be taken to commercialise the PBMR technology.

FINANCIAL PROVISIONS.

Mr. Maqubella states that the applicant (ESKOM) accepts liabilities related to financial provisions associated with the proposed PBMR DPP upon hot commissioning of the proposed plant. A statement on the provisions made for long term management and custodianship of radio active waste and spent fuel should be included EIR.

GOVERNMENT SUPPORT.

The officials of the DME state that although the proposed PBMR DPP is supported by the government it is not a given that approval shall be granted for the construction of the demonstration plant. All requirements for licensing and approval must be complied with. This statement follows from an issue raised by IAPs that it appears that the PBMR DPP will receive approval irrespective of the outcome of the EIR and other approval processes.

LOCAL SKILLS.

DME officials expressed the requirement that the EIR must assess the level of local skills to maintain and operate the proposed PBMR DPP, as well as the skills development process to be put in place by ESKOM to develop adequate local skills.

HELIUM SUPPLY.

Mr. Maqubella expressed the requirement that the EIR should assess the supply of adequate helium resources for the proposed PBMR DPP.

ATTENDANCES REGISTER.

An attendance register was circulated. The register is attached.

NAME AND SURNAME	ORGANISATION	POSTAL ADDRESS	CONTACT DETAILS	
H Haresh	Department of Mineral and Energy	123 Visagie Street	Tel:	Fax:
		Pretoria	Cell: 082 335 9134	
		0001	E-mail:	
D Kgomo		234 Visagie Street	Tel: 012 317 8475	Fax:
		Pretoria	Cell:	
		0001	E-mail:	
J Maqubela		234 Visagie Street	Tel:	Fax:
		Pretoria	Cell: 082 450 9224	
		0001	E-mail:	
O Graupner		P.O.BOX 13540	Tel:	Fax:
		Hatfield	Cell: 082 820 5440	
		0028	E-mail:	
W Lombaard		P.O.BOX 13540	Tel:	Fax:
		Hatfield	Cell: 083 273 5601	
		0028	E-mail:	

8.4.5 VAALPUTS PUBLIC SAFETY FORUM - FOCUS GROUP

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED 400MW(t) PBMR DPP AT KOEBERG NPS SITE IN THE WESTERN CAPE

Date: 1 February 2006

Time: 10h00

Venue: Vaalputs , Northern Cape: Garing Conference Room

WELCOME AND INTRODUCTION

The Mawatsan Team were invited to make a short presentation at the Vaalputs Public Safety Forum meeting. This meeting had been arranged by NECSA, and included representatives from a variety of communities. When reaching the appropriate item on the agenda, Mr. Lombaard made the following presentation.

PRESENTATION

EIA PROCESS - MR. LOMBAARD

Mr. Lombaard described the EIA process to be followed for the new application for the 400 MW(t) Pebble Bed Modular Reactor Demonstration Power Plant. He said that the construction, commissioning, operation, maintenance and decommissioning of the demonstration plant all form part of this EIA process.

Mr. Lombaard specified that the EIA application is lodged in terms of the old and not the new regulations. The application would be submitted to the national Department of Environmental Affairs and Tourism. The Western Cape Environmental Affairs Department would be the commenting authority. He said that exemption for the public participation process on the site alternatives was being considered.

He said that the Public Participation Process aimed to inform IAPs of the progress made to date on the EIA, to confirm their details and register any new IAPs. He said that background information documents were made available at the meeting. He indicated that additional information could be obtained from the website, at the public meeting and focus group meetings. He said that newspaper advertisements were placed in the several newspapers and that public meetings were held in several of the major centres.

Mr. Lombaard said that provisional issues had been identified for investigation. These form part of the specialist studies that emanated from the previous process. However new issues that may need to be addressed could also be raised. He said that the issues included technical issues, biophysical issues, social impacts and economic impacts.

Mr. Lombaard indicated that a formal cooperative governance framework between DEAT and the NNR was developed. He highlighted that the NNR is still the responsible authority on nuclear safety issues. Such issues however will be identified as part of the

EIA. Mr. Lombaard gave a description of the category of issues and how these would be handled by each authority – please refer to the attached presentation. Mr. Lombaard indicated that it is important to take note that the EIA process could be concluded before the NNR makes a decision in terms of its nuclear licensing process. However, all issues that pertain to the NNR decision making process would be identified in the EIA.

ELECTRICITY DEMAND AND SUPPLY - MR. LOMBAARD

Mr. Lombaard then continued with a brief presentation on the electricity demand and supply status in South Africa. He said that the electricity demand is increasing steadily, both the total amount of electricity used each year as well as the peak demand required each day and specifically in the winter periods. He stated that coal power stations are the main source of electricity and that they are situated close to the source of coal which keeps the transportation costs as low as possible. Eskom's energy mix also includes pumped storage schemes, nuclear power generation at Koeberg, two small kerosene-fuelled gas turbines and hydro electricity generation.

He said that the current Eskom net generation capacity, excluding the imported electricity, is about 36 400 MW and that the 2007 peak demand will exceed the current net generation plus the normal reserve margin capacity. New new generation capacity will be necessary immediately, to cater for the growing demand, and later (after 2020) to also cater for the replacement of older power stations when it is no longer economically viable to operate such stations.

Mr. Lombaard emphasised that the primary energy sources available in South Africa for electricity generation are coal and uranium. He noted that importing gas or oil is possible but expensive. He said that renewable energy sources, especially ones with high potential in South Africa, such as solar, are being investigated. He said that different energy sources are been considered and that several pilot projects are planned or are underway. He said that a hybrid of the energy sources would probably be the most suitable way to cater for the demand for electricity in South Africa. He stated that this public meeting forms part of the Environmental Impact Assessment for the proposed 400 MW(t) PBMR Demonstration Power Plant (DPP).

OVERVIEW OF THE PROPOSED PBMR DPP - MR. LOMBAARD

Mr. Lombaard gave a brief overview of the proposed PBMR DPP. He said that it is a small power station that would generate 165 MW. He said that it is a high temperature design, which makes it more efficient. Furthermore it makes use of Helium gas to remove the heat from the nuclear fuel – the hot helium gas then drives the turbine. He said that the PBMR is graphite moderated, which slows the neutrons that target the uranium atoms. He explained that the resulting nuclear reaction produces heat energy, which then through the turbo-generator is converted into electrical energy. He said that the design is called Pebble Bed because the fuel is in a spherical shape like a pebble. Very small particles of uranium dioxide, each about the size of a sugar grain, are coated with layers of silicon carbide and pyrolitic carbon. These particles are embedded in graphite to form a fuel sphere or pebble about the size of a tennis ball. He explained that approximately 400,00 pebbles are needed in such a power plant.

Mr. Lombaard described the principles of generating electricity from a thermal (heat) source. Heat can be obtained from burning wood, coal, oil etc. This heat in turn is used to boil water and create steam. The steam is used to turn a turbine which turns a generator. The generator consists of copper wires and a magnetic field. When copper wires turn inside a magnetic field, electricity flows through the copper wires. Instead of boiling water and creating steam, one can also heat a gas and use the hot gas to drive the turbine. He said that in the PBMR design the heat is produced by the nuclear reaction in the uranium in the pebble fuel. The heat is removed by the helium gas which then drives the gas turbine. The turbine causes the generator to turn and generate electricity.

DISCUSSION

An attendee enquired when the process would be finalised. Mr. Lombard explained that it depends upon the EIA process and the various government decisions, but anticipated that the EIA process would-be completed towards the last quarter of the year 2006.

Me. E Groeners wanted to know why not build another Koeberg type rector and what the difference was between the Koeberg rector and the proposed PBMR DPP. Mr. Lombaard explained that whilst both utilised a nuclear reaction as the heat source, the designs were substantially different. The fuels are different, the designs are different. Different gases are used as the driving mechanisms, (Water in the case of Koeberg and Helium in the case of the PBMR). Koeberg requires active safety and operational control while the PBMR is designed to according to passive control precipices. The sizes of the reactors are also different, with Koeberg substantially larger than the PBMR DPP.

An attended enquired as to how many of these reactors Eskom intends building. Dr. de Waal responded that they are uncertain, as they are only involved in the demonstration PBMR DPP. It could however be expected that, if the studies and demonstrations are successful, that there would be an intention by Eskom to build more of the reactor – either locally or for export.

CONCLUSION

Mr. Lombaard presented a CD copy of the draft scoping report and thanked the chairperson for the opportunity.

ATTENDANCE REGISTER

ATTENDEE	ORGANISATION
1. A DE BEER	Necsa, VAALPUTS
2. A C VAN NIEUWHOLTZ	SAPS GARIES
3. A CAROLISSEN	Necsa, PELINDABA
4. BW CORNELISSEN	DTEC SPRINGBOK
5. C BEYLEVELD	Necsa, PELINDABA
6. C BRANDT	NOURIVIER
7. C CLOETE	GARIES
8. C CLOETE	TWEERIVIER ONTWIKKELINGS FORUM
9. CD CLOETE	SAPS GARIES
10. D DE WAAL	MAWATSAN
11. D KGOMO	DME
12. D KORDOM	KAMIESKROON
13. E CLAASEN	PAULSHOEK - ONDERVOORSITTER
14. E GROENERS	DTEC KIMBERLEY
15. E STEENKAMP	SOEBATSFONTEIN
16. G BINAS	KLIPFONTEIN ONTIKKELINGS FORUM
17. G GANESH	ESKOM MEGAWATT PARK, JHB
18. G PRETORIUS	NKR
19. G S WOLFAARDT	SAPD NOODDIENSTE
20. J BEUKES	KAMASIES
21. J BRAND	ROOIFONTEIN
22. J CLOETE	KHEIS
23. J JOOSTE	LEKIEFONTEIN
24. J KRIEL	LELIEFONTEIN
25. J LOT	PAULSHOEK - VOORSITTER
26. J P DE VILLIERS	SAPS GARIES

ATTENDEE	ORGANISATION
27. J STUURMAN	CDW – INKDM - WKPA
28. K STUURMAN	NAALWERKPROJEK
29. M BRANDT	ROOIFONTEIN
30. M CLOETE	HONDEKLIPBAAI
31. M MOSTERT	NECSA SEKURITEIT
32. M PEMIDIE	WYKSVERTEENWOORDIGER – TWEERIVIER
33. M SAUL	KHARKAMS
34. N FICK	ESKOM MEGAWATT PARK, JHB
35. P BREDELL	Necsa, PELINDABA
36. P JANSEN VAN RENSBURG	Necsa, PELINDABA (SEKRETARESSE)
37. P POLS	GARIES
38. R LINKS	HONDEKLIPBAAI
39. S BEZUIDENHOUT	KAMASSIES
40. S JOSEPH	NOURIVIER
41. S VAN NIEKERK	NUWEFONTEIN PRIM - KLIPRAND
42. T VAN SCHALKWYK	SOEBATSFONTEIN
43. V ROOI	KLIPFONTEIN
44. W LOMBAARD	MAWATSAN
45. Y OORTMAN	KLIPRAND

8.5 APPENDIX 5: MINUTES OF PUBLIC MEETINGS

8.5.1 MILNERTON PUBLIC MEETING

Milnerton Sports Club 9 November 2005 18:30

Environmental Impact Assessment for the Proposed 400 MW(t) Pebble Bed Modular Reactor Demonstration Power Plant (PBMR DPP) on the Koeberg Power Station site in the Western Cape[9]

WELCOME

Dr. de Waal welcomed the attendees and introduced the project team. No apologies were received. The agenda was read and approved.

PURPOSE OF THE MEETING

Dr. de Waal stated that the purpose of the meeting was to provide interested and affected parties with information on the proposed project, as well as on the previous Environmental Impact Assessment (EIA) process and thereby provide an information base for this project. Dr. de Waal said that this was the start of the scoping process and that IAPs should ensure that their details are registered with Mawatsan. This is to ensure that the IAPs are kept informed on the progress of the process. He emphasised that this public participation process forms part of a new application to the relevant departments. Dr. de Waal enquired whether all attendees are English speaking. No members of the audience indicated that an alternative language would be required during the communication. He then introduced Mr. Tony Stott.

PRESENTATION ON THE ELECTRICITY DEMAND AND SUPPLY IN SOUTH AFRICA

Mr. Stott gave a presentation on the electricity demand and supply status in South Africa. He said that Eskom generates approximately 95% of South Africa's power. The remaining 5% is generated by large corporations such as Sappi, Sasol and Municipalities such as the City of Johannesburg, City of Tshwane and the City of Cape Town.

He said that the electricity demand is increasing steadily, both the total amount of electricity used each year as well as the peak demand required each day and specifically in the winter periods. He stated that coal power stations are the main source of electricity and that they are situated close to the source of coal which keeps

[9] Note: This is not a verbatim reflection of the meeting, but an attempt to reflect the presentations and discussion session in a clear and concise manner.

the transportation costs as low as possible. Eskom's energy mix also includes pumped storage schemes, nuclear power generation at Koeberg, two small kerosene-fuelled gas turbines and hydro-electricity generation.

He said that the current Eskom net generation capacity, excluding the imported electricity, is about 36 400 MW. Mr. Stott went on to say that the 2007 peak demand will exceed the current net generation plus the normal reserve margin capacity. He said that it is assumed that power stations would last for 50 years and that new generation capacity will be necessary, to cater for the growing demand, and later (after 2020) to also cater for the replacement of older power stations when it is no longer economically viable to operate such stations.

He said that the Department of Minerals and Energy is responsible for integrated energy planning and that the National Electricity Regulator develops the National Integrated Resource Plan for long term planning of electricity generating options. Eskom also plans for future generation options through a process called Integrated Strategic Electricity Planning.

Mr. Stott emphasised that the primary energy sources available in South Africa for electricity generation are coal and uranium. He noted that importing gas or oil is possible but expensive. He said that renewable energy sources, especially ones with high potential in South Africa, such as solar, are being investigated.

Mr. Stott said that Eskom had several initiatives that promote awareness on energy efficiency on a commercial and an industrial level. He indicated that the National Electricity Regulator set an objective of a 152 MW saving for 2004, and that 197 MW was saved. He said that even with such initiatives – more electricity generating capacity would be needed.

Regarding new electricity generating capacity, Mr. Stott said that several technologies for producing cleaner power using coal are being explored. These include a pilot underground coal gasification project. A solar pilot project is being planned, that could produce 100 MW. Similarly, wind generation is also under investigation. He said that the option also exists to import electricity from Southern African countries, such as the DRC. These however were challenging due to the long (~ 4000 km from DRC) transmissions lines that would be required. Mr. Stott said that on the nuclear side, the PBMR technology is being investigated. The PBMR plant at Koeberg would be a demonstration plant.

Mr. Stott summarised that the need to expand on the availability of current electricity generating capacity exists. He said that different energy sources are been considered and that several pilot projects are planned or are underway. He said that a hybrid of the energy sources would probably be the most suitable way to cater for the demand for electricity in South Africa. He concluded in saying that Environmental Impact Assessments are being conducted for Open Cycle Gas Turbine projects, pumped storage schemes, a new coal-fired power station, and a solar thermal plant. He stated that this public meeting forms part of the Environmental Impact Assessment for the proposed 400 MW(t) PBMR Demonstration Power Plant (DPP).

After concluding the presentation on the electricity demand and supply in South Africa, Mr. Stott gave a presentation on the background to the PBMR EIA, the previous EIA process and the court case that followed.

Mr. Stott gave a brief overview of the proposed PBMR DPP. He said that it is a small power station that would generate 165 MW. He said that it is a high temperature design, which makes it more efficient. Furthermore it makes use of Helium gas to remove the heat from the nuclear fuel – the hot helium gas then drives the turbine. He said that the PBMR is graphite moderated, which slows the neutrons that target the uranium atoms. He explained that the resulting nuclear reaction produces heat energy, which then through the turbo-generator is converted into electrical energy. He said that the design is called Pebble Bed because the fuel is in a spherical shape like a pebble. Very small particles of uranium dioxide, each about the size of a sugar grain, are coated with layers of silicon carbide and pyrolitic carbon. These particles are embedded in graphite to form a fuel sphere or pebble about the size of a tennis ball. He explained that approximately 400,00 pebbles are needed in such a power plant.

Mr. Stott briefly described the principles of generating electricity from a thermal (heat) source. Heat can be obtained from burning wood, coal, oil etc. This heat in turn is used to boil water and create steam. The steam is used to turn a turbine which turns a generator. The generator consists of copper wires and a magnetic field. When copper wires turn inside a magnetic field, electricity flows through the copper wires. Instead of boiling water and creating steam, one can also heat a gas and use the hot gas to drive the turbine. He said that in the PBMR design the heat is produced by the nuclear reaction in the uranium in the pebble fuel. The heat is removed by the helium gas which then drives the gas turbine. The turbine causes the generator to turn and generate electricity.

In terms of the previous EIA process for the 302 MW(t) design of the PBMR, Mr. Stott said that the final EIR was submitted in June 2000, where after the Department of Environmental Affairs and Tourism (DEAT) Director-General issued the applicant (Eskom) with a positive Record of Decision (ROD). In January 2005 the RoD was set aside by the Cape High Court on the basis that interested and affected parties (IAPs) had not been given an opportunity to comment on the final EIR directly to the Director-General. The Cape High Court ordered the Director-General to provide IAPs a further comment period, and to consider such submissions before making a decision anew on the EIA. Mr. Stott indicated that the judgment is available on the website. He said that the RoD was not overturned as a result of a flawed EIA, but that an augmented commenting period was required on the Final EIR.

Mr. Stott said that the design of the PBMR DPP had evolved since the EIR was submitted. The power output of 302 MW(t) that was proposed in the previous process had changed to 400 MW(t) and the turbine design is now horizontal instead of vertical .In addition the footprint of the building is also slightly larger. He concluded in saying that the changes warranted a new application to be lodged.

Dr. de Waal thanked Mr. Stott for his presentation and requested that questions be kept for after the presentation to be made by Mr. Lombaard on the EIA process to be followed.

EIA PROCESS

Dr. de Waal described the EIA process to be followed for the new application for the 400 MW(t) Pebble Bed Modular Reactor Demonstration Power Plant. He said that the construction, commissioning, operation, maintenance and decommissioning of the demonstration plant all form part of this EIA process.

Dr. de Waal specified that the EIA application is lodged in terms of the old and not the new regulations. The application would be submitted to the national Department of Environmental Affairs and Tourism. The Western Cape Environmental Affairs Department would be the commenting authority. He said that exemption for the public participation process on the site alternatives was being considered.

He said that the Public Participation Process aimed to inform IAPs of the progress made to date on the EIA, to confirm their details and register any new IAPs. He said that background information documents were made available at the meeting. He indicated that additional information could be obtained from the website, at the public meeting and focus group meetings. He said that newspaper advertisements were placed in the several newspapers and that public meetings were held in several of the major centres.

Dr. de Waal said that provisional issues had been identified for investigation. These form part of the specialist studies that emanated from the previous process. However new issues that may need to be addressed could also be raised. He said that the issues included technical issues, biophysical issues, social impacts and economic impacts.

Dr. de Waal indicated that a draft scoping report would be made available for a period of 30 days for public comment and that a RFSR including the comments received would be sent to the authorities thereafter. He said that notification of the IER would be sent to all IAPs, and that comments on the EIR would go to DEAT.

Dr. de Waal indicated that a formal cooperative governance framework between DEAT and the NNR was developed. He, however highlighted that the NNR is still the responsible authority on nuclear safety issues. Such issues however will be identified as part of the EIA. Dr. de Waal gave a description of the category of issues and how these would be handled by each authority.

Dr. de Waal indicated that the EIA process could be concluded before the NNR makes a decision in terms of its nuclear licence process. However, all issues that pertain to the NNR decision making process would be identified in the EIA.

DISCUSSION

How long will the RSA coal reserves last? Mr. Stott indicated that the average estimate is that the coal reserves will last for 100 years due to the increased cost of coal mining.

Where the mothballing of Eskom's closed down power stations subject to an EIA? Mr. Stott replied that as part of the mothballing process, an application was made to DEAT and authorization obtained.

The question was raised whether the emissions of the coal power stations are conforming satisfactorily to legislation? It was indicated that the coal power stations does confirm. Various emission reduction technologies have been introduced (e.g. Fabric filters, sulphur injections, etc.) to maintain Registration certificates limits.

A participant asked if consumer behaviour and moderation are factored into Eskom's future anticipated growth scenarios. Mr. Stott replied that this was indeed the case.

There was a request for a cost comparison between the various supply technologies. Mr. Stott indicated the following cost comparison:

- Coal cost about $1200/kWh.
- Nuclear about $1500 – 2000/kWh.
- Solar about $20,00/kWh.

A participant asked if consumer behaviour and moderation are factored into Eskom's future anticipated growth scenarios. Mr. Stott replied that this was indeed the case.

In reply to a question on how the costs for the various technologies are calculated, Mr. Stott indicated that the life cycle costing approach is applied.

A participant enquired whether it would not be feasible for the RSA to consider the reduction of the supply voltage since this could lead to substantial generation savings. Mr. Harris from Eskom commented that the suggestion is not feasible since the output of a station is not related to the voltage system. Implementing such a system will incur huge cost without any benefit.

The question was raised as to what energy losses are experienced during transmission and whether Eskom exports electricity? Mr. Stott indicated that the RSA uses an integrated transmission network to ensure quality and reliability of supply. Given the long distances of transmission the losses can be up to 7%. In addition, Mr. Stott stated that in 2004 about 16 000 GWh was exported and 14 00 GWh was imported.

A participant asked on what the basis electricity growth scenarios were based and also enquired whether it makes provision for inherent growth due to new entrances to the market?

Mr. Stott replied that the scenarios make provision for inherent growth as well as for new entrants. Thirty (30) years ago only 50% of the population had access to electricity. By 2012 Eskom aims to raise the figure to 100%. Mr. Stott also indicated that the split between industrial and domestic is about 80%: 20%.

There was a suggestion that Eskom should consider the supply of electricity to local communities on a direct basis rather than off the grid? Mr. Stott responded that Eskom is in support of off-grid supply of electricity and furthermore is considering this option via various renewable technologies as well as the affordability of these options

There was a question on why did Eskom increase the output of the PBMR from 110 MW(e) to 165 MW(e). Mr. McGowan responded that the current design evolved from analysis made by PBMR Limited into international requirements for power generating plants. Internationally generation plants are connected to supply grids in 300 MW(e) or 600 MW(e) units. This relates to the proposed 400 MW(t) output. Furthermore the PBMR Limited design team, with inputs from international companies such as Mitsubishi, concluded that a horizontal turbine/generator is more appropriate than a vertical design.

Earthlife Africa (ELA) stated that the economical Feasibility Study and Business Plan for the PBMR were not available to IAPs in the previous EIA. Will it be available in this EIA, together with other information which Earthlife Africa wishes to study in order to meaningfully participate in the EIA? Mr. McGowan stated that the first Business Plan of the PBMR (Pty) Ltd was an over estimation of the market potential of the plant, given the design at that stage and therefore not feasible. The current Business plan is seen as more realistic and feasible.

A viewpoint was raised that a review period of 30 days for the Scoping Report is too short and 45 calendar days is more appropriate, given the mass of information that the IAPs need to work through. Dr. D de Waal responded that the review period for the draft scoping reports will be 30 calendar days and that this will afford IAPs sufficient time to comment on the document. He however noted the request for longer review time

A participant asked how the current EIA address would address nuclear safety issues, seen in the light of the Cape High Court Ruling directing that the DG for Environment Affairs could not abdicate his responsibility in this regard to the DG of DME?

Dr. de Waal responded that the DEAT and the NNR have reached an agreement on how radiological and nuclear safety issues will be dealt with within the EIA. This agreement will form part of the Draft Scoping Report

ELA indicated that:

- They and the public will require timely information in generally and on safety issues in order to participate in the EIA and to make decisions.
- The EIA cannot direct or address policy issues e.g. nuclear waste policy given the EIA's status.
- ELA requests focus groups meetings to discuss and debate specialist issues and reports.

Dr. de Waal stated that the comments are noted and the participation of the ELA will be accommodated within the EIA process

It was asked whether magnetic radiation (EMR) from power lines form part of the EIA. Mr. Stott responded that the new lines that will link the PBMR to the National grid will transect Eskom property only. These lines will be about 700 meters in length. EMR will be within the prescribed limits of the ACT and will not form part of the EIA.

There was a question on whether the property of 150 hectare near the N7 road and Melkbosstrand, which was bought 12 years ago for an electricity substation, is linked to the PBMR? Mr. Stott indicated that there is no link between the projects.

It was stated that certain persons have contracted cancer while in the employment of Eskom and that Eskom is allegedly withholding medical records from such employees at Koeberg. Can Eskom be trusted? Mr. Stott stated that employees' rights with regard to their medical status are strictly respected and they have full access thereto. He further said that it is equally important for Eskom to know the medical status of employees to exercise the diligence and safeguards with regard to employees' health. No employee at Koeberg or member of the public, have contracted cancer as a result of Koeberg's operation.

ELA requested where they can make input into the process of alternatives? They stated that it would appear that the NO-GO alternative is the only option given the demonstration nature of the project. Mr. Stott responded that alternatives were considered in the previous EIA and Koeberg NPS site was found to be best suited for the demonstration module PBMR. The NO-GO option will be addressed in the scoping report. Dr. de Waal stated that ELA is welcome to submit their comments with regard to alternatives and that this issue will also be addressed in the scoping report.

ELA indicated that the viewpoint that the issues of health, safety and alternatives were poorly addressed in the previous EIA. Dr. de Waal said that the viewpoint is noted.

A participant asked what the purpose of the project was. Mr. T McGowan responded that the project is for the establishment of a life cycle demonstration plant that needs to confirm the integration of the various technology components of the plant in an efficient and cost effective manner.

It was also asked why Eskom choose dangerous and potentially harmful technologies for demonstration, and what would happen if the PBMR is not feasible? Mr. Stott replied that Eskom is pursuing various other technologies for demonstration. However if the PBMR is not feasible it will be decommissioned and dismantled.

A participant asked what responsibility Eskom will take if things go wrong with the PBMR? Mr. Stott replied that Eskom is and remains responsible for all of its power stations, which will include the PBMR.

ELA requested access to the economic feasibility studies that have been conducted for the PBMR. Dr. de Waal replied that ELA's request is noted, but that the feasibility report falls outside of the scope of this EIA.

ELA also asked what the commercial relationship between Eskom and the PBMR is. They said it appears that public funds are used to develop a commercial product for a private company? They also asked why Eskom is paying for the EIA? Mr. Stott responded that Eskom is a shareholder in the PBMR Company and furthermore also funds the EIAs for all of its other demonstration projects.

A participant stated that in the previous EIA, health and epidemiological studies were of a desktop nature and that this EIA needed more information on this aspect. Dr. de Waal replied that Epidemiological studies are not feasible nor a prerequisite for the EIA, due to a number of reasons. The EIA thus have to be guided by international experience, results and findings, which will again be assessed within the EIR.

A participant indicated that the PBMR is a safe, clean and cost-effective technology and must be promoted. There is a concern that the EIA studies and authorizations are taking too long and thereby erodes South Africa's competitive advantages as a supplier technology to international markets. Dr. de Waal replied by stating that due process must be followed, but that the concern is noted.

A question was asked on how would non-English speaking persons be accommodated in the EIA process? Dr. de Waal responded that although the documentation is mostly in English, the consultants will endeavour to address this issue on request.

It was stated that scoping documents cannot be reviewed during holiday periods and needs to be available in public libraries other than Tableview. Dr. de Waal stated that holiday periods does not count for review time although the draft Scoping Report may be out before year-end. The documents will be placed in various public libraries around Cape Town and Koeberg residential areas.

A participant stated that economics is a core issue in the debate and asked how does Eskom track the economics of other new or emerging technologies? Mr. Stott stated that there is an energy committee that specifically looks/tracks emerging technologies and their economics.

It was requested if any construction of the PBMR have been started at Koeberg yet? Mr. Stott replied that no construction activities for the PBMR have been started at Koeberg. Such activity will only start when all of the required authorizations have been obtained.

CLOSURE

Dr. de Waal thanked all the attendees and said that the minutes would be distributed in due time. He said that IAPs should ensure that their details are on the attendance registers in order to allow us to keep them informed. The meeting closed at 20:50.

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8.5.2 ATLANTIS PUBLIC MEETING

Atlantis Beestekraal Community Hall 10 November 2005 18:30 – 20:20

. Environmental Impact Assessment for the Proposed 400 MW(t) Pebble Bed Modular Reactor Demonstration Power Plant (PBMR DPP) on the Koeberg Power Station site in the Western Cape

WELCOME

Dr. de Waal welcomed the attendees and introduced the project team. No apologies were received. The agenda was read and approved.

PURPOSE OF THE MEETING

Dr. de Waal stated that the purpose of the meeting was to provide interested and affected parties with information on the proposed project, as well as on the previous Environmental Impact Assessment (EIA) process and thereby provide an information base for this project. Dr. de Waal said that this was the start of the scoping process and that IAPs should ensure that their details are registered with Mawatsan. This is to ensure that the IAPs are kept informed on the progress of the process. He emphasised that this public participation process forms part of a new application to the relevant departments. Dr. de Waal enquired whether all attendees are English speaking. No members of the audience indicated that an alternative language would be required during the communication. He then introduced Mr. Tony Stott.

PRESENTATION ON THE ELECTRICITY DEMAND AND SUPPLY IN SOUTH AFRICA

Mr. Stott gave a presentation on the electricity demand and supply status in South Africa. He said that Eskom generates approximately 95% of South Africa's power. The remaining 5% is generated by large corporations such as Sappi, Sasol and Municipalities such as the City of Johannesburg, City of Tshwane and the City of Cape Town.

He said that the electricity demand is increasing steadily, both the total amount of electricity used each year as well as the peak demand required each day and specifically in the winter periods. He stated that coal power stations are the main source of electricity and that they are situated close to the source of coal which keeps the transportation costs as low as possible. Eskom's energy mix also includes pumped storage schemes, nuclear power generation at Koeberg, two small kerosene-fuelled gas turbines and hydro-electricity generation.

He said that the current Eskom net generation capacity, excluding the imported electricity, is about 36 400 MW. Mr. Stott went on to say that the 2007 peak demand will exceed the current net generation plus the normal reserve margin capacity. He said that it is assumed that power stations would last for 50 years and that new generation capacity will be necessary, to cater for the growing demand, and later (after 2020) to also cater for the replacement of older power stations when it is no longer economically viable to operate such stations.

He said that the Department of Minerals and Energy is responsible for integrated energy planning and that the National Electricity Regulator develops the National Integrated Resource Plan for long term planning of electricity generating options. Eskom also plans for future generation options through a process called Integrated Strategic Electricity Planning.

Mr. Stott emphasised that the primary energy sources available in South Africa for electricity generation are coal and uranium. He noted that importing gas or oil is possible but expensive. He said that renewable energy sources, especially ones with high potential in South Africa, such as solar, are being investigated.

Mr. Stott said that Eskom had several initiatives that promote awareness on energy efficiency on a commercial and an industrial level. He indicated that the National Electricity Regulator set an objective of a 152 MW saving for 2004, and that 197 MW was saved. He said that even with such initiatives – more electricity generating capacity would be needed.

Regarding new electricity generating capacity, Mr. Stott said that several technologies for producing cleaner power using coal are being explored. These include a pilot underground coal gasification project. A solar pilot project is being planned, that could produce 100 MW. Similarly, wind generation is also under investigation. He said that the option also exists to import electricity from Southern African countries, such as the DRC. These however were challenging due to the long (~ 4000 km from DRC) transmissions lines that would be required. Mr. Stott said that on the nuclear side, the PBMR technology is being investigated. The PBMR plant at Koeberg would be a demonstration plant.

Mr. Stott summarised that the need to expand on the availability of current electricity generating capacity exists. He said that different energy sources are been considered and that several pilot projects are planned or are underway. He said that a hybrid of the energy sources would probably be the most suitable way to cater for the demand for electricity in South Africa. He concluded in saying that Environmental Impact Assessments are being conducted for Open Cycle Gas Turbine projects, pumped storage schemes, a new coal-fired power station, and a solar thermal plant. He stated that this public meeting forms part of the Environmental Impact Assessment for the proposed 400 MW(t) PBMR Demonstration Power Plant (DPP).

After concluding the presentation on the electricity demand and supply in South Africa, Mr. Stott gave a presentation on the background to the PBMR EIA, the previous EIA process and the court case that followed.

Mr. Stott gave a brief overview of the proposed PBMR DPP. He said that it is a small power station that would generate 165 MW. He said that it is a high temperature design, which makes it more efficient. Furthermore it makes use of Helium gas to remove the heat from the nuclear fuel – the hot helium gas then drives the turbine. He said that the PBMR is graphite moderated, which slows the neutrons that target the uranium atoms. He explained that the resulting nuclear reaction produces heat energy, which then through the turbo-generator is converted into electrical energy. He said that the design is called Pebble Bed because the fuel is in a spherical shape like a pebble. Very small particles of uranium dioxide, each about the size of a sugar grain, are coated with layers of silicon carbide and pyrolitic carbon. These particles are embedded in graphite to form a fuel sphere or pebble about the size of a tennis ball. He explained that approximately 400,00 pebbles are needed in such a power plant.

Mr. Stott briefly described the principles of generating electricity from a thermal (heat) source. Heat can be obtained from burning wood, coal, oil etc. This heat in turn is used to boil water and create steam. The steam is used to turn a turbine which turns a generator. The generator consists of copper wires and a magnetic field. When copper wires turn inside a magnetic field, electricity flows through the copper wires. Instead of boiling water and creating steam, one can also heat a gas and use the hot gas to drive the turbine. He said that in the PBMR design the heat is produced by the nuclear reaction in the uranium in the pebble fuel. The heat is removed by the helium gas which then drives the gas turbine. The turbine causes the generator to turn and generate electricity.

In terms of the previous EIA process for the 302 MW(t) design of the PBMR, Mr. Stott said that the final EIR was submitted in June 2000, where after the Department of Environmental Affairs and Tourism (DEAT) Director-General issued the applicant (Eskom) with a positive Record of Decision (ROD). In January 2005 the RoD was set aside by the Cape High Court on the basis that interested and affected parties (IAPs) had not been given an opportunity to comment on the final EIR directly to the Director-General. The Cape High Court ordered the Director-General to provide IAPs a further comment period, and to consider such submissions before making a decision anew on the EIA. Mr. Stott indicated that the judgement is available on the website. He said that the RoD was not overturned as a result of a flawed EIA, but that an augmented commenting period was required on the Final EIR.

Mr. Stott said that the design of the PBMR DPP had evolved since the EIR was submitted. The power output of 302 MW(t) that was proposed in the previous process had changed to 400 MW(t) and the turbine design is now horizontal instead of vertical .In addition the footprint of the building is also slightly larger. He concluded in saying that the changes warranted a new application to be lodged.

Dr. de Waal thanked Mr. Stott for his presentation and requested that questions be kept for after the presentation to be made by Mr. Lombaard on the EIA process to be followed.

EIA PROCESS

Dr. de Waal described the EIA process to be followed for the new application for the 400 MW(t) Pebble Bed Modular Reactor Demonstration Power Plant. He said that the construction, commissioning, operation, maintenance and decommissioning of the demonstration plant all form part of this EIA process.

Dr. de Waal specified that the EIA application is lodged in terms of the old and not the new regulations. The application would be submitted to the national Department of Environmental Affairs and Tourism. The Western Cape Environmental Affairs Department would be the commenting authority. He said that exemption for the public participation process on the site alternatives was being considered.

He said that the Public Participation Process aimed to inform IAPs of the progress made to date on the EIA, to confirm their details and register any new IAPs. He said that background information documents were made available at the meeting. He indicated that additional information could be obtained from the website, at the public meeting and focus group meetings. He said that newspaper advertisements were placed in the several newspapers and that public meetings were held in several of the major centres.

Dr. de Waal said that provisional issues had been identified for investigation. These form part of the specialist studies that emanated from the previous process. However new issues that may need to be addressed could also be raised. He said that the issues included technical issues, biophysical issues, social impacts and economic impacts.

Dr. de Waal indicated that a draft scoping report would be made available for a period of 30 days for public comment and that a RFSR including the comments received would be sent to the authorities thereafter. He said that notification of the IER would be sent to all IAPs, and that comments on the EIR would go to DEAT.

Dr. de Waal indicated that a formal cooperative governance framework between DEAT and the NNR was developed. He, however highlighted that the NNR is still the responsible authority on nuclear safety issues. Such issues however will be identified as part of the EIA. Dr. de Waal gave a description of the category of issues and how these would be handled by each authority.

Dr. de Waal indicated that the EIA process could be concluded before the NNR makes a decision in terms of its nuclear licence process. However, all issues that pertain to the NNR decision making process would be identified in the EIA.

DISCUSSION

It was confirmed that Eskom has 20 years of experience with operation of the Koeberg Nuclear power station. It was then asked why it was necessary to change to an unproved design? Confirmation was given that Eskom is looking for smaller units that provides for incremental growth, short construction times, passive safety features and cost effectiveness. The PBMR is a proven technology that has been around since the late 1960's and the fact that units can be combined into a Nuclear Park also optimizes infrastructure and establishment and use.

Concern about the length of time involved in obtaining the required authorization was expressed, especially the EIA and this erodes the competitive advantage of the RSA design to market the plant internationally. The statement was noted without comment.

It was asked if nuclear standards, practices, and procedures were sufficiently demonstrated and maintained at Koeberg NPS? Mrs. Mentoor from the Atlantis community responded as fellows to the question " a delegation from the Atlantis community visited Koeberg on several occasions and learnt a great deal about the safety and operation of Koeberg. We are satisfied with the safety standards and practices, especially as far as it affects the community and its well being".

It was asked if the PBMR technology had been proven else where in the world? Mr. Stott confirmed that the technology had been tested in German Research reactor (10 MW(e)) for an extended period of 20 years. Further the Chinese are currently testing a similar type of reactor that has demonstrated the passive safety shut down capability of the technology. The RSA design is unique in its different feature components and the objective is to demonstrate the safety, efficiency and cost effectiveness of the integrated design.

An attendee inquired what the evacuation boundary for the PBMR was? Mr. Stott responded that it was 400m from the reactor building.

An attendee asked what the construction time and how many jobs would be created? Mr. Stott stated that the PBMR is a small plant (165MW(e) and the construction time would be from 2007 to 2010. During the construction phase between 400 to 500 people will be employed on site. Once operational only a small number of people will be needed (15-20) and these people will be trained by Eskom.

An attendee asked how the PBMR project would contribute to science and technology training the in the long term, especially with regard to support to schools? The applicant confirmed current supports school math and science programs and once the PBMR is a reality, Eskom will further expand their support on these subjects. Eskom already draws strongly on the skills base from Atlantis for maintenance work at Koeberg.

It was asked what would happen if there was accidental radio active release from PBMR and what contingencies are in place for Koeberg? It was alleged that Koeberg is not very safe and that the emergency plans are nor sufficient. Ms. De Villiers responded that monthly exercises and assessments Koeberg Emergency Plan (EP) and various scenarios are practiced on a proactive basis. Although Atlantis falls outside the emergency zone (16 km) radius it is included in the EP to ensure awareness and diligence from the community. Eskom maintains an open ended invitation to the members of the community to attend monthly forum meetings on these issues.

It was stated by the applicant that the fuel characteristics of the PBMR prevent a core melt down and consequently there is no need for an emergency plan. As long as Koeberg is operational a 60 km action zone (evacuation zone) will remain in force. However, the emergency and radio active addition of the PBMR will still fall within the Koeberg foot print and the evacuation zone will not enlarge of the consequence of the proposed PBMR DPP.

Once Koeberg is decommissioned the evacuation zone will come down to within the calculated distance from the PBMR plant. The world history of commercial Light Water Reactors for electricity generation, recorded no deaths, directly or indirectly related to such plants, over the past 40 years. The worst accident was at the Three Mile Island and the consequence to human life was zero.

It was inquired that how many carbon credits could PBMR earn? Mr. T Stott responded that Nuclear Power Stations cannot earn carbon credits.

Mrs. Mentoor urged and encouraged the Atlantis community/residents to attend the monthly nuclear safety meetings in Atlantis.

CLOSURE

Dr. de Waal thanked all the attendees and said that the minutes would be distributed in due time. He said that IAPs should ensure that their details are on the attendance registers in order to allow us to keep them informed.

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8.5.3 JOHANNESBURG PUBLIC MEETING

Eskom Convention Centre 15 November 2005 18:30

Environmental Impact Assessment for the Proposed 400 MW(t) Pebble Bed Modular Reactor Demonstration Power Plant (PBMR DPP) on the Koeberg Power Station site in the Western Cape[10]

WELCOME

Dr. de Waal welcomed the attendees and introduced the project team. No apologies were received. The agenda was read and approved.

PURPOSE OF THE MEETING

Dr. de Waal stated that the purpose of the meeting was to provide interested and affected parties with information on the proposed project, as well as on the previous Environmental Impact Assessment (EIA) process and thereby provide an information base for this project. Dr. de Waal said that this was the start of the scoping process and that IAPs should ensure that their details are registered with Mawatsan. This is to ensure that the IAPs are kept informed on the progress of the process. He emphasised that this public participation process forms part of a new application to the relevant departments. Dr. de Waal enquired whether all attendees are English speaking. No members of the audience indicated that an alternative language would be required during the communication. He then introduced Mr. Tony Stott.

PRESENTATION ON THE ELECTRICITY DEMAND AND SUPPLY IN SOUTH AFRICA

Mr. Stott gave a presentation on the electricity demand and supply status in South Africa. He said that Eskom generates approximately 95% of South Africa's power. The remaining 5% is generated by large corporations such as Sappi, Sasol and Municipalities such as the City of Johannesburg, City of Tshwane and the City of Cape Town.

He said that the electricity demand is increasing steadily, both the total amount of electricity used each year as well as the peak demand required each day and specifically in the winter periods. He stated that coal power stations are the main source of electricity and that they are situated close to the source of coal which keeps the transportation costs as low as possible. Eskom's energy mix also includes pumped

[10] Note: This is not a verbatim reflection of the meeting, but an attempt to reflect the presentations and discussion session in a clear and concise manner.

storage schemes, nuclear power generation at Koeberg, two small kerosene-fuelled gas turbines and hydro-electricity generation.

He said that the current Eskom net generation capacity, excluding the imported electricity, is about 36 400 MW. Mr. Stott went on to say that the 2007 peak demand will exceed the current net generation plus the normal reserve margin capacity. He said that it is assumed that power stations would last for 50 years and that new generation capacity will be necessary immediately, to cater for the growing demand, and later (after 2020) to also cater for the replacement of older power stations when it is no longer economically viable to operate such stations.

He said that the Department of Minerals and Energy is responsible for integrated energy planning and that the National Electricity Regulator develops the National Integrated Resource Plan for long term planning of electricity generating options. Eskom's also plans for future generation options through a process called Integrated Strategic Electricity Planning.

Mr. Stott emphasised that the primary energy sources available in South Africa for electricity generation are coal and uranium. He noted that importing gas or oil is possible but expensive. He said that renewable energy sources, especially ones with high potential in South Africa, such as solar, are being investigated.

Mr. Stott said that Eskom had several initiatives that promote awareness on energy efficiency on a commercial and an industrial level. He indicated that the National Electricity Regulator set an objective of a 152 MW saving for 2004, and that 197 MW was saved. He said that even with such initiatives – more electricity generating capacity would be needed.

Regarding new electricity generating capacity, Mr. Stott said that several technologies for producing cleaner power using coal are being explored. These include a pilot underground coal gasification project.. A solar pilot project is being planned, that could produce 100 MW. Similarly wind generation is also under investigation. He said that the option also exists to import electricity from Southern African countries, such as the DRC. These however were challenging due to the long (~ 4000 km from DRC) transmissions lines that would be required. Mr. Stott said that on the nuclear side, the PBMR technology is being investigated. The PBMR plant at Koeberg would be a demonstration plant.

Mr. Stott summarised that the need to expand on the availability of current electricity generating capacity exists. He said that different energy sources are been considered and that several pilot projects are planned or are underway. He said that a hybrid of the energy sources would probably be the most suitable way to cater for the demand for electricity in South Africa. He concluded in saying that Environmental Impact Assessments are being conducted for Open Cycle Gas Turbine projects, pumped storage schemes, a new coal-fired power station, and a solar thermal plant. He stated that this public meeting forms part of the Environmental Impact Assessment for the proposed 400 MW(t) PBMR Demonstration Power Plant (DPP).

After concluding the presentation on the electricity demand and supply in South Africa, Mr. Stott gave a presentation on the background to the PBMR EIA, the previous EIA process and the court case that followed.

Mr. Stott gave a brief overview of the proposed PBMR DPP. He said that it is a small power station that would generate 165 MW. He said that it is a high temperature design, which makes it more efficient. Furthermore it makes use of Helium gas to remove the heat from the nuclear fuel – the hot helium gas then drives the turbine. He said that the PBMR is graphite moderated, which slows the neutrons that target the uranium atoms. He explained that the resulting nuclear reaction produces heat energy, which then through the turbo-generator is converted into electrical energy. He said that the design is called Pebble Bed because the fuel is in a spherical shape like a pebble. Very small particles of uranium dioxide, each about the size of a sugar grain, are coated with layers of silicon carbide and pyrolitic carbon. These particles are embedded in graphite to form a fuel sphere or pebble about the size of a tennis ball. He explained that approximately 400,00 pebbles are needed in such a power plant.

Mr. Stott briefly described the principles of generating electricity from a thermal (heat) source. Heat can be obtained from burning wood, coal, oil etc. This heat in turn is used to boil water and create steam. The steam is used to turn a turbine which turns a generator. The generator consists of copper wires and a magnetic field. When copper wires turn inside a magnetic field, electricity flows through the copper wires. Instead of boiling water and creating steam, one can also heat a gas and use the hot gas to drive the turbine. He said that in the PBMR design the heat is produced by the nuclear reaction in the uranium in the pebble fuel. The heat is removed by the helium gas which then drives the gas turbine. The turbine causes the generator to turn and generate electricity.

In terms of the previous EIA process for the 302 MW(t) design of the PBMR, Mr. Stott said that the final EIR was submitted in June 2000, where after the Department of Environmental Affairs and Tourism (DEAT) Director-General issued the applicant (Eskom) with a positive Record of Decision (ROD). In January 2005 the RoD was set aside by the Cape High Court on the basis that interested and affected parties (IAPs) had not been given an opportunity to comment on the final EIR directly to the Director-General. The Cape High Court ordered the Director-General to provide IAPs a further comment period, and to consider such submissions before making a decision anew on the EIA. Mr. Stott indicated that the judgement is available on the website. He said that the RoD was not overturned as a result of a flawed EIA, but that an augmented commenting period was required on the Final EIR.

Mr. Stott said that the design of the PBMR DPP had evolved since the EIR was submitted. The power output of 302 MW(t) that was proposed in the previous process had changed to 400 MW(t) and the turbine design is now horizontal instead of vertical .In addition the footprint of the building is also slightly larger. He concluded in saying that the changes warranted a new application to be lodged.

Dr. de Waal thanked Mr. Stott for his presentation and requested that questions be kept for after the presentation to be made by Mr. Lombaard on the EIA process to be followed.

EIA PROCESS - MR. LOMBAARD

Mr. Lombaard described the EIA process to be followed for the new application for the 400 MW(t) Pebble Bed Modular Reactor Demonstration Power Plant. He said that the construction, commissioning, operation, maintenance and decommissioning of the demonstration plant all form part of this EIA process.

Mr. Lombaard specified that the EIA application is lodged in terms of the old and not the new regulations. The application would be submitted to the national Department of Environmental Affairs and Tourism. The Western Cape Environmental Affairs Department would be the commenting authority. He said that exemption for the public participation process on the site alternatives was being considered.

He said that the Public Participation Process aimed to inform IAPs of the progress made to date on the EIA, to confirm their details and register any new IAPs. He said that background information documents were made available at the meeting. He indicated that additional information could be obtained from the website, at the public meeting and focus group meetings. He said that newspaper advertisements were placed in the several newspapers and that public meetings were held in several of the major centres.

Mr. Lombaard said that provisional issues had been identified for investigation. These form part of the specialist studies that emanated from the previous process. However new issues that may need to be addressed could also be raised. He said that the issues included technical issues, biophysical issues, social impacts and economic impacts.

Mr. Lombaard indicated that a draft scoping report would be made available for a period of 30 days for public comment and that a RFSR including the comments received would be sent to the authorities thereafter. He said that notification of the IER would be sent to all IAPs, and that comments on the EIR would go to DEAT.

Mr. Lombaard indicated that a formal cooperative governance framework between DEAT and the NNR was developed. He, however highlighted that the NNR is still the responsible authority on nuclear safety issues. Such issues however will be identified as part of the EIA. Mr. Lombaard gave a description of the category of issues and how these would be handled by each.

Mr. Lombaard indicated that it is important to take note that the EIA process could be concluded before the NNR makes a decision in terms of its nuclear licence process. However, all issues that pertain to the NNR decision making process would be identified in the EIA.

DISCUSSION

Mr. Mashile Phalane from Earthlife Africa, asked whether the EIA and the NNR processes would run in parallel. Dr. de Waal said that they would in principle run in parallel, however during consideration of the issues raised there would be cross references between the two processes.

Dr. van As said that the EIA process was rather confusing. He asked whether this EIA considers alternative energy forms, and whether impacts are compared. He asked whether the global impact is assessed as part of the EIA. He said that reference was made to cooperative governance, and asked whether integrated governance is necessary. He said that he understands that energy is necessary, but that energy with the least environmental impact should be used. Mr. Stott responded that all electricity generation methods need to undergo EIA's and that the environmental impacts specific to the location is explored. He said that the National Electricity Regulator conduct national studies and address issues such as global warming and the reduction of greenhouse gases. Dr. de Waal said that the EIA has a comparative framework for the cumulative impacts and that electricity protocols are determined by National Policy.

Mr. Barker said that a 30% increase in terms of generation is indicated. What effect does this have on the amount of material that would be necessary? How is the transport of material going to be handled and has alternative sites been properly evaluated? Dr. de Waal said that fuel transport forms part of a separate process. He indicated that fuel will need to be transported from Durban to Pelindaba and then to Koeberg and that this issue would be considered as part of the EIA. Dr. de Waal responded that four sites have been considered as part of the process that started in 1999. He said that the factors that influenced the site selection process had remained the same and therefore does not need to be reassessed.

Mr. Phalane from Earthlife Africa asked what changes in technology took place during the design evolution and what impact it has on the fuel usage. He asked whether more pebbles would be used and whether the pebbles have been redesigned. He further asked whether an exhaustive assessment of alternatives has taken place. Dr. de Waal said that a variety of sources are used to provide electricity, but that this application does not include a comparative assessment to other sources of electricity generation. Mr. Terry McGowan said that there would be an increase in fuel caused by the increase in capacity, and that a higher output of fuel would inevitably cause a higher need for fuel. Mr. McGowan said that the fuel used is the same as what would have been used in the previous process and that it would only be the volumes used that changes and not the fuel itself. He said that the fuel used is manufactured according to the German design. He said that the transportation needed for the fuel would be similar to that of the previous process and that there would only be a slight increase.

Ms. Mieke Barry asked whether the RoD would be released under the old Environment Conservation Act to whether the new regulations that would be promulgated soon would be taken into account. Dr. De Waal said that legislation would need to be legal before processes are structured according to it and that the new regulations have not been promulgated yet. This application would continue under the old regulations. He stated however, that the new regulations would be taken into consideration and that the Public Participation Process would send the draft document out for review and the final document out for notifications as are set out in the new regulations.

Dr. Wedlake asked whether other competing technologies have been considered and asked whether it would be possible for the consultants to compare other nuclear technologies to the proposed pebble bed technology. He asked where the pebble bed reactor would fit in, in relation to other technologies and this design in relation to designs used in other countries. Mr. McGowan said that the proposed PBMR Demonstration Power Plant is a 4^{th} generation plant and that this design is safer that any of the previous ones. He said that the proposed system is extremely small compared to others worldwide and because it is a passive system it will shut down if there was any kind of problem with the system. Mr. Stott said that Eskom is the client of PBMR and that Eskom have considered other technologies, such as the European Pressurised Water Reactor. He said that Eskom also consider various coal alternatives.

CLOSURE

Dr. de Waal thanked all the attendees and said that the minutes would be distributed in due time. He said that IAPs should ensure that their details are on the attendance registers in order to allow us to keep them informed.

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8.5.4 DURBAN PUBLIC MEETING

Durban Exhibition Centre 17 November 2005 18:30

Environmental Impact Assessment for the Proposed 400 MW(t) Pebble Bed Modular Reactor Demonstration Power Plant (PBMR DPP) on the Koeberg Power Station site in the Western Cape[11]

WELCOME

Dr. de Waal welcomed the attendees and introduced the project team. No apologies were received. The agenda was read and approved.

PURPOSE OF THE MEETING

Dr. de Waal stated that the purpose of the meeting was to provide interested and affected parties with information on the proposed project, as well as on the previous Environmental Impact Assessment (EIA) process and thereby provide an information base for this project. Dr. de Waal said that this was the start of the scoping process and that IAPs should ensure that their details are registered with Mawatsan. This is to ensure that the IAPs are kept informed on the progress of the process. He emphasised that this public participation process forms part of a new application to the relevant departments. Dr. de Waal enquired whether all attendees are English speaking. No members of the audience indicated that an alternative language would be required during the communication. He then introduced Mr. Tony Stott.

PRESENTATION ON THE ELECTRICITY DEMAND AND SUPPLY IN SOUTH AFRICA

Mr. Stott gave a presentation on the electricity demand and supply status in South Africa. He said that Eskom generates approximately 95% of South Africa's power. The remaining 5% is generated by large corporations such as Sappi, Sasol and Municipalities such as the City of Johannesburg, City of Tshwane and the City of Cape Town.

He said that the electricity demand is increasing steadily, both the total amount of electricity used each year as well as the peak demand required each day and specifically in the winter periods. He stated that coal power stations are the main source of electricity and that they are situated close to the source of coal which keeps the transportation costs as low as possible. Eskom's energy mix also includes pumped storage schemes, nuclear power generation at Koeberg, two small kerosene-fuelled gas turbines and hydro-electricity generation.

He said that the current Eskom net generation capacity, excluding the imported electricity, is about 36 400 MW. Mr. Stott went on to say that the 2007 peak demand will

[11] Note: This is not a verbatim reflection of the meeting, but an attempt to reflect the presentations and discussion session in a clear and concise manner.

exceed the current net generation plus the normal reserve margin capacity. He said that it is assumed that power stations would last for 50 years and that new generation capacity will be necessary immediately, to cater for the growing demand, and later (after 2020) to also cater for the replacement of older power stations when it is no longer economically viable to operate such stations.

He said that the Department of Minerals and Energy is responsible for integrated energy planning and that the National Electricity Regulator develops the National Integrated Resource Plan for long term planning of electricity generating options. Eskom's also plans for future generation options through a process called Integrated Strategic Electricity Planning.

Mr. Stott emphasised that the primary energy sources available in South Africa for electricity generation are coal and uranium. He noted that importing gas or oil is possible but expensive. He said that renewable energy sources, especially ones with high potential in South Africa, such as solar, are being investigated.

Mr. Stott said that Eskom had several initiatives that promote awareness on energy efficiency on a commercial and an industrial level. He indicated that the National Electricity Regulator set an objective of a 152 MW saving for 2004, and that 197 MW was saved. He said that even with such initiatives – more electricity generating capacity would be needed.

Regarding new electricity generating capacity, Mr. Stott said that several technologies for producing cleaner power using coal are being explored. These include a pilot underground coal gasification project.. A solar pilot project is being planned, that could produce 100 MW. Similarly wind generation is also under investigation. He said that the option also exists to import electricity from Southern African countries, such as the DRC. These however were challenging due to the long (~ 4000 km from DRC) transmissions lines that would be required. Mr. Stott said that on the nuclear side, the PBMR technology is being investigated. The PBMR plant at Koeberg would be a demonstration plant.

Mr. Stott summarised that the need to expand on the availability of current electricity generating capacity exists. He said that different energy sources are been considered and that several pilot projects are planned or are underway. He said that a hybrid of the energy sources would probably be the most suitable way to cater for the demand for electricity in South Africa. He concluded in saying that Environmental Impact Assessments are being conducted for Open Cycle Gas Turbine projects, pumped storage schemes, a new coal-fired power station, and a solar thermal plant. He stated that this public meeting forms part of the Environmental Impact Assessment for the proposed 400 MW(t) PBMR Demonstration Power Plant (DPP).

After concluding the presentation on the electricity demand and supply in South Africa, Mr. Stott gave a presentation on the background to the PBMR EIA, the previous EIA process and the court case that followed.

Mr. Stott gave a brief overview of the proposed PBMR DPP. He said that it is a small power station that would generate 165 MW. He said that it is a high temperature design, which makes it more efficient. Furthermore it makes use of Helium gas to remove the heat from the nuclear fuel – the hot helium gas then drives the turbine. He said that the PBMR is graphite moderated, which slows the neutrons that target the uranium atoms. He explained that the resulting nuclear reaction produces heat energy, which then through the turbo-generator is converted into electrical energy. He said that the design is called Pebble Bed because the fuel is in a spherical shape like a pebble. Very small particles of uranium dioxide, each about the size of a sugar grain, are coated with layers of silicon carbide and pyrolitic carbon. These particles are embedded in graphite to form a fuel sphere or pebble about the size of a tennis ball. He explained that approximately 400,00 pebbles are needed in such a power plant.

Mr. Stott briefly described the principles of generating electricity from a thermal (heat) source. Heat can be obtained from burning wood, coal, oil etc. This heat in turn is used to boil water and create steam. The steam is used to turn a turbine which turns a generator. The generator consists of copper wires and a magnetic field. When copper wires turn inside a magnetic field, electricity flows through the copper wires. Instead of boiling water and creating steam, one can also heat a gas and use the hot gas to drive the turbine. He said that in the PBMR design the heat is produced by the nuclear reaction in the uranium in the pebble fuel. The heat is removed by the helium gas which then drives the gas turbine. The turbine causes the generator to turn and generate electricity.

In terms of the previous EIA process for the 302 MW(t) design of the PBMR, Mr. Stott said that the final EIR was submitted in June 2000, where after the Department of Environmental Affairs and Tourism (DEAT) Director-General issued the applicant (Eskom) with a positive Record of Decision (ROD). In January 2005 the RoD was set aside by the Cape High Court on the basis that interested and affected parties (IAPs) had not been given an opportunity to comment on the final EIR directly to the Director-General. The Cape High Court ordered the Director-General to provide IAPs a further comment period, and to consider such submissions before making a decision anew on the EIA. Mr. Stott indicated that the judgement is available on the website. He said that the RoD was not overturned as a result of a flawed EIA, but that an augmented commenting period was required on the Final EIR.

Mr. Stott said that the design of the PBMR DPP had evolved since the EIR was submitted. The power output of 302 MW(t) that was proposed in the previous process had changed to 400 MW(t) and the turbine design is now horizontal instead of vertical .In addition the footprint of the building is also slightly larger. He concluded in saying that the changes warranted a new application to be lodged.

Dr. de Waal thanked Mr. Stott for his presentation and requested that questions be kept for after the presentation to be made by Mr. Lombaard on the EIA process to be followed.

EIA PROCESS - MR. LOMBAARD

Mr. Lombaard described the EIA process to be followed for the new application for the 400 MW(t) Pebble Bed Modular Reactor Demonstration Power Plant. He said that the construction, commissioning, operation, maintenance and decommissioning of the demonstration plant all form part of this EIA process.

Mr. Lombaard specified that the EIA application is lodged in terms of the old and not the new regulations. The application would be submitted to the national Department of Environmental Affairs and Tourism. The Western Cape Environmental Affairs Department would be the commenting authority. He said that exemption for the public participation process on the site alternatives was being considered.

He said that the Public Participation Process aimed to inform IAPs of the progress made to date on the EIA, to confirm their details and register any new IAPs. He said that background information documents were made available at the meeting. He indicated that additional information could be obtained from the website, at the public meeting and focus group meetings. He said that newspaper advertisements were placed in the several newspapers and that public meetings were held in several of the major centres.

Mr. Lombaard said that provisional issues had been identified for investigation. These form part of the specialist studies that emanated from the previous process. However new issues that may need to be addressed could also be raised. He said that the issues included technical issues, biophysical issues, social impacts and economic impacts.

Mr. Lombaard indicated that a draft scoping report would be made available for a period of 30 days for public comment and that a RFSR including the comments received would be sent to the authorities thereafter. He said that notification of the IER would be sent to all IAPs, and that comments on the EIR would go to DEAT.

Mr. Lombaard indicated that a formal cooperative governance framework between DEAT and the NNR was developed. He, however highlighted that the NNR is still the responsible authority on nuclear safety issues. Such issues however will be identified as part of the EIA. Mr. Lombaard gave a description of the category of issues and how these would be handled by each authority.

Mr. Lombaard indicated that it is important to take note that the EIA process could be concluded before the NNR makes a decision in terms of its nuclear licence process.

However, all issues that pertain to the NNR decision making process would be identified in the EIA.

DISCUSSION

Mr. Lakani requested that attendees indicate their affiliation. Dr. de Waal requests attendees to indicate affiliation. Eskom/PBMR Limited had nine attendees, Consultants had four attendees, General public two attendees, and interested organisations five attendees.

Mr. Lakani enquired why ELA members were not invited and notified individually. Dr. de Waal responded that ELA Offices in Cape Town and Johannesburg was notified and that they indicated that they would notify their membership of all public meetings and of the Scoping Process.

Dr. de Waal requested attendees to ensure that their names and contact details on the attendance register are correct and complete.

Mr. Murphy asked Mr. Stott whether the demand curve he has shown includes future domestic and other demands for electricity. Mr. Stott confirmed that it does.

Mr. Lakani requested that the percentage domestic demand, - commercial demand, and bulk user demand be made available to IA&Ps. Dr. de Waal responded that this would be done in the Issues Register to be compiled following the public participation process.

Mr. Lakani stated that wind and solar electricity generation could be double that indicated by Mr. Stott, and why that was not indicated in the presentation made by Mr. Stott? Mr. Stott responded that as indicated on the presentation, the information in the presentation comes from the Energy Research Institute of the University of Cape Town.

Mr. Lakani stated that wind generation is economically viable, and that Eskom should do more research into this area and present the public with the true facts. He further stated that the Eskom test wind facility does not comply to international standards because the generator towers are not high enough, only 50 m, and that Eskom is therefore biased in their assessment of wind generation. It was indicated that this would be responded to in the minutes. The response is as follows:

The largest turbine at Klipheuwel has a rotor at 60m. At the time of installation the largest mobile crane was used - a turbine with a 80m rotor would have been impossible to install. 80m is not an international standard, the turbine size depends on the wind conditions, capacity etc

Mr. Moulton commented that Eskom does not give sufficient attention to the development of Pumped Storage Generation. He further states that all renewable energy sources are not reflected in the information presented by Mr. Stott.

Mr. Murphy asked whether the PBMR technology is the only nuclear option. Mr. Stott replied that all nuclear options are investigated and the development thereof monitored by Eskom.

Mr. Lakani stated that Eskom investment into the assessment of proven technologies is disproportionate. He states that the investment into PMBR is R 1.9 Billion whereas the investment into the assessment of all other options is R 20 to R 30 million. Mr. Stott responded that as stated in the Eskom 2005 Annual Report the total Research, Development and Demonstration expenditure in the 15 months ending march 2005 was R 263 million, of which R 35 million was for the PBMR.

Mr. Lakani stated that Eskom should allocate equal amounts of funds to each of the available and viable options of electricity generation. The comment was noted.

Mr. Lakani asked that the shareholding in PBMR Limited be made known.

Mr. Lakani asked why the PBMR was not commercialised in Germany if it was proven. Mr. Stott replied that the German AVR facility demonstrated different fuel and fuel handling technologies associated with a pebble bed type reactor, whereas the proposed PBMR demonstration plant will include the above technology components, combined to a turbine, generator and associated components to demonstrate the electricity generating capability of the plant.

Mr. Murphy asked whether Eskom is considering other nuclear options such as fusion technology. Mr. Stott responded that other nuclear options are considered. Fusion technology is still being internationally researched and is many tens of years away from commercial implementation.

Mrs. Herbst reminded the meeting that this application is for a PBMR DPP and not a process to compare technology options.

Dr. van As asked what the mandate of Eskom is with regards to electricity generation. Mr. Stott responded that it is the mandate of Eskom to provide 70% of the national demand in a cost effective and affordable manner that is sustainable. He further stated that Eskom does not have a mandate to perform fundamental (i.e. basic physics) research.

Mr. Moulton stated that it is critical to supply affordable electricity as it is one of the factors that determine economic growth. Mr. Stott added that the price of electricity is not determined by Eskom, but by the National Electricity Regulator.

Mr. Lakani asked why Eskom is supporting the least job intensive option if job creation is one of the objectives of Eskom. Mr. Stott explained that Eskom’s mandate is to supply affordable and reliable electricity, and provide electricity generating capacity, and thereby stimulate the economy and job creation.

Mr. Murphy requested that the presentations made at the meeting be attached to the minutes for distribution. These will be attached.

Mr. Lakani stated that the BID distributed at the meeting is insufficient for IAPs to participate in the process, and that full and comprehensive information be made available to IAPs. Furthermore that IAPs be offered sufficient time to review and respond to information and documentation. The comments were noted.

Mr. Murphy asked how the design of the current application compares to that of the previous application. Mr. Stott referred back to his slides and further explained the evolution of the 302 MW(t) design to the 400 MW(t) design.

Mr. Lakani brings it to the attention of the meeting that the High Court Judgement presented by Mr. Stott is not the full judgement. Mr. Stott indicates that he extracted the conclusions and order from the Court judgement and not the background information. Mr. Stott confirmed that the full judgement is available on the PBMR web site.

Mr. Murphy asked why changes were made to the PBMR design. Mr. T McGowan responded that the current design evolved from analysis made by PBMR Limited into international requirements for power generating plants. Internationally generation plants are connected to supply grids in 300 MW(e) or 600 MW(e) units. This relates to a 400 MW(t) output. Furthermore the PBMR Limited design team, with inputs from international companies such as Mitsubishi, concluded that a horizontal turbine/generator is more appropriate than a vertical design.

Mr. Lakani stated that the economics of the PBMR is one of the major issues of concern. He stated that the estimated total cost of the PBMR has increased to R 15b.

Mr. Lakani asks how many orders PBMR Limited has for the PBMR plant. Mr. Terry McGowan responds that there currently were none.

Mr. Murphy asked if the South African taxpayer is required to gamble on the PBMR, and what about considering other 4th generation nuclear options. Mr. Terry McGowan responded that PBMR is one of the first of the 4th generation options that are available. France is investigating 4th generation nuclear technology, and may even be a future investor in the PBMR.

Mr. Murphy stated that he is not convinced of the walk away safety features of the PBMR, and that the public should be presented with other 4th generation technologies. Why did Eskom decide on the PBMR as a 4th generation option? Mr. Terry McGowan responded that PBMR is one of the first available 4th generation options, and that PBMR Limited keeps track of all developments internationally.

Mr. Lakani made a statement that the PBMR Safety Case is poorly developed and would not be approved in other parts of the world, that there is no market internationally for the PBMR, that there is no expression of interest internationally, and that the PBMR is developed to keep national nuclear experts and engineers in jobs. He requested that the Safety Case Report be released to the public for review. He further stated that transport of uranium and fuel be made part of this EIA, and enquired into the status of the ROD pertaining to these aspects that where issued. Dr. de Waal responded that the latter issue is the subject of another application brought by a different applicant and that enquiry into the status relating to the mentioned application and associated ROD should be made with DEAT.

Mr. Lakani requested to place on record that ELA demands that Environmental-, Social, and Economic Aspects be included in this EIA process. It was placed on record.

Mr. Murphy requested clarification on a statement he has read that it is safe to place a PBMR reactor in an oil refinery. Mr. Terry McGowan responds that it would be possible to do this safely.

Mr. Murphy asked whether it is feasible to run a turbine on helium, considering cost and availability of helium. Mr. McGowan confirmed that it is feasible.

Mr. Lakani enquired whether a review panel similar to that in the first EIA process will be established by DEAT. Dr. de Waal responded that DEAT is in the process to establish a review panel.

Mr. Lakani stated that ELA demands to be included in the review panel. Dr. de Waal responded that the composition of the review panel is the prerogative of DEAT.

Mr. Murphy stated that the issue of walk away safety in the event of a fire that escalates to a carbon combusting fire should be included in the EIA. This assessment should include breaching of the reactor by malicious intent. Mr. Terry McGowan responded that this is a requirement of the Safety Case Process of the National Nuclear Regulator.

Mr. Murphy stated that the issue of long term custodianship and management of the nuclear waste should be included in the EIA.

Dr. van As commented that additional generation capacity is required, and in his opinion coal and nuclear is the most suitable to supply in the demand. He indicated his support for nuclear power.

Mr. Murphy responds to Dr. van As and stated that it is not a matter of a choice between coal and nuclear, and that other options must also be brought into the debate.

Mr. Lakani asked why Eskom, according to the presentation by T Stott, not consider wind as a significant future contributor to the energy mix? Mr. Lakani stated that if 2% of the coast line of South Africa is used for wind generation, and 2% of the surface area for solar generation it would be possible to double the current generating capacity of Eskom. The response is that wind generation is significantly more expensive than conventional power generation and wind has a low capacity factor, in other words the wind only blows for a relatively small amount of time per year in SA. The typical average per annum would be about 20% for moderate areas and 25-30% for high wind areas. The rest of the time no power will be generated. Coastal areas are sensitive, as such land use is quite restricted.

Mr. Lakani requested a list of the focus group meetings held by the consultants. It was indicted that this would be available in the scoping report.

Mr. Moulton stated that there is a risk that should this technology not be sited in South Africa that PBMR Limited may take it to a neighbouring country with the associated loss of investment in South Africa. He referred examples of lost investment that went to Mozambique.

Mr. Lakani requested to place on record that the review times for the public indicated by Mr. Lombaard in the presentation on the program is too short and should be at least 60 days. He further stated that he wants to review the final EIR before it is submitted to DEAT.

Mr. Lakani on behalf of ELA requests to place on record that they reject the PBMR DPP. He also requested a copy of the Cooperative Governance Agreement between NNR and DEAT.

CLOSURE

Dr. de Waal thanked all the attendees and said that the minutes would be distributed in due time. He said that IAPs should ensure that their details are on the attendance registers in order to allow us to keep them informed.

ATTENDANCE REGISTER

NAME AND SURNAME	ORGANISATION	POSITION	POSTAL ADDRESS	CONTACT DETAILS
T Ferreira	PBMR	Communication Manager	Box 6714 Welgemoed 7538	0838646188 tom.Ferreira@pbmr.co.za
T Stott	ESKOM	Senoir manager Generation	PO Box 1091 Johannesburg	Tony.stott@eskom.co.za
Mervyn Harris	Eskom	PBMR Client Service Manager	Private Bag x10 Melkbosstrand	0823313704 jharris@telkomsa.net
Z Hlashinjo	PBMR Fuel	Senior Environmental Coordinator		012 6779925 fax 0828260919 zola.hlotshinjo@pbmr.co.za
S Dhupelic	Tabloid Newspaper + Personal	Columnist	PO Box 2001 Durban 4000	031 2074028 031 2076836 fax 0845550806 satish@icon.co.za
T Mgoum	PBMR		Senior Project Consultant	012 67775291 fax
D Herbst	ESKOM	Environmental Manager		

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NAME AND SURNAME	ORGANISATION	POSITION	POSTAL ADDRESS	CONTACT DETAILS
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Nurse Shabangu	PBMR	Communication Officer	PO Box 9396 Centurion 0046	012 6775290 012 67709971 fax 0733559561 nurse.shabangu@pbmr.co.za
R Mouton	BPRA	Chairman	1041 Bluff Road Durban 4052	031 4661379 031 4663705 fax 0837453403 mashesha@MW(e)b.co.za
P Thema	PBMR	Manager		012 67709400 012 6775225 fax Patrick.Thema@ pbmr.co.za
Muna Lakane	ELA			

8.6 APPENDIX 6: WITHDRAWAL OF THE APPLICATION FOR EXEMPTION.

8.6.1 NOTIFICATION OF WITHDRAWAL OF APPLICATION FOR EXEMPTION TO AUTHORITIES

MAWATSAN

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Mawatsan Registration nr: 199801131207

Mawatsan ref: M 0601- 001

Chief Director: Environmental Impact Assessment
Department Environmental Affairs and Tourism
Private Bag X447
Pretoria
0001

Attention: Mr C Agenbach

12 January 2006

Dear Sir,

***Application and Plan of Study for the Proposed 400MW(t) PBMR DPP*.**
Withdrawal of the Application for Exemptions on Alternatives

We refer to your letter of 8 November 2005 and the subsequent meetings with Mr. D Smit on 29 November 2005 and Mrs L.Bothma, D. Smit and yourself on 21 Dec 2005

We thank you for the responses to the Application and the Plan of Study for a proposed 400 MW(t) Pebble Bed Modular Reactor Demonstration Power Plant (PBMR DPP) at the Koeberg Power Station Site in the Western Cape.

The meeting of 29 November and 21 December 2005 fully clarified the DEAT's requirements contained in the letter of acceptance of the mentioned Application and Plan of Study for Scoping (POSS). W

With reference to your point 12 of the numbered points in your letter of 8 November 2005, namely that a dedicated application for exemption is required by the Department, Mawatsan wishes to state and respond as follows:

- The request for the granting of Exemption on alternatives (technology and site), as indicated in the text of the Application in the prescribed format of the Western Cape Dept of Environment Affairs and Development Planning, is herewith withdrawn from the Application and the issues will be dealt with in the scoping processes, Scoping Report and the EIR within the context of the demonstration nature of the proposed PBMR DPP.
- This letter should be included with and considered part of the Application as submitted to the DEAT and the DEA&DP: Western Cape for the purposes of the record.

I trust that you find this arrangement in order and will be pleased to receive the Departments acceptance thereof.
With kind regards

Original signed by O.F. Graupner for Dr D de Waal

Dr. D de Waal.

Cc Melanie Webber (Western Cape Department of Environment Affairs and Development Planning)

8.6.2 NOTIFICATION OF WITHDRAWAL OF APPLICATION FOR EXEMPTION TO PUBLIC

MAWATSAN

P O Box 13540
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0028
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Dear Sir/Madam 02 March 2006

WITHDRAWAL OF THE APPLICATION FOR EXEMPTION FOR SPECIFIC ACTIVITIES IN TERMS OF THE EIA APPLICATION FOR THE PROPOSED 400 MW(t) PEBBLE BED MODULAR REACTOR DEMONSTRATION POWER PLANT (PBMR DPP.

This notification serves to inform you that the Application for exemption for assessing

- Alternatives for Energy and Technology; and
- Geographical (Site) alternatives.

which formed part of the Application for the proposed PBMR DPP to the national Department of Environmental Affairs, has been withdrawn by Eskom, the Applicant.

These aspects will be dealt with in both the draft and final EIR for the proposed PBMR DPP.

Comprehensive site alternative assessments and public participation processes were implemented during the 302 MW(t) PBMR DPP environmental assessment. The information from this previous process was evaluated and is still considered valid. It therefore has been utilised in the assessment of the site alternatives during the 400 MW(t) PBMR DPP EIA process.

The energy and technology alternatives are motivated in terms of Eskom's integrated strategic electricity planning (ISEP) process, which stems from the prerogatives set by government in terms of the White Paper on national energy policy, the integrated energy plan (IEP) of the Department of Minerals and Emergy and the national integrated resource plan (NIRP) of the National Electricity Regulator (NER).

If you have any further enquiries, please contact the following people:

CONTACT DETAILS:	**WHO TO CONTACT:**
MAWATSAN P. O. Box 13540 Hatfield, 0028 **Tel**: (012) 362-2908 **Fax**: (012) 362-2463 **e-mail**: pbmr@mawatsan.co.za	**Requests for Scoping Reports on CD-Rom**: Mr. Ian MacFadyen **Comments on the Draft Scoping Report**: Ms Manni Khan or Mrs. Martie Moolman (in writing please) **Other queries**: Mrs. Martie Moolman or Dr David de Waal

Kind regards

DP de Waal

David de Waal
MAWATSAN

8.7 APPENDIX 7: ISSUES REGISTER

HOW DOES THE CROSS-REFERENCES WORK

If an aspect is to be considered n the EIA phase, it will be so indicated with a reference to the final scooping report where it is indicated how that aspect will be addressed during the EIA phase. In certain instances, answers/comments are also provided in the last column. The issues raised during the Scoping process, including those dealing with comments on the draft and RFSRs, remain part of the process.

ISSUES, CONCERNS & QUESTIONS

The following tables provide an integrated perspective of the issues and concerns identified during the course of the 110 MWe and the 400 MW PBMR DPP processes. Those comment in the first process that were in direct response to the documentation of that process (i.e. the scoping report, draft EIR, etc) are not included in this register. In a similar vein, the comments relating to the public participation process of the first process have also not been included ion this register, as this is a new process, even though there is strong similarity in subject matter.

Issues raised during the previous (110MWe Class Demonstration PBMR) processes are indicated by dates before 2005.

1. **ENVIRONMENTAL AND ALLIED IMPACTS**

•	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
1.1.	There has been little attention to the potentially serious and negative effects on our export and tourism markets.	27-09-01	Messrs. RCH & TAHH Garbett, Ms. C.T. Garbett, Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd., The Karee Trust, Wat Props (Pty) Ltd.	A tourism impact assessment will be undertaken during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 7
1.2.	The countries that are continuing with new nuclear power developments are notably Japan, Korea and China – all of which have appalling records in both environmental and human rights records. We believe that South Africa's image will be tarnished by this project.	27-09-01	Messrs RCH & TAHH Garbett, Ms. CT Garbett, Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd., The Karee Trust, Wat Props (Pty) Ltd.	This aspect is noted. Nuclear is receiving new focus in the USA as a well The issue of tarnishing South Africa's image internationally will be assessed in the EIA phase.
1.3.	Adverse impacts outweigh beneficial impacts.	May-01	Mr. A. Murphy, Part Time Lecturer: eThekwini ECOPEACE	The viewpoint is noted. It is however the purpose of the EIA to assess the environmental impacts of this proposed development and to determine if adverse aspects can be mitigated managed or avoided.
1.4.	Although low levels of radiation do seem to be acceptable, the effect of long-term low radiation on the environment is not clear.	11-10-02	Mr. T. Gxaba, Head of Department: DEAT (Free State)	This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 23.
1.5.	What impact will the PBMR and the fuel manufacturing plant have on job creation?	09-04-02	Mr. J. Tsiane, Regional Manager – COSATU.	This impact of the PBMR DPP will be addressed during the EIA phase. The fuel manufacturing plant impact has been dealt with in another EIA.

	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
				Please refer to chapter 7 of the RFSR: issue number 1.
1.6.	The visual impact of the building should be kept at a minimum.	13-03-02	Mr. J. Becker, Member: Afrikaanse Handelsinstituut (AHI).	A visual impact assessment will be undertaken as part of the EIA phase. Please refer to chapter 7 of the RFSR: issue number 3.
1.7.	Biodiversity should be protected and the long-term impacts mitigated.	13-03-02	Mr. J. Becker, Member: Afrikaanse Handelsinstituut (AHI).	It is the purpose of the EIA to assess the environmental impacts of this proposed development and to determine if adverse aspects can be mitigated managed or avoided.
1.8.	What will the impact of the project be on the coal mining industry?	27-03-02	Dr. D. Wymer, Mining Consultant: Chamber of Mines.	The demand from coal due to electricity generation has increased to such an extent that the PBMR DPP will have negligible impact on the mining industry.
1.9.	The impact of the PBMR on the socio-economic realities of communities should be investigated; such studies should be a condition in the approval of the project.	14-03-02	Adv. D Barnard, Director: Duard Barnard and Associates.	This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1.
1.10.	The PBMR project should add value to affected communities.	14-03-02	Adv. D Barnard, Director: Duard Barnard and Associates.	This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1.
1.11.	The potential downside (of allowing nuclear installations) on our economy is too high a risk, in particular as the job creation is low and the impacts that are most likely to occur are in high	27-9-01	Messrs. RCH & TAHH Garbett, Ms. C.T. Garbett, Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd., The Karee	This aspect will be addressed during the EIA phase. As indicated above, a tourism impact study and an export impact study will be undertaken.

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	employment and foreign exchange earners, namely our tourist and export markets.		Trust, Wat Props (Pty) Ltd.	Please refer to chapter 7 of the RFSR: issue number 7.
1.12.	The threat of a maritime disaster off the Cape coast is a concern.	29-01-2001	Prof. D. Holm, Chairperson: Hartbeespoort Water Forum	The potential for a maritime disaster either on the PBMR DPP or as a result of the PBMR DPP will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 16.
1.13.	What will the impact be on the environment?	10-08-00	Mr. M. A. Ranoszek, General Manager: Pioneer Natural Resources of South Africa, Cape Town.	It is the purpose of the EIA to assess the environmental impacts of this proposed development and to determine if adverse aspects can be mitigated, managed or avoided. The findings of the environmental assessment will be addressed in the EIR.
1.14.	Provision should be made for: Rescuing paleaontological work, through the South African Museum (Dr. Roger Smith) to prevent the loss of fossils? A “rescue-window” in all contracts associated with the construction of the PBMR project. (During a study undertaken for the boreholes on this project, a whole whale skeleton was destroyed due to contract deadlines.)	24-10-00	Mr. R. van Zyl, Operations Manager: Centre for Marine Studies: University of Cape Town (UCT).	Eskom is not aware of any skeleton of a whale shark being destroyed during any borehole drilling. It is requested that exact details where and when such damage is alleged to have occur and whether it was in a test pit or a borehole.
1.15.	Possible biological impact on marine life must be investigated. Some of these impacts occur if certain survival parameters are exceeded for a short period – i.e. sharp increase in temperature	02-10-00	Prof. J.R.E. Lutjeharms, University of Cape Town (UCT); Mr. R. van Zyl, Operations Manager: Centre for Marine	The concern is noted and will be assessed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 13.

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	in the bay.		Studies, University of Cape Town.	
1.16.	The long-term climate impacts must be investigated.	02-10-00	Prof. J.R.E. Lutjeharms, University of Cape Town Mr. R. van Zyl, Operations Manager: Centre for Marine Studies, University of Cape Town.	Nuclear power stations emit very negligible quantities of green house gases. This will be described in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 13 and 21.
1.17.	The diverse impacts must be integrated into the EIA.	02-10-00	Prof. J.R.E. Lutjeharms, University of Cape Town Mr. R. van Zyl, Operations Manager: Centre for Marine Studies, University of Cape Town.	It is the purpose of the EIA to assess the environmental impacts of this proposed development and to determine if adverse aspects can be mitigated, managed or avoided. The findings of the environmental assessment will be addressed in the EIR. Cumulative impacts will be assessed during the IEA phase. Please refer to chapter 7 of the RFSR: issue number 36.
1.18.	What is the implication of the PBMR when sea levels rise over the next 40-50 years?	02-10-00	Prof. J.R.E. Lutjeharms, University of Cape Town Mr. R. van Zyl, Operations Manager: Centre for Marine Studies, University of Cape Town.	This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 17.
1.19.	Are seismic impacts being investigated?	02-10-00	Prof. J.R.E. Lutjeharms, University of Cape Town Mr. R. van Zyl, Operations Manager:	A geo-technical assessment will be undertaken as part of the EIA phase. Please refer to chapter 7 of the RFSR:

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			Centre for Marine Studies, University of Cape Town.	issue number 18.
1.20.	Will there be long-term impacts on waves and sea streams?	02-10-00	Prof. J.R.E. Lutjeharms, University of Cape Town Mr. R. van Zyl, Operations Manager; Centre for Marine Studies, University of Cape Town (UCT).	It is the purpose of the EIA to assess the environmental impacts of this proposed development and to determine if adverse aspects can be mitigated, managed or avoided. The findings of the environmental assessment will be addressed in the EIR. Please refer to chapter 7 of the RFSR: issue number 13.
1.21.	The PBMR would be constructed on or close to an active fault. Concerned about waste disposal and requested calculating the true projected costs.	11-08-00	Mr. N. Wullschleger, Member: Aksent, Koue Bokkeveld.	A geo-technical assessment will be undertaken as part of the EIA phase. An assessment of waste disposal will be undertaken as part of the EIA phase. A socio – economic study will be undertaken as part of the EIA phase. Please refer to chapter 7 of the RFSR: issues number 12, 18, and 24.
1.22.	The PBMR debate should be fully informed from a technical, economical, political, environmental and historical perspective.	02-10-00	Dr. L. Platzky, Deputy Director-General, Department of Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town.	The PBMR DPP EIA is conducted within the relevant policy and legislative frameworks and is informed by many of these aspects. It is the purpose of the EIA to assess

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				the environmental impacts of this proposed development and to determine if adverse aspects can be mitigated, managed or avoided. The findings of the environmental assessment will be addressed in the EIR. Please refer to chapter 7 of the RFSR: issues number 1, 10, 12, 24, 34, 35 and 36.
1.23.	Cape Town is a prime international tourism destination particularly for Europeans and North Americans. Nuclear is unacceptable to most Europeans and North Americans. What will the impact of the PBMR on Cape Town as a preferred tourism destination be?	02-10-00	Mr. S. Thorne, Director: Energy Transformations CC, Cape Town. Representative from the Cape Metropolitan Council (CMC), Cape Town. Energy and Development Research Centre, (EDRC).	This aspect is noted. A tourism impact assessment will be undertaken during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 7
1.24.	What evidence has been collated on the radiological hazard of these emissions from the coal fired power stations that have been deposited on the ground, to any local indigenous population groups?	18-09-00	Mr. M.A. Ranoszek, General Manager: Pioneer Natural Resources of South Africa, Cape Town; Mr. F. Carruthers; Cape Town; Mr. R. M. Longden-Thurgood, Representative: Institution of Nuclear Engineers South Africa Branch, Cape Town	This aspect falls outside the scope of this EIA.
1.25.	The Koeberg site is situated in the Southern core of the proposed West Coast Biosphere Reserve.	29-09-00	Mr. M. Botha, Programme Leader: Botanical Society of	It is the purpose of the EIA to assess the environmental impacts of this

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	What is Eskom's commitment to sound environmental management in the long term in this area and, what is their medium term conservation plans?		South Africa (Kirstenbosch), Cape Town.	proposed development and to determine if adverse aspects can be mitigated, managed or avoided. The Koeberg site is part of the bio-sphere and the site is a nature reserve, and Eskom ensures that this site is managed on sound conservation principles. . Please refer to chapter 7 of the RFSR: issue number 13.
1.26.	How is Eskom going to support the IAPs to deal with the influx of people and perceived increase in crime? (The increase in population, would lead to an increase in crime.)	19-09-00 19-09-00	Duynefontein Community Policing Forum. Mr. R. van der Toorn, Mr. P.M. Jewell, Ms. W. van Schalkwyk (Member: Koeberg Policing Forum), Ms. L. Nolte, Ms. D. Moore, Ms. V.A. Jewell, Sgt. J.T. Grobbelaar (SAPS)	This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1.
1.27.	What are the impacts on rural communities especially around issues of environmental awareness, health and energy?	11-08-00	Mr. N. Wullschleger, Member: Aksent, Koue Bokkeveld.	This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1.
1.28.	Have studies been done regarding the impact of nuclear reactors on the ocean? Is such information available?	27-09-00	Mr. F. Bekker, Director: Safrich, Johannesburg.	An independent body (UCT) has been monitoring the marine impact around the Koeberg site for more that 20 years and hence a baseline has been established. The cumulative impacts of the PBMR DPP and Koeberg nuclear power station will be assessed during the EIA phase.

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				Please refer to chapter 7 of the RFSR: issue number 13.
1.29.	What will the impacts be immediately beyond the site?	23-09-00	Ms. D. Murray, Chairperson: Urban Planning and Environment; Blaauwberg Administration, City of Cape Town; D. Stoffberg, Mr. D.C. Bettesworth, Town planner, Blaauwberg Administration, City of Cape Town; R. Rodman; Ms. P. Titmus, Cape Town.	It is the purpose of the EIA to assess positive and negative environmental, social and economic impacts of this proposed development. This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 2 and 13.
1.30.	The updated Water Management Plan needs to reflect the PBMRs impact.	26-01-01	Ms. J. Enele, Consultant: Department of Water Affairs and Forestry (DWAF), Gauteng Province; M. Mathegana.	This aspect will be assessed as part of the EIA phase Please refer to chapter 7 of the RFSR: issue number 22.
1.31.	Is there a danger of radiation?	23-09-00	Messrs. V. Theunissen, K. Lerm, P.J. Pienaar, C.C. Webb; Mr. P.G. Beets, Director: Department of Transport, Western Cape, Cape Town; B.C. Alcock,	The PBMR DPP will be the very latest nuclear technology (Generation IV) and designed to have minimal impact. This aspect will be discussed in the EIR in terms of the co-operative governance agreement between DEAT and the NNR. Please refer to chapter 7 of the RFSR: issue number 23.
1.32.	Should anything go wrong, the impact on the surrounding environment would be catastrophic.	01-05-01	Mrs. K. Cleminshaw, IAP, Cape Town.	The PBMR DPP will be the very latest nuclear technology (Generation IV)

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				and designed to have minimal impact. This aspect will be discussed in the EIR in terms of the co-operative governance agreement between DEAT and the NNR. Please refer to chapter 7 of the RFSR: issue number 23.
1.33.	Concern is expressed about the possible environmental and economic implications of this programme.	07-11-00	Mr. S. Harwin IAP.	A socio-economic study will be undertaken as part of the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1.
1.34.	The EWT believes that the export of PBMRs to the energy-hungry nations of the developing world can reverse the tide of ever-increasing greenhouse gas emissions from these countries.	30-10-00	Dr. J. A. Ledger, Director: Endangered Wild Life Trust (EWT).	Nuclear power stations emit negligible quantities of greenhouse gasses. This will be described in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 13.
1.35.	Is there a record of studies undertaken to determine the effect of nuclear power on the ocean?	02-10-00	Afrikaanse Handelsinstituut, Bellville, Cape Town.	Yes, such studies have been conducted at the Koeberg site over many years. The relevant information will be included in the EIR. Please refer to chapter 7 of the RFSR: issue number 13.
1.36.	How will the nuclear-based PBMR at Koeberg, impact on international tourism destinations in	27-09-00	Dr. L. Platzky, Deputy Director-General, Department of	A tourism impact assessment will be undertaken during the EIA phase.

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	the fairest of Capes?		Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town.	Please refer to chapter 7 of the RFSR: issue number 7
1.37.	The pilot plant at Koeberg could signal the beginning of new generation of nuclear power stations in South Africa. It is therefore imperative that all relevant issues be addressed.	03-10-00	Mr. H.B. Thorpe, Chairperson: Kouga Anti Nuclear Group (KANG).	The PBMR DPP EIA is conducted within the relevant policy and legislative frameworks. It is the purpose of the EIA to assess positive and negative environmental, social and economic impacts of this proposed development. Please refer to chapter 7 of the RFSR: issues number 13 and 36. .
1.38.	Are people going to be transported from the townships?	19-09-00	Mr. R. van der Toorn, Mr. P.M. Jewell, Ms. W. van Schalkwyk (Member: Koeberg Policing Forum), Ms. L. Nolte, Ms. D. Moore, Ms. V.A. Jewell, Sgt. J.T. Grobbelaar (SAPS) Duynefontein Community Policing Forum (Duynefontein).	A socio economic study will be undertaken as part of the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1.
1.39.	How would the PBMR influence the environment?	19-09-00	Mr. R. van der Toorn, Mr. P.M. Jewell, Ms. W. van Schalkwyk (Member: Koeberg Policing Forum), Ms. L. Nolte, Ms. D. Moore, Ms. V.A. Jewell, Sgt. J.T. Grobbelaar (SAPS) Duynefontein Community Policing Forum (Duynefontein).	It is the purpose of the EIA to assess positive and negative environmental, social and economic impacts of this proposed development. Please refer to chapter 7 of the RFSR: issue number 13.

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1.40.	What is the nature of hazardous material and what will the environmental impact be?	Undated	Anonymous.	This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1, 13, 24 and 29.
1.41.	Will the PBMR lead to restrictions on coastal development?	Undated	Anonymous.	The current development restrictions around Koeberg will not be increased as a result of the PBMR DPP This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1 and 2.
1.42.	There are already various radioactive substances in the environment. What about the cumulative impact?	02-09-00	Attendant: Pelindaba open day.	The cumulative impacts will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 36.
1.43.	The erection of power lines from the PBMR must be done in an environmental sensitive manner, so as not to damage the flora.	Undated	Anonymous.	The additional transmission lines required for the PBMR are limited to the Koeberg site. The erection of power lines coming from the PBMR DPP will be done in an environmentally sensitive manner. Recommendations to achieve this will be included into the EIR. Please refer to chapter 7 of the RFSR: issue number 14.
1.44.	The project will have a negative impact on the quality of life of communities.	Undated	Anonymous.	The motivation of this project is to create a benefit for South African communities.

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				It is the purpose of the EIA to assess positive and negative environmental, social and economic impacts of this proposed development. This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1.
1.45.	How much of the PBMR will be seen from the road?	Undated	Anonymous.	Due to the nature of the terrain, parts of the PBMR DPP will be visible from the road. A visual impact assessment will be undertaken as part of the EIA phase. Please refer to chapter 7 of the RFSR: issue number 3.
1.46.	What about radioactivity and the damages it causes?	30-03-01	Ms. J.L. de Villiers, Director: Wildlife and Environmental Society of South Africa (WESSA), Cape Town.	The PBMR DPP will be the very latest nuclear technology (Generation IV) and designed to have minimal impact. This aspect will be discussed in the EIR in terms of the co-operative governance agreement between DEAT and the NNR. Please refer to chapter 7 of the RFSR: issue number 23.
1.47.	The hypothetical nuclear holocaust at Koeberg implies a much bigger area than a 400 m radius being affected. (This is typical misinformation).	25-04-01	Prof. L. Londen, Department of Public Health and Primary Health Care, University of Cape Town (UCT).	This issue will be best addressed during the Licensing process of the NNR.

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1.48.	Increase in PBMRs could lead to new problems that cannot be identified through the construction and running of only one plant.	19-09-00	Mr. R. Karotti, Mr. H. Winkler, Senior Researcher: Energy and Development Research Centre (EDRC), University of Cape Town.	The PBMR will be a full scale demonstration power plant which will confirm operation characterises providing sufficient information to enable extrapolation to allow for the addition of further modules.
1.49.	The communities within the 16 km. radius of the safety zone are held at ransom until a decision has been taken regarding the PBMR.	Undated	Anonymous.	The current development restrictions around Koeberg will not be increased as a result of the PBMR DPP. Please refer to chapter 7 of the RFSR: issue number 1 and 26.
1.50.	What area would be affected by a nuclear disaster related to this project of this size?	Undated	Anonymous.	The PBMR DPP will be the very latest nuclear technology (Generation IV) and designed to have minimal impact. The boundaries of the exclusion zone are unlikely to increase. Please refer to chapter 7 of the RFSR: issue number 15.
1.51.	The South African coast is archeologically very rich; containing archaeological material such as shell middens, cave sites, burials, fish traps, numerous historical shipwrecks – all which are protected by the National Monuments Act (Act No 28 of 1969 as amended). Any plans to develop in the areas proposed, will require archaeological impact assessments as part of the EIA process.	26-03-00	Mr. J Gribble, IAP, Cape Town.	Suggestion noted. This aspect will be addressed during the EIA phase and will also be reflected in the EMP. Please refer to chapter 7 of the RFSR: issue number 15

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1.52.	The EIA has to take cognisance of the five-year upgrade plan for provincial roads.	03-10-00	Mr. B. Veldman, Chief Director: Department of Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town.	This aspect will be considered during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 2
1.53.	It is important to be responsible to future generations.	28-09-00	Prof. B. de Villiers, University of Stellenbosch.	is the purpose of the EIA to assess positive and negative environmental, social and economic impacts of this proposed development.
1.54.	The NNR / CNS will have to use contractors, which might have commercial interests in the project, to evaluate the technology during the regulatory process.	Undate d	Anonymous.	The licensing process will be carried out in terms of the National Nuclear Act and all its provisions. The requirements of the Act include provisions for good corporate governance and the declaration of interests in any projects in which application for nuclear authorisation has been submitted.
1.55.	In view of the existing widespread support for the decommissioning of Koeberg due to high extraneous urban-related costs, there is considerable concern that the PBMR demonstration cause is a prelude to long term continuation of nuclear presence at this site, and therefore the continuation of what is already widely perceived to be an activity that should be discontinued.	23-08-00	Cape Metropolitan Council (CMC).	Considering the important contribution that Koeberg has to the supply of electricity to the Western Cape, indications are that there is not widespread support for the decommissioning of Koeberg. This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1 and 2.
1.56.	Decommissioning must be done over time and in	28-09-00	Prof. B. de Villiers, University of	This aspect will be assessed during

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	phases; otherwise it would impact negatively on the social and financial environment.		Stellenbosch.	the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1 and 9.
1.57.	How are the residents of the surrounding area going to benefit from the development of the PBMR?	19-09-00	Mr. R. Van der Toorn (Vice Chairperson), Mr. P.M. Jewell, Ms. W. Van Schalkwyk, Ms. L. Nolte, Ms. D. Moore, Ms. V.A. Jewell, Sgt. J.T. Grobbelaar (SAPS), Duynefontein Community Policing Forum (Duynefontein).	The positive aspects of this project include both direct and indirect job creation, stimulation of local industries. This aspect will be assessed in the socio-economic study in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1.
1.58.	Who will benefit from the electricity produced? Will disadvantaged communities benefit any more than they do from the present plant?	28-03-01	Ms. H. Kingwill, Freelance Journalist, Big Issue News, Cape Town.	The government has aspirations to ensure that everybody has access to affordable electricity by 2012, and this project would contribute to achieving that goal.
1.59.	What employment opportunities exist for the local population?	Undate d.	Anonymous.	The positive aspects of this project include both direct and indirect job creation, stimulation of local industries. This aspect will be assessed in the socio-economic study in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1.
1.60.	The effect on existing and future emergency planning procedures have not been addressed, or the effect of the PBMR on spatial planning,	18-05-01	Messrs. K. Wiseman & E Weinronk, Cape Metropolitan Council: Planning,	The cumulative effective of the PBMR on the Koeberg site, is unlikely to change the scope and extent of the

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	land use and potential health risks in the vicinity of Koeberg and throughout the City of Cape Town area.		Environment & Housing – Environmental Management.	existing emergency plan and the restrictions on development in the area. This aspect will be discussed in the EIR in terms of the co-operative governance agreement between DEAT and the NNR. Please refer to chapter 7 of the RFSR: issues number 1, 2, 26 and 29.
1.61.	An architectural sketch/draft plan to give a visual representation of the building, which will house this operation, would enable IAPs to be more realistic about a possible visual impact.	Aug 01	Messrs. P. Hardcastle & C le Roux, Provincial Department of Environment and Cultural Affairs and Sport, Western Cape Province.	Suggestion noted. This aspect will be addressed in the visual impact assessment. Please refer to chapter 7 of the RFSR: issue number 3.
1.62.	Please provide information about any upgrading of transmission networks and new lines that may need to be constructed if this demonstration module proves to be successful.	Aug 01	Messrs. P. Hardcastle & C le Roux, Provincial Department of Environment and Cultural Affairs and Sport, Western Cape Province.	The additional transmission lines required for the PBMR are limited to the Koeberg site. The erection of power lines coming from the PBMR DPP will be done in an environmentally sensitive manner. Recommendations to achieve this will be included into the EIR. Please refer to chapter 7 of the RFSR: issue number 14.
1.63.	Examining the full life of reactors and the spent material is required. Taking these aspects into account, the infrastructure costs of the PBMR project may far outweigh its viability. The	22-05-01	Dr. L. Platzky, Deputy Director General: Department of Economic Affairs, Agriculture and Tourism, Western Cape,	This is an aspect of the techno-economic demonstration of the PBMR DPP.

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	implications to taxpayers and consumers of electricity of infrastructure costs must be carefully examined through the full life cycle of the PBMR project, which includes the costs of radioactive waste management and disposal by future generations.		Cape Town	
1.64.	The potential risk to adjacent communities should be evaluated.	17-10-01	Dr. P Hanekom, Head of Department, Department of Agriculture, Conservation, Environment and Land Affairs – Gauteng Province.	The PBMR DPP will be the very latest nuclear technology (Generation IV) and designed to have minimal impact. This aspect will be discussed in the EIR in terms of the co-operative governance agreement between DEAT and the NNR. Please refer to chapter 7 of the RFSR: issues number 23, 28 and 29.
1.65.	We believe that heating fuel spheres at 1950 °C exceeds the 'safety' temperature of 1800°C. The explosion hazard for this stage of the process must also be included in the studies. A full HAZOP must also be carried out.	19-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	Please refer to chapter 7 of the RFSR: issue number 28.
1.66.	In our view it is ill-conceived and unconstitutional that the South African public subsidise Eskom and the nuclear industry to develop an industry that is shown to be unsafe for humans as well as the environment, uneconomic and unsustainable, while polluting this country and our planet for hundreds of thousands of generations to come.	14-07-01	Messrs EA Peackock, S Peackock, JH Peacock, W Peacock and AM Peacock, Affected Parties, Broederstroom.	Your comment is noted However it is also true that many people hold the opposite view. The environmental impact assessment will consider all policy and legislative requirements to ensure that this project Is not unconstitutional and ill-conceived.
1.67.	What range of seismic activity has the proposed	22-10-01	Mr. M. Lakhani, Anti-nuclear	The seismic value chosen to envelope 80% of all sites worldwide is

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	site experienced to date?		Co-ordinator: Earthlife Africa.	0.4 g horizontal acceleration. The seismic conditions at the proposed Koeberg site require a 0.3 g capability, and therefore pose no problems for the proposed demonstration plant Records on the range of seismic activity are available and will inform the relevant aspects of the EIA phase. Please refer to chapter 7 of the RFSR: issue number 18.
1.68.	What will the impacts of rainfall, temperature and wind be on the PBMR?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	The wind speed, rainfall and temperature data recorded at the Koeberg NPS weather station over the past 20 years have been processed statistically in order to obtain estimates of these parameters for design basis events, having low probabilities of occurrence. These parameters are then used in the design of the civil structures. This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 21.
1.69.	Detailed information with regard to potential impacts is requested, e.g. the rise in water temperature. Also, alternatives to minimise impacts need to be discussed in detail, e.g. why do water need to be released at a warmer	11-10-01	Mr. T. Gxaba, Head of Department, DEAT: Free State.	An independent body (UCT) has been monitoring the marine impact around the Koeberg site for more that 20 years and hence a baseline

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	temperature to the external environment and not be contained in an "internal cycle".			has been established. The cumulative impacts of the PBMR DPP and Koeberg nuclear power station will be assessed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 13.
1.70.	The Cape was starved of energy and there was also the promise of free basic electricity supply. The project could therefore have a positive impact in terms of these aspirations. The construction phase would create extra jobs (approximately 4 000).	04-04-02	Prof. P. Lloyd, Industrial and Petro-chemical consultants.	Studies undertaken by Eskom and NERSA have indicated a need for additional electricity generating capacity in the Western Cape. The positive aspects of this project will be evaluated in the EIR..
1.71.	Why is Eskom supporting the least job intensive option, i.e. PBMR	17-11-05	Mr. Lakane	Eskom support growth by providing affordable electricity
1.72.	If a "bomb" would be released at the PBMR, it could propel the pebbles into air. There could be a shock-wave of approximately 3 km and a release of gas. Even though the pebbles would be released into the air, it would not be problematic, as it would still be sealed due to its resistance. One could experience radiation burns if one touched the pebbles.	04-04-02	Prof. P. Lloyd, Industrial and Petro-chemical consultants.	The PBMR DPP will be the very latest nuclear technology (Generation IV) and designed to have minimal impact. The boundaries of the exclusion zone are unlikely to increase. This aspect will be addressed during EIA phase. Please refer to chapter 7 of the RFSR: issue number 28.
1.73.	The pebbles are not soluble and because they are encapsulated, there would be no impact if they were exposed to water.	04-04-02	Prof. P. Lloyd, Industrial and Petro-chemical consultants.	Opinion noted.

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1.74.	Any impact of the NNPS on the Waterfront might jeopardise Cape Town as a tourism destination.	05-04-02	Mr. S. Thorne. Director: Energy Transformation CC, Cape Town.	This aspect is noted. A tourism impact assessment will be undertaken during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 7
1.75.	The PBMR would have a visual impact on the area.	05-04-02	Mr. S. Thorne. Director: Energy Transformation CC, Cape Town.	A visual impact assessment will be undertaken during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 3.
1.76.	Plume dispersion modelling to be done to determine the combined effect of the PBMR and the KNPS.	18-05-01	Messrs K Wiseman and E Weinronk, Cape Metropolitan Council: Department of Planning, Environment and Housing.	Meteorological and dispersion modelling will be addressed as part of the EIA phase. Cumulative impacts will also be assessed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 21.
1.77.	How much Carbon credits can the PBMR earn?	10-11-05	Unanimous	At this point in time Nuclear Power Stations can unfortunately not earn Carbon credits
1.78.	Eliminating all carbon dioxide emitting power stations will not achieve the full reduction in carbon dioxide emissions without eliminating its emission from motor vehicle exhausts.	10-11-05	Mr. Longden-Thurgood	Observation noted.
1.79.	Would the global impacts be assessed as part of the EIA?	15-11-05	Dr. van As	No, the National Electricity Regulator conducts national studies and address issues such as global warming and the reduction of greenhouse gasses.

	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
1.80.	Failure to identify key issues: Regulations 6(b) and (c) of GNR 1183 provide that a Scoping Report must include a brief description of how the environment may be affected and a brief description of environmental issues identified. In addition, under the PAJA. A decision-maker is required (amongst other things) to take relevant considerations into account. The DSR does not provide a description of how the environment may be affected by the construction and operation of the proposed PBMR DPP, and the on-site storage of spent nuclear fuels, under abnormal or emergency conditions (as opposed to normal operating conditions).	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	Please refer to chapter 7 of the RFSR :
1.81.	Details of greenhouse gas emissions and radioactive gas emissions should be detailed. Why does Eskom misrepresent the PBMR as a clean power to the general public?	7-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	Nuclear power stations emit negligible quantities of greenhouse gasses. This will be addressed in the EIA phase Please refer to chapter 7 of the RFSR: issue number 23.

2. DATA ACCURACY ISSUES

2.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
2.1.	We do not accept that the PBMR technology has been tried and tested overseas – the configuration at hand has never been built anywhere.	01-10-01	Mr. M Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	Certain elements of the technology are tried and tested. The integration of the technology into an electricity generating plant is the purpose of the demonstration PBMR DPP. Please refer to section 4.3.6 of the RFSR.
2.2.	No scientific information is provided for the decisions made around the suitability of the various sites. As such, these represent opinions, as none of the information is referenced, nor assessed by independent experts.	01-10-01	Mr. M Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	The site alternatives were assessed by independent consultants. This information was reassessed by independent consultants for the 400 MW (t) PBMR DPP.
2.3.	Officials of the investing companies should be present at events to answer questions and learn about the public opinion first hand.	30-04-01	Mr. M. Louwrens, IAP, Cape Town.	Comment noted.
2.4.	There is a question mark over the realism of describing waste that takes 300 years to decay as "short lived".	Undated	Anonymous.	Waste management aspects will be assessed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 24.
2.5.	PBMRs have short lead times, which is obviously bogus. Renewable energy projects have shorter lead times and can match demands with much lower economic risks. The energy recovery time for proven nuclear technology is over ten years, for the PBMR it could be longer or it could even be proven to be non-feasible.	Feb. 01	eThekwini ECOPEACE.	Lead times for the construction of the PBMR DPP is estimated to be 3 years. This will be confirmed during the construction of the plant. This aspect will be important for the commercialisation of the technology. .
2.6.	Selective attention is paid to the principles of environmental management, particularly those that	Aug 01	Messrs P Hardcastle & C le Roux, Provincial Department	This aspect is addressed in the RFSR report.

	related to cradle-to-grave and intergenerational equity.		of Environment and Cultural Affairs and Sport, Western Cape Province.	Please refer to sections 2.2.2 and 2.2.3 of the RFSR.
2.7.	The proposed use of the HAWK model is but one method of assessing risk. What checks and balances will there be to ascertain the accurate potential impacts due to climate? What assumptions will be made? What multiple failure scenarios will be used?	22-10-01	Mr. M Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	We do not propose to use the HAWK model for the 400 MW (T) PBMR DPP. The HAWK model is primarily used for control of risks from an emergency atmospheric release. Other models such as AIRDOS, PHAST (which are internationally approved) are used for project planning purposes in relation to risks and consequences. Such models use annual average climatic conditions including wind, stability and dispersion factors to predict potential doses from routine releases. Site specific data from the on-site meteorological station is used to ensure representativeness.
2.8.	Again it is stressed that the basis on which the decision will be taken to prove if the module is economically viable must form part of the EIR report for evaluation purposes. It is of the utmost importance from our point of view to see if and how environmental issues are calculated in this analysis.	11-10-01	Mr. T Gxaba, Head of Department, DEAT: Free State.	The economic feasibility have been assessed in the pre-feasibility and feasibility process and reported in the feasibility report. This is a demonstration of the techno-economic performance of the full scale plant. In addition, it is the purpose of the EIA to assess positive and negative environmental, social and economic impacts of this proposed development.

3. HEALTH, SAFETY, AND SECURITY

3.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
3.1.	The lack of population information, for example the actual total number of people residing / working within the impact areas is cause for concern. How will it logistically be possible to move all of the people within 50 km of either of the proposed sites to a safe distance, regardless of the road infrastructure?	01-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	Emergency and related aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 26.
3.2.	The PBMR does not need a huge containment vessel, as do the 'normal' reactors. They only use an air and watertight structure. In fact the PBMR can't function effectively without this thin-skinned container. The problem is that if the container is holed, the pebbles (chunks of carbon) will immediately ignite and burn fiercely due to the temperature in the vessel (900°C under normal conditions. Carbon ignites at 400°C and burns rapidly at 550°C). Thus a high power rifle or a shoulder fired rocket to penetrate the shell and cause a major contamination event. (Graphite burning went on for months at Chernobyl.) Additionally, the exclusion zone around a PBMR is only 400 m. Well within the reach of a high power rifle or shoulder fired rocket.	21-02-02	Ms. E. Weinronk, Review coordinator – Environmental Management Department: Cape Metropolitan Council Administration. City of Cape Town.	Safety and accident/terror related aspects will be addressed during the EIA phase. The confinement building is not a thin skinned container but consists of thick concrete to withstand missles such as aircraft without comprosing the nuclear safety. The exclusion zone will be greater than 400m and will be discussed in the EIR. The NNR licensing process will also consider these and related aspects Please refer to chapter 7 of the RFSR: issue number 28.
3.3.	Issues of safety are enormously important (even more so given recent world events). Specialists who can then be evaluated by the NNR must assess these.	09-10-01	Ms. L McDaid, Member: Koeberg Alert, Earthlife Africa, Western Cape.	Safety and accident/terror related aspects will be addressed during the EIA phase. The NNR licensing process will also consider these and related aspects Please refer to chapter 7 of the RFSR:

3.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
				issue number 28 and 34.
3.4.	Health risks and radiation monitoring: Health monitoring is needed both to reassure the public and surrounding communities, and to timeously identify any health impacts that may occur. The City Of Cape Town requested (during the previous EIA comment process) that a health risk assessment be undertaken. The DSR proposes that the health issue will be addressed by means of an international literature review. This approach is questioned as there are no PBMRs of equivalent scale or technology combinations operating elsewhere in the world. Applicability of the information found via the literature review to this particular project may therefore be questionable. The Directorate: City Health has requested that a team of respected epidemiologists undertake an "independent and unbiased study to generate sufficient epidemiological evidence".	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	The health and safety aspects will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issues number 28 and 29 The health issue does not relate to the technology, but rather the radiological component of the plant under adverse or normal operating conditions and the NNR's standard for such releases. International studies on the subject of health risk incorporates all kinds of nuclear plant and hence the consultants recommendation to follow international best practice and knowledge. Such a study will involve a prolonged period (about 10 years) and the result will be within that of international conclusions. Current monitoring of staff and environmental media at Koeberg nuclear power station indicate results that are well within the standards of the NNR and the international norms.
3.5.	How will fuel be moved from one vessel to another if the storage tank is damaged? What are the implications of a damaged spent fuel storage tank? How will the spent fuel storage area be "well	Answer provided on 22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	The spent fuel storage tanks are designed for eventual transfer of the fuel to a final disposal site. The same mechanism can be used for internal

3.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
	shielded"?			transfer of fuel. A damaged spent fuel tank is not a danger to anyone as the fuel will be stored at low temperatures and there is very little release of fission products during storage. The storage tanks are below ground with a sufficiently thick concrete floor above the tanks to allow access to equipment on those floors without adding meaningfully to the collective dose of the personnel.
3.6.	Safety in storage is vital, including the prevention of fires. What measures are intended to be implemented to assure that the necessary safeguards are in place?	26-09-01	Mr. L.M. Longden-Thurgood	Safety and related aspects will be addressed during the EIA phase. The NNR licensing process will also consider these and related aspects Please refer to chapter 7 of the RFSR: issue number 28.
3.7.	The safety issue is also being made off as to be as remote as nearly impossible, and does not warrant any further attention. But will such a facility withstand a direct hit by a commercial airliner, with the resultant contamination of the environment?	11-10-02	Mr. T. Gxaba, Head of Department: DEAT (Free State)	The safety and accident/terror related aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 28.
3.8.	The objective of sustainable development that meets the needs of the present without compromising the quality of health should be used as a policy directive during these processes.	Undated	Dept. of Health (Western Cape)	The PBMR DPP EIA is conducted within the relevant policy and legislative frameworks. It is the purpose of the EIA to assess positive and negative environmental, social and economic impacts of this proposed development.

3.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
3.9.	Plutonium 239 is a problem, and will be so for the next 250,00 years. This issue should be driven by international procedures and be addressed as a local issue.	19-03-02	Prof. P. Lloyd and Messrs. J. Walmsley and M. Longden-Thurgood	This will be considered as part of the safety and waste assessment in the EIA phase. As per Generation IV aspirations PBMR is designed to be proliferation resistant. Triso fuel coatings act as miniature containment barriers and are highly resistant to corrosion. The stability of silicon carbite and poly carbon over extended periods of time means that the reliance on packaging is unnecessary. International standards require that these practices are in place to prevent or mitigate consequences of highly unlikely events. This may create the impression that the risks are high, but in fact the opposite is the case. However, the safety and related aspects will be addressed during the EIA phase. Please refer to chapter 7: Issue number 28.
3.10.	The fact that safety zones, emergency plans, risk assessments, etc. are put in place, creates the impression that there is a risk. The more measures that are put in place to mitigate the risk, the more people believe that the activity is dangerous.	15-03-02	Ms. P. Drodskie, Director: South African Chamber of Business (SACOB)	International standards require that these practices are in place to prevent or mitigate consequences of highly unlikely events. This may create the impression that the risks are high, but in fact the opposite is the case. However, the safety and related aspects will be addressed during the

3.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
				EIA phase. Please refer to chapter 7 of the RFSR: issues number 26 and 28.
3.11.	Without a containment building, the reactor is wide open to a terrorist attack, how will you protect the local communities from such an attack?	28-03-02	Mrs. C.T. Garbett, Director: Watt Props (Pty) Ltd. Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd.	The safety and related aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 28. In addition, the proposed PBMR demonstration module building, which comprises the entire structure that houses the power plant and its ancillary systems, is designed to withstand significant external forces such as aircraft impacts and tornadoes. It is also highly resistant to explosions from potential saboteurs. The thickness of the reinforced concrete roof and walls (above ground level) of this structure is 1 m. Within – and integral with – the module building, is the reinforced concrete containment (or citadel) that encloses the Rector Pressure Vessel (RPV) and the Power Conversion Unit (PCU). The thickness of the walls surrounding the RPV is 2, 2 m. The PCU comprises the high- and low-pressure turbo-units, power turbine generator, a recuperator and coolers.
3.12.	Fuel or waste can be used in conventional weapons, e.g. pipe bombs, to make them thousands of times	20-09-01	Mr. A. Murphy, Member: eThekwini ECOPEACE	Nuclear fuel from a nuclear plant can be converted into weapons material

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	more lethal.			which is an international concern. Thus South Africa is a signatore to the IAEA Non Proliferation Treaty, and thus must comply with strict controls to ensure that fissile materials are accounted for and is secure. The conversion of plant fuel into weapns is very difficult for PBMR fuel because PBMR fuel is proliferation resistant.
3.13.	Carbon encased fuel at 1 000°C will combust violently when exposed to air. It will also react with steam with or without the presence of oxygen. Water in contact with carbon at high temperature will immediately vaporize causing a steam explosion and will also severely compromise the integrity of the ceramic. These conditions could occur due to internal or external factors either unintentionally by accident or intentionally as sabotage. The spreading of radioactive dust and ash then becomes possible as does the reconfiguring of the fuel and waste products to cause a meltdown.	20-09-01	Mr. A. Murphy, Member: eThekwini ECOPEACE	Comment noted. However, the safety and related aspects will be addressed during the EIA phase. The NNR licensing process will also consider these and related aspects. Please refer to chapter 7 of the RFSR: issue number 28.
3.14.	The safety issues must be dealt in a clear and quantifiable manner.	01-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	The PBMR DPP EIA is conducted within the relevant policy and legislative frameworks. It is the purpose of the EIA to assess positive and negative environmental, social and economic impacts of this proposed development. The safety and related aspects will be addressed during the EIA Phase. The NNR licensing process will also

3.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
				consider these and related aspects. Please refer to chapter 7 of the RFSR: issue number 28.
•	Public comments regarding the "Julich Plant" may be interpreted as political, but there are many real concerns about the safety and viability of this plant. These opinions cannot be labelled as "facts" but should be dealt with as concerns, issues, etc.	25-04-01	Prof. L. Londen, Department of Public Health and Primary Health Care, University of Cape Town (UCT).	Comments are considered as issues. Nuclear fuel from a nuclear plant can be converted into weapons material which is an international concern. Thus South Africa is a signatore to the IAEA Non Proliferation Treaty, and thus must comply with strict controls to ensure that fissile materials are accounted for and is secure. The conversion of plant fuel into weapns is very difficult for PBMR fuel because PBMR fuel is proliferation resistant
•	If nuclear technology is to be considered appropriately, then the plans for it need to include: Safer mining of uranium; Safe local enriching of uranium; A minimum amount of transport of nuclear and radioactive materials or fuel and wastes; Safer design of nuclear facilities; Safer operation of nuclear facilities; and Safe decommissioning of nuclear facilities.	Feb. 01	eThekwini ECOPEACE.	This is a strategic issue that is not only related to the PBMR DPP. The PBMR DPP by itself is a result of a requirement to build safer reactors. Uranium mining and enrichment is not part of this EIA. This aspect deals with the demonstration power plant only. The other aspcts however will be dealt with in the EIR.
3.15.	Regarding fundamental safety principles: • How and by whom is significance rated? • What are the radiation dose limitation criteria? • Who underwrites these safety criteria?	03-10-00	Earthlife Africa.	This issue will be best addressed during the Licensing process of the NNR. With regard to good nuclear safety design practice, of prime consideration are the principles of

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	• Provide definition and detail of ALARA principles? • What is the toxicity / radiation level of effluent discharges? How will it be controlled?			defence in depth and of ensuring that risks and radiation doses to members of the public and workers will be maintained as low as reasonably achievable (ALARA) below laid down radiation dose limits. This principle defence-in-depth requires that there should be multiple layers (structures, components, systems, procedures, or a combination thereof) of overlapping safety provisions. Accident prevention and accident mitigation are natural consequences of the defence-in-depth principle. Application of the ALARA principle involves selection of design and operational features that provide the optimum level of safety. The process involves uses a range of techniques ranging from simple to complex. The ALARA principle as low as reasonably achievable for radiation dose reduction is implemented to bring doses further below safe limits without expending excessive effort and money in achieving the reduction. It is similar to the concept of continual improvement and is based on the concept of cost optimisation and risk minimisation. Additional information on definitions

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				and concepts will be included in the EIR report.
3.16.	The political, technical and economic feasibility of disposal of all types of waste and of the decommissioning thereof has to be proven. This is not the case with the PBMR, since only design safety has been emphasised.	Feb. 01	eThekwini ECOPEACE.	Low and intermediate waste generated by the PBMR is similar to that of conventional nuclear reactors and will be handled in a similar fashion. PBMR spent fuel is significantly safer than convention nuclear spent fuel. This aspect will be addressed in the EIA phase. The political, technical and economic feasibility of disposal of all types of waste has been proven international. South Africa under the national nuclear waste policy considers these international options for local conditions. Please refer to chapter 7 of the RFSR: issue number 24
•	What policy of compensation does Eskom have for health risks to workers who fall ill as a result of exposure to radiation?	27-01-01	Mr. M. Kantey, Chairperson: Koeberg Alert, Cape Town.	In the unlikely event of a worker becoming ill as a result of radiation, compensation will be dealt with in terms of the Compensation Of Occuptional Injuries and Diseases Act
3.17.	In terms of health, ordinary operation is guaranteed to release carcinogenic radioactive particles into the atmosphere, thus endangering the lives of the surrounding communities and workers.	27-01-01	Mr. M. Kantey, Chairperson: Koeberg Alert, Cape Town.	The health and related aspects will be addressed during the EIA phase. The NNR licensing process will also consider these and related aspects Please refer to chapter 7 of the RFSR: issues number 1 and 29.
•	Has any kind of monitoring or record till date been	28-03-01	Ms. H. Kingwill, Freelance	Environmental monitoring of the food

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	made of the effect of the present power plant on residents living in the area surrounding Koeberg?		Journalist, Big Issue News, Cape Town.	chain started two years before Koeberg began operating (in 1984). This was to get a base line for radiation levels in an area of 50 kilometres surrounding Koeberg. This monitoring has been ongoing and no significant changes in the radiation levels have been detected. No changes in the environment surrounding Koeberg have been detected. This monitoring is under the control and inspection of the National Nuclear Regulator, is based on international standards and is intended to demonstrate that discharges of radioactivity from Koeberg result in no significant risk to members of the public. The annual report of the National Nuclear Regulator (Council for Nuclear Safety Annual Report 1998/1999, page 19) states "…as in previous years, there were no indications of external radiation above normal background levels, whether close to the power station or further afield". The PBMR monitoring regime will begin two years before operation and will be on-going for the duration of its lifetime.
3.18.	The risk for proliferation will increase exponentially as more PBMRs are built.	19-09-00	Mr. R. Karotti, Mr. H. Winkler, Senior Researcher: Energy and Development Research Centre (EDRC), University of	The PBMR DPP will be the very latest nuclear technology (Generation IV) and designed to have minimal impact. One of the principles Generation IV

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			Cape Town.	aspires to is to contain the possibility of nuclear proliferation.
3.19.	Increase in PBMRs will lead to an increase in security and safety costs.	19-09-00	Mr. R. Karotti, Mr. H. Winkler, Senior Researcher: Energy and Development Research Centre (EDRC), University of Cape Town.	Comment noted. This aspect does not fall within the ambit of this EIA. If more PBMR are considered in the future, this could be an aspect to be considered.
3.20.	What is the leap required to go from nuclear power for peaceful purposes to destructive purposes?	16-02-01	Ms. B. M. Blignaut, Secretary: Green Belt Action Group, Roodepoort.	This concern is noted. However, nuclear power developed initially as a "leap" from nuclear weapons programmes and not visas versa.
3.21.	If the possibility existed for the PBMR to have a meltdown in 7000 years, the possibility existed for it to happen tomorrow.	23-01-01	Mr. H. Oelsner, IAP, Darling. (Attendant: Milnerton public meeting).	This plant cannot experience a core melt down. Due to the inherent characteristics of the fuel. Please refer to chapter 7: issues number 28 and 29.
3.22.	Will provisions be made for health surveillance processes to determine long-term health and related impacts? Who will fund this?	28-09-00	Attendant form the Department of Community Health, university of Cape Town (UCT).	Please refer to chapter 7 of the RFSR: issue number 1 and 29.
3.23.	What are the standard safety measures for a PBMR?	02-09-00	Attendant: Pelindaba open day.	This aspect is described in the section 4.5 of the RFSR.
3.24.	There is a concern about spreading nuclear technology in the 3rd world. These are unstable countries where anything is liable to happen.	02-09-00	Attendant: Pelindaba open day.	Comment noted. This aspect, however, does not fall within the ambit of this EIA.
3.25.	What are the health hazards to local communities?	Undated	Anonymous.	Health and safety aspects will be addressed during the EIA process. Please refer to chapter 7 of the RFSR:

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				issues number 1 and 29.
3.26.	Could one get cancer if exposed to radioactive material? How would the safety of the public be guaranteed?	01-02-01	Attendant: Pelindaba public meeting.	Health and safety aspects will be addressed during the EIA process. Please refer to chapter 7 of the RFSR: issue number 29.
3.27.	Safety is of the utmost importance. People view nuclear as dangerous.	27-09-00	Mr. F. Bekker, Director: Safrich, Johannesburg.	It is the purpose of the EIA to assess both the positive and negative environmental impacts of this proposed development and to determine if adverse aspects can be mitigated, managed or avoided. The findings of the environmental assessment will be addressed in EIR. The PBMR DPP will be the very latest nuclear technology (Generation IV) and designed to have minimal impacts. One of the principles of Generation IV technology aspires to is to contain the possibility of nuclear proliferation.
•	Are the international standards for radiation acceptable?	Undated	Anonymous.	International standards are based on extentsive international research carried by numerous independent internation organisations. There is consistent evidence that the health effects are neligiable. The health effects of radiation will be discussed in the EIR.
3.28.	How much radiation can a person stand?	Undated	Anonymous.	There is no absolute answer to this question.

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				However, organisations such as Eskom, which operate nuclear installations, are obliged by law to ensure that people living around their installations and working within them are not exposed to radiation levels above certain tightly controlled limits. These limits are determined by the Minister of Minerals and Energy on the advice of the National Nuclear Regulator (NNR). The NNR bases its advice partly on internationally accepted recommendations, and partly on its own calculation of the health risk due to radiation. It then ensures that organisations such as Eskom comply with the radiation exposure levels promulgated by the Minister.
3.29.	Have the safety aspects of the PBMR been tested?	Undated	Anonymous.	Health and safety aspects will be addressed during the EIA process. Please refer to chapter 7 of the RFSR: issue number 28.
•	Is the safety zone going to be 400 meters?	Undated	Anonymous.	For the existing Koeberg reactors, the safety zone is the emergency plan zone which extends beyond the site boundary. Since it is proposed to locate the PBMR adjacent to the Koeberg unit (approximately 500 m away), it will fall within the safety zone (emergency plan) of Koeberg.

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				The safety exclusion zone around the PBMR was originally intended to be less than 400 metres. This will not be the case for the PBMR DPP because the Koeberg emergency plan already exists.
3.30.	What are the time frames involved in relation to contamination, if a disaster takes place?	Undated	Anonymous.	Health and safety aspects will be addressed during the EIA process. Please refer to chapter 7 of the RFSR: issue number 28.
3.31.	Can Eskom guarantee that no disaster can take place?	Undated	Anonymous.	No. There is a certain amount of risk attached to every human activity and industry. The risk of a disaster will be quantified and will meet, or be lower than, regulatory criteria
3.32.	What are the risks involved for the community?	Undated	Anonymous.	The risks of the PBMR demonstration module to the community are expected to be insignificant. All risks will be quantified in the nuclear licensing process and checked for acceptability within the standards. However, health and safety aspects will be addressed during the EIA process. Please refer to chapter 7 of the RFSR: issues number 28 and 29.
3.33.	The waste needs to be stored in Koeberg for a long time. How safe is this to the inhabitants and the environment?	Undated	Anonymous.	Waste management will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR:

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				issues number 24, 28 and 29.
3.34.	Will the current exclusion zone remain after Koeberg has been shut down?	Undated	Anonymous.	After Koeberg ceases to operate, changes to the exclusion zone may be possible, based on the reduced risk from not running units. The risk of operating the PBMR and from the fuel in the Koeberg fuel pools would need to be modelled and a license change issued by the National Nuclear Regulator.
3.35.	It is unknown whether low levels of radiation are hazardous.	Undated	Anonymous.	A fact that indicates that low radiation doses of the order of many times above average natural background doses are NOT harmful and certain not lethal is that certain populations safely live in geographical regions that have unusually high natural radiation. In Ramsar, Iran the background radiation dose due to high radium concentration in some cases varies from 55 to 200 times higher than normal background levels in the world. The population living in that area show a radioadactive response in their body cells. This indicates a possible threshold that separates health effects of natural radiation from harm of large doses. Reference: Ghiassi-nejad, M. Javad Mortazavi, et al. Health Physics, 82(1) 87-93, 2002.
3.36.	How stable is the experimental reactor? Is it safe to	Undated	Anonymous.	Safety aspects will be addressed

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	operate?			during the EIA process. Please refer to chapter 7 of the RFSR: issue number 28.
3.37.	What would happen if you had a graphite fire at the PBMR?	23-01-01	Mr. W. de Pinho, Member: Tableview Residents Association, Cape Town (TVRA) (Milnerton public meeting).	Safety and related aspects will be addressed during the EIA. Assessing the possibility and impact of this event will also be addressed as part of the NNR licensing process. Please refer to chapter 7 of the RFSR: issue number 28.
3.38.	Is the PBMR vulnerable to civil strife?	30-01-01	Mr. R. Makroti, Member: Goodlife Initiative Africa, Durban (Durban public meeting).	Yes – any infrastructure is potentially vulnerable to civil strife.
3.39.	Details concerning the environmental and security implications associated with the 40-year storage of the nuclear waste at the selected site should be provided. The current international terrorist activities requires that issues related to security of the facility and transport of fuel, as well as any future PBMR that may be constructed are clearly identified in the scoping process and assessed in detail in the EIA.	Aug 01	Messrs. P. Hardcastle & C. le Roux, Provincial Department of Environment and Cultural Affairs and Sport, Western Cape Province.	Issues relating to security of the facility will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 24 and 28.
3.40.	Radioactive waste must be safely managed for the protection of human health and the environment. The safe management of all radioactive waste must be dealt with according to the comprehensive set of internationally agreed principles as established by the International Atomic Energy Agency (IAEA).	17-10-01	Mr. D. Louw, Director, Department of Health – Western Cape.	Comment noted. Aspects relating to radioactive waste management will be dealt with in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 24.
3.41.	An extensive environmental monitoring programme,	17-10-01	Mr. D. Louw, Director,	Comment noted. Emergency, safety

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	both on and off-site, including an overall site emergency plan for accidents, with regular exercises between the on-site emergency services and fire brigade should be instituted.		Department of Health – Western Cape.	and security matters will be addressed as part of the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1, 26, 27 and 28.
3.42.	The fact that pebbles will burn readily in air at temperatures above 800°C is of great concern. This assumes that the vessel will never fracture and that a fire is impossible. These assumptions are ludicrous and must be corrected. This adds substantively to the gases generally and specifically outside the reactor. The fact that chemicals will not react at room temperature is of little comfort, as they will be operating under temperatures of up to nearly 2000°C. No information regarding these issues is available and must be included in the EIR. In addition there is no secondary containment. The impact of an aircraft will expose the core and results in a catastrophic nuclear fire. This scenario makes a mockery of the proposed 400 m safety zone as well as the existing 5 km zone. …"not fracture easily" is an opinion and unsubstantiated. As the pebbles will be removed and replaced constantly, the potential for mechanical damage is high. This has been the problem with other similar reactors. More details must be provided for these assertions and opinions including full studies. The nuclear information shows that 30 possibilities exist for criticality per trip! This is unacceptable. The statement that "… a criticality accident cannot take place" is also an opinion and rejected. Reality dictates that this is indeed possible and must be	19-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	These safety related aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 28.

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	taken into account			
3.43.	We comprehensively reject the notion that a desktop study is adequate for potential impacts on local populations. We re-iterate our demand for a full and detailed epidemiological study.	19-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	Please refer to chapter 7 of the RFSR: issue number 29.
3.44.	Nuclear power is acknowledged to be unsafe, potentially to a totally unacceptable degree and the cause of cancers, genetic damage and is especially detrimental to HIV sufferers, the elderly, pregnant mothers and young children.	14-07-01	Messrs. E. A. Peackock, S. Peackock, J. H. Peacock, W. Peacock and A.M. Peacock, Affected Parties, Broederstroom.	Comment noted. The environmental impact assessment will determined whether there is any credible correlation between cancers and commercial nuclear facilities/reactors. Please refer to chapter 7 of the RFSR: issue number 28 and 29.
3.45.	Who will go into the radiation controlled zones, and how will they be protected from exposure?	14-07-01	Messrs. E. A. Peackock, S. Peackock, J. H. Peacock, W. Peacock and A.M. Peacock, Affected Parties, Broederstroom.	The people who will go into the radiation controlled zones shall be authorized Radiation Workers. Red Zones will be kept locked and entry to these zones will be strictly controlled by Radiation Protection (RP). RP will be responsible for the control of the keys for these zones. Entry to such a zone will require a Radiation Protection Certificate issued by a Senior Authorized Person (SAP) RP. When people enter a red zone, they shall wear the appropriate protective clothing and an RP monitor shall accompany them at all times. Eskom shall maintain occupational exposure to radiation As Low As Reasonably Achievable (ALARA) and way below the regulatory limits. The means of

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				reducing radiation exposure will be threefold, namely; Time: The time spent on the job in the radiation field shall be kept to a minimum. Distance: The distance between the worker and the source shall be kept as large as possible. Shielding: The gap between the source and the worker shall be occupied by a dense shielding material such as lead, concrete and water to reduce radiation to minimum levels.
3.46.	The issue of constant surveillance to prevent theft of hazardous materials by terrorist groups.	2-08-06	C T Garbett R C H Garbett	The PBMR DPP is a national key point with very stringent of security. Please refer to chapter 7 of the RFSR: issue number 28.
3.47.	What is the radiation hazard of the equipment that is removed from the site to be repaired by the OEM? What will the safety be during the times when these major components are being maintained?	14-07-01	Messrs. E. A. Peackock, S. Peackock, J. H. Peacock, W. Peacock and A.M. Peacock, Affected Parties, Broederstroom.	A decontamination plan will be developed for each item that will pose a radiation hazard during maintenance on or off site. The facilities in the decontamination workshop and the temporary decontamination system will be custom designed. If the component is too big or heavy to be transported to the central decontamination facility, it shall be decontaminated in temporary erected decontamination facilities. The extent of decontamination

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				required will be specified by RP as per the permitted levels of radiation after decontamination. This level shall be dependent on the subsequent activities to be performed on the item. After processing and decontamination clearance by RP to the level required, the item will be wrapped in plastic if required and transferred to the Equipment Handling System for transport to the next activity.
3.48.	Health Risk assessment must be done with respect to the plant, fuel, handling, transport, storage and disposal.	18-05-01	Messrs K Wiseman and E Weinronk, Cape Metropolitan Council: Department of Planning, Environment and Housing.	These aspects, with the exception of the fuel transport, will be assessed in the EIA phase. Please refer to chapter 7 of the RFSR: issues number s 28, 37 and 38.
3.49.	An independent ambient radiation monitoring network should be established in conjunction with the local authority to ensure adequate protection of the community.	18-05-01	Messrs K Wiseman and E Weinronk, Cape Metropolitan Council: Department of Planning, Environment and Housing.	Koeberg has an extensive radiation monitoring network that form part of the NNR licence requirement. The PBMR DPP will link into the existing system.
3.50.	Will additional control regulations be put in place for Pebble Bed?	18-05-01	Messrs K Wiseman and E Weinronk, Cape Metropolitan Council: Department of Planning, Environment and Housing.	Yes, the PBMR will require additional licensing by the NNR.
3.51.	Will the Pebble Bed be a separate safety issue?	18-05-01	Messrs K Wiseman and E Weinronk, Cape Metropolitan Council: Department of Planning,	The PBMR will have an independent safety case, and therefore independent safety assessment. As the off-site emergency requirements

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			Environment and Housing.	for this type of design are substantially less than that for a pressurised water reactor (such as the Koeberg reactors), any implications are more than adequately covered by the existing Koeberg site precautions.
3.52.	What will be the required medical intervention for public safety in case of an incident?	18-05-01	Messrs K Wiseman and E Weinronk, Cape Metropolitan Council: Department of Planning, Environment and Housing.	Preliminary indications are that the most extreme potential PBMR accident would not result in radiation levels at site boundary requiring any medical intervention. However, this aspect will be assessed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 26 and 28
3.53.	What safety measures would be put in place and how will they be maintained?	18-05-01	Messrs K Wiseman and E Weinronk, Cape Metropolitan Council: Department of Planning, Environment and Housing.	The design of the PBMR is specifically tailored to remove the need for "safety systems". The design clearly has certain features which are important to maintain for this level of safety to be achieved. The NNR license will lay down any activities needed to ensure this.
3.54.	The Housing Task Team expressed strong concerns relating to the issues of safety and any change of operation or use to any extension to the existing Koeberg Nuclear Power Station.	18-05-01	Messrs K Wiseman and E Weinronk, Cape Metropolitan Council: Department of Planning, Environment and Housing.	Health and safety aspects will be addressed during the EIA process. Please refer to chapter 7 of the RFSR: issue number 2, 24 and 28.
3.55.	Certain persons have contracted cancer while in the employment of Eskom. Eskom is allegedly withholding	9-11-05	Unknown participant	Eskom indicated that no employee at Koeberg has developed an

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	medical records from such employees at Koeberg. Can Eskom be trusted?			occupational related cancer as a result of Koeberg's operation. Employees have access to their personal medical records.
3.56.	Why does Eskom choose dangerous and potentially harmful technologies for demonstration? What will happen if the PBMR DPP is not feasible?	9-11-05	Unknown participant	Eskom does not choose dangerous and harmful technologies for demonstration. If the PBMR DPP is not feasible it will be decommissioned and dismantled. However, the health and safety aspects will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1, 11 and 23.
3.57.	What will happen if there is an (accidental) radioactive release from the PBMR and what contingencies are in place for Koeberg? There are allegations that Koeberg is not so safe and that the emergency plans are not sufficient.	10-11-05	Unknown participant	Koeberg is safe. Koeberg is benchmarked against international nuclear peer groups and operates within the NNR licence requirements. Nevertheless an emergency plan approved by the NNR and which includes the local authorities is in place and is regularly exercised and evaluated. However, the health and safety aspect will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1, 28 and 29.
3.58.	What if there is ingress of oxygen? Not convinced of the walk away safety of the plant. What about a scenario where the containment of the reactor is	17-11-05	Mr. Murphy	This issue is considered in the Safety Analysis Report of the Safety Case to be presented to NNR in terms of the

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	breached, even forcefully (9/11).			NNR/DEAT Cooperative Governance Agreement. However, the health and safety aspect will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 28.
3.59.	Safety Case put to NNR would not be accepted in other parts of the world.	17-11-05	Mr. Lakane	As a member state of the IAEA South Africa has to comply with its requirements. Therefore the NNR process adheres to international standards. However, the health and safety aspect will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 33.
3.60.	There could be a potential problem with uranium from a neurological point of view.	2-12-05	Ms. I. Waidje	There is no human exposure to uranium in the PBMR DPP.
3.61.	WESSA suggest that safety issues be carefully assessed in this EIA process, including risks from unpredictable catastrophic events and sabotage (recent events at Koeberg indicate that the latter is possible, if not likely).	6-03-06	WESSA Western Cape Region: Samantha Ralston (Environmentalist)	The health and safety aspect will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 28.
3.62.	Development must be socially, environmentally and economically sustainable: The generation and storage on site at Koeberg of high level nuclear waste which potentially poses a significant threat to human health and the environment cannot be considered sustainable.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	The health and safety aspect will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1, 24, 28 and 29.
3.63.	That a risk averse and cautious approach is applied	6-03-06	City of Cape Town: Keith	The issue of "opportunity cost" will be

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	which takes into account the limits of current knowledge about the consequences of decisions and actions: Locating a 'demonstration' plant adjacent to a large and growing city does not appear to be a risk averse or cautious approach. It is questioned whether it is wise or appropriate to 'test the operability, safety and maintainability of the integrated plant system' in an urban environment where there are growing human populations located 2 km away from the proposed plant and there is significant urban growth northwards (pg 45 of DSR indicates that there is growth north of Milnerton and Table View). The presence of the Koeberg Nuclear Power Station already creates an opportunity cost in terms of city planning and this will be further extended by the existence of the PBMR and the presence of radioactive waste on the site for an indefinite period. There does not appear to be any comparable nuclear plant elsewhere in the world at a similar scale and combination of technology components, which would enable a reasonable assessment of potential risk and impact. Page 119 of the DSR states that the proposed PBMR design is 'unique in its different feature components'.		Wiseman (Manager: Integrated Environmental Management) for City Manager	addressed within the context of spatial planning in the EIA phase. The health and safety aspect will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issues number 27 and 28.
3.64.	Responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity exists throughout its lifecycle: The potential costs of the PBMR and the lifecycle costs of storing and final disposal of nuclear waste must be assessed. Decommissioning of the PBMR and the final disposal of nuclear waste should	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	The health and safety aspect will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1, 28. and 29

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	be addressed in the EIA. The national Policy on Radioactive Waste and the agreement between DEAT and the NNR both provide a framework for the assessment of the potential impacts of the proposed PBMR throughout its lifecycle.			
3.65.	Assumptions of the Study: In the context of safety, a major deficiency in the DSR is its failure to provide for an assessment of the probabilities and consequences of a catastrophic event affecting the PBMR and/or the adjacent Koeberg. This is a mandatory relevant consideration in the assessment process under the legislation and also has been identified as a major concern in the White Paper. … Pursuant to s197(1) of the Constitution, all decision-makers have a duty to loyally execute the lawful policies of the government of the day.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	This issue has been included for assessment in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 28.
3.66.	The radiological / radiation issues and the NNR evaluation must be available to IAPs during the EIA phase. It is not acceptable that the NNR evaluation is made a condition of the RoD. IAPs will be unable to comment on these issues.	7-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	Radiological/radiation aspects will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 23. Comments on the cooperative agreement between DEAT and the NNR should be addressed to DEAT and the NNR.
3.67.	The radiological / radiation issues must be addressed in the EIA. The consultation between the NNR and DEAT must be open to public review and comment to ensure objectivity and public participation.	7-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services	Radiological/radiation aspects will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issues number 23 and 29. The co-operative agreement is a process indicated by DEAT and the

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			(Pty) Ltd	NNR and followed by the consultants. Comments on the cooperative agreement between DEAT and the NNR should be addressed to DEAT and the NNR.
3.68.	Full disclosure of potential hazards to "receiving" populations should be detailed and explained fully to those "receiving populations".	7-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	Radiological/radiation aspects will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issues number 23, 28 and 29. The EIA process is a public process and the EIR is a public document. Any impacts (hazards) assessed in terms of this process will be fully disclosed.
3.69.	The public should be aware of and given full details of the German PBMR accident that was the reason that Germany abandoned PBMR and is now phasing out nuclear technology.	7-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	Referring to your request we have found the following information: On May 4 1986 during the addition of absorber spheres to the THTR core, a fuel handling error caused the release of some radioactivity to the environment. The cause of the error was that the addition of these spheres was undertaken through manual manipulation of the various locks and the operator opened a valve before evacuating the lock. The resulting overpressure forced 0.5 cub meter of contaminated helium out of the fuelling system and through the stack. Due to the high background resulting from the Chemobyl accident on April 26, the release was only detected

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				during a weekly evaluation of the aerosol filter in the exhaust air. It was calculated that 4.6 x 10^{7}13g (.0013Ci) of long lived aerosols had been released. This amounted to 62% of the allowed daily maximum release limit. It was reported to the authorities and classified as not reportable. The calculated increase in soil activity was 0.1 Bq/m^2 which compares with the post Chernobyl measured activity of 50,00 Bq/m^2 (washed out by precipitation on May 3) and the normal background of 500 Bq/m^2. After false reports attributing the measured high values to the THTR the authorities ordered a shut down of the THTR on June 3, and the German government appointed a commission to investigate. The result of this study confirmed the THTR version and power operation was permitted again from June 13 1986.
3.70.	The ability of the applicant to manufacture fuel for the PBMR without defects was previously questioned by us as we understand that this was a problem with the previous HTR in Germany. We believe that this may pose a threat to the safety of the operation PBMR and believe that in depth research should take place in respect of the problems that German technology over decades was unable to overcome.	10-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	The issue of fire will be assessed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 28.

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	Fire hazards of PBMR fuel should be dealt with in detail.			
3.71.	How long after decommissioning will the level of radioactivity constitute a health hazard?	27-03-06	Wilhelm Alheit	Decommissioning includes a decontamination process. The radioactivity at the plant area will be decontaminated on dismantling.
3.72.	Failure to identify key issues: The LRC submit that key issues that should be described in the DSR include: The potential impact of the PBMR DPP on the operation and management of the existing Koeberg Nuclear Power Station in the event of an abnormal or emergency event at the PBMR DPP, and visa versa; The potential impact of the PBMR DPP on the environment in the event of a catastrophic incident.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	Safety and emergency aspects will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issues number 26, 27 and 28.
3.73.	I am worried that radiation maybe affecting my health and ask that a health study be done on communities near Vaalputs.	6-02-06	A W Pienaar M Goedeman A Darlington F Kordom J Kriel F Vries G Beukes I Saloma C Boyce	Safety and emergency aspects will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 23 and 29. The aspect of a health study at Vaalputs will be referred to NECSA.
3.74.	Can the waste be used to produce bombs or any other form of military application?	Undated	Anonymous	The PBMR DPP will be the very latest nuclear technology (Generation IV) and designed to have minimal impact. One of the principles Generation IV technology aspires to is to contain the

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				possibility of nuclear proleration.

4. EMERGENCY ISSUES

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4.1.	What is the "emergency zone" for the PBMR? As the most likely accident will result in burning graphite, radioactivity will be released via smoke and flames – the smoke could drift over several kilometres – have all these (potentially) affected communities been warned of the potential disaster and where would these people be housed in the event of an evacuation>	28-03-02	Mrs. C.T. Garbett, Director: Watt Props (Pty) Ltd. Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd.	It is intended, through the design of the PBMR, to have a 400 m radius exclusion zone (emergency zone) around the demonstration plant. Again, through the design of the PBMR, if things were to go very wrong, the worst that can happen is that the system will gradually cool down and stabilise at a safe temperature without any core failure or release of radioactivity to the environment.
4.2.	The PBMR does not need a huge containment vessel, as do the 'normal' reactors. They only use an air and watertight structure. In fact the PBMR can't function effectively without this thin-skinned container. The problem is that if the container is holed, the pebbles (chunks of carbon) will immediately ignite and burn fiercely due to the temperature in the vessel (900°C under normal conditions. Carbon ignites at 400°C and burns rapidly at 550°C). Thus a high power rifle or a shoulder fired rocket to penetrate the shell and cause a major contamination event. (Graphite burning went on for months at Chernobyl.) Additionally, the exclusion zone around a PBMR is only 400 m. Well within the reach of a high power rifle or shoulder fired rocket.	21-02-02	Ms. E. Weinronk, Review co-ordinator – Environmental Management Department: Cape Metropolitan Council Administration. City of Cape Town.	Because of its different characteristics, the PBMR does not have a high pressure sealed containment as with a Light Water Reactor such as Koeberg. The PBMR does, however, have a very solid double concrete building. The module building, which comprises the entire structure that houses the power plant and its ancillary systems, is designed to withstand significant external forces such as aircraft impacts and tornadoes. It is also highly resistant to explosions from potential saboteurs. The thickness of the reinforced concrete roof and walls (above ground level) of this structure is 1m. Within – and an integral part of – the module building, is the reinforced concrete containment, or citadel, that encloses the Reactor Pressure Vessel

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				(RPV) and the Power Conversion Unit (PCU). The thickness of the walls surrounding the RPV is 2,2 m. The PCU comprises the high- and low-pressure turbo-units, power turbine generator, a recuperator and coolers. It is also engineered, by geometry, to limit any air ingress into the reactor area, thereby preventing any potential for a graphite fire or major plant damage. The existence of such a substantial building, linked to the very slow evolution of this kind of event, allows adequate time (many hours or even days) to seal the building to stop air ingress. (Note that "seal the building" means, for instance, to close the door or put a plastic bag over a breach as there is not a differential pressure issue.
4.3.	There does not appear to be any published plan for dealing with the fire hazard risks when dealing with the graphite during the fuel manufacturing process. What other elements are located within the risk area of proximity that could exacerbate these fire hazards?	27-09-01	Messrs. RCH & TAHH Garbett, Ms. C.T. Garbett, Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd., The Karee Trust, Wat Props (Pty) Ltd.	Safety aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 26 and 27.
4.4.	What types of accidents are expected?	01-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	Safety aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 28.
4.5.	What organisation'(s) are involved in the disaster plan	Undated	Anonymous.	There is an extensive emergency plan,

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	for Koeberg?			which is tested every year by the South African National Nuclear Regulator (NNR) in terms of Koeberg's licence. The following organisations participate in the Koeberg emergency plan: ❖ EDF ❖ District sampling teams from Eskom ❖ Framatome ❖ SABC ❖ IAEA ❖ Portnet ❖ NECSA ❖ Taxi association ❖ NNR ❖ Golden Arrow bus company ❖ SANDF ❖ Cape Metropolitan Municipality & its various administrations ❖ SAPS ❖ Provincial Administration ❖ Tygerberg hospital ❖ Robben Island In the event of an emergency, people will be notified in the 16 km zone of Koeberg by means of fixed sirens and patrolling traffic vehicles. Radio Good Hope and other media are used to inform people in areas further than the 16 km zone.

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				The evacuation time is dependant on the levels of radiation that is being emitted by the station. Eskom has recently assessed the evacuation times for the population in the vicinity of KNPS. ❖ Evacuation times for the current population is as follows: ❖ Evacuation of population in 0-5 km: less than 1 hour. ❖ Evacuation of population in 5-20 km (Blaauwberg & Table View) approximately 4 hours ❖ Evacuation of population in 5-20 km (Atlantis) approximately 4 hours. Public Notification is an integral part of the Koeberg Nuclear Emergency Plan. The public is informed promptly upon declaration of a nuclear emergency. The public is informed to tune their radios onto the SABC KFM broadcast channel for information on the incident. Initial notifications are achieved via Omni-sirens (densely populated areas) and/or farm-sirens (on farms) and/or via traffic officers with PA systems (low density residential areas.)
4.6.	The Melkbosstrand Residents Ratepayers Association located very close to Koeberg, is concerned whether the emergency plans that have been in place for so long, are still effective?	12-10-00	Ms. S. M. la Grange. Member: Melkbosstrand Residents Association, Cape Town.	The emergency plan is tested every year by the NNR in terms of Koeberg's licence and revised and updated on a regular basis. Please refer to chapter 7: issues number

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				26 and 27.
4.7.	How would the PBMR activities impact on the present Koeberg emergency plan? Will there be any additional requirements or will the present plan cover the PBMR reactor?	08-02-01	Mr. H. Munnik, Assistant Director: Provincial Administration: Disaster Management, Western Cape.	If applicable, the NNR will set additional safety requirements. The EIA phase will address the aspect of emergency plan requirements for the PBMR DPP. Please refer to chapter 7 of the RFSR: issues number 236 and 27.
4.8.	What is the contingency plan if the reactor becomes unstable?	23-10-00	Mr. J.W.C Heineman, Town Secretary; Mr. M.K. Poo, Mr. G.H. Stemmer, Acting Head: Public Safety, Mr. L.T. Simpson, Auditor, Mr. S. Swart, Personnel Officer, Mr. J.L. Mynhardt, Electro-technical City Engineer, Mr. P.W.N. Nyembe, Acting Head: Community Services, Mr. E.V. Sweeny, Acting Treasurer, Mr. J.J. van Staden, Head of Department: Local Municipality of Madibeng, Brits.	Safety aspects will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 26 and 28.
4.9.	In terms of safety, the technology has built-in design and engineering weaknesses and there is no evacuation plan for Cape Town.	27-01-01	Mr. M. Kantey, Chairperson: Koeberg Alert, Cape Town.	The Koeberg emergency plan is tested every year by the NNR in terms of Koeberg's licence and revised and updated on a regular basis. This includes an evacuation process. Evacuation times for the current

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				population is as follows: ❖ Evacuation of population in 0-5 km: less than 1 hour. ❖ Evacuation of population in 5-20 km (Blaauwberg & Table View) approximately 4 hours ❖ Evacuation of population in 5-20 km (Atlantis) approximately 4 hours. The EIA phase will address the aspect of emergency plan requirements for the PBMR DPP. Please refer to chapter 7 of the RFSR: issue number 26 and 27.
4.10.	What is Koeberg's risk to the PBMR? Impact of emergency meltdown on PBMR reactor?	23-08-00 30-01-01	Representative from the Cape Metropolitan Council. (CMC), Cape Town. Mr. M. Louwrens, IAP, Cape Town (Durban public meeting).	This aspect will be assessed in terms of evacuation boundaries and exclusion zones. The probabilistic risk assessment forms part of the safety case that will be assessed by the NNR during the licensing process.
4.11.	Koeberg is built within a 5 km radius of an active geological fault. In the event of an earthquake, what safety precautions have been made for the waste on site? We are aware that the reactors themselves have been built on 'earthquake safe' foundations.	28-03-01	Ms. H. Kingwill, Freelance Journalist, Big Issue News, Cape Town.	This aspect will be addressed during the EIA phase, The issue will also be addressed during the Licensing process of the NNR. Please refer to chapter 7 of the RFSR: issue number 26 and 27.
4.12.	What would happen if the experiment does not work as planned?	23-10-00	Mr. J.W.C Heineman, Town Secretary; Mr. M.K.	This aspect will be addressed during the EIA phase.

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			Poo, Mr. G.H. Stemmer, Acting Head: Public Safety, Mr. L.T. Simpson, Auditor, Mr. S. Swart, Personnel Officer, Mr. J.L. Mynhardt, Electro-technical City Engineer, Mr. P.W.N. Nyembe, Acting Head: Community Services, Mr. E.V. Sweeny, Acting Treasurer, Mr. J.J. van Staden, Head of Department: Local Municipality of Madibeng, Brits.	Please refer to chapter 7 of the RFSR: issue number 11.
4.13.	Does Koeberg have an evacuation plan?	23-01-01 30-01-01	Mr. S. Cedile, Member: Masifundisane Environmental Group, Cape Town. (Milnerton public meeting). Mr. R. Makroti, Member: Goodlife Initiative Africa, Durban (Durban public meeting).	The Koeberg emergency plan is tested every year by the NNR in terms of Koeberg's licence and revised and updated on a regular basis. This includes an evacuation process.
4.14.	According to international standards, the whole of Cape Town would have to be evacuated in the event of a meltdown at Koeberg.	23-01-01	Mr. M. Kantey, Chairperson: Koeberg Alert, Cape Town. (Milnerton public meeting).	This would be true only if the meltdown could not be contained in the reactor containment building. Three Mile Island experienced a partial meltdown. Investigations after the accident show that there was no need to evacuate anyone from the area. This shows that the containment buildings do exactly

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				what they are designed to do – contain any radioactive releases.
4.15.	Does the NNR have an emergency plan in case something happened at a nuclear plant?	01-02-01	Attendant: Pelindaba public meeting	Yes, each nuclear facility has its own emergency plan.
4.16.	What will happen if an emergency takes place during peak hour traffic? How will people be notified and evacuated?	Undated	Anonymous.	People will be notified in the 16 km zone by means of fixed sirens, patrolling traffic vehicles, Radio Good Hope and other media.
4.17.	What will the impact of a disaster be on Khayalitsha?	Undated	Anonymous.	This aspect will be assessed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1 and 28.
4.18.	How far will the effects of a shock wave resulting from an explosion on site be felt?	Undated	Anonymous.	The PBMR DPP by itself cannot "explode", hence there cannot be a shock wave from the PBMR DPP.
4.19.	How many accidents have taken place at Koeberg?	Undated	Anonymous.	According to the International Nuclear Event Scale (INES) (from IAEA and NEA/OECD) there has been no "accidents". Levels 1 to 3 events are called "incidents" and only above level 4 are events referred to as "accidents". At Koeberg the highest level events were classified at level 2 (incidents) of which there have been two. As a comparison, Three Mile Island (level 5), Chernobyl (level 7), Tokai Mura (level 4) can be mentioned.

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				The INE scale is as follows: 7 - major accident 6 - serious accident 5 - accident with off-site risk 4 - accident without significant risk 3 - serious incident 2 – incident 1 – anomaly
4.20.	The effect on existing and future emergency planning procedures have not been addressed, or the effect of the PBMR on spatial planning, land use and potential health risks in the vicinity of Koeberg and throughout the City of Cape Town area.	18-05-01	Messrs. K. Wisemand & E. Weinronk, Cape Metropolitan Council: Planning, Environment & Housing – Environmental Management.	The PBMR will be operating under a nuclear license of the NNR which will have conditions specific for the design of the reactor. The fundamental design basis of the PBMR is to ensure there is not impact on population development outside the 400m emergency planning zone around the power station. This is due to the very limited activity of the worst-case release. The PBMR Itself has therefore no impact on off-site residential development and a negligible off-site health effect even under the worst accident conditions. Please refer to chapter 7 of the RFSR: issue number 2, 26 and 27.
4.21.	The existing evacuation plan for the Koeberg site needs to be re-evaluated in total. Include the following: Existing capacity of the road network that will be used during the evacuation. The required LOS for evacuation must be superimposed on the existing	18-05-01	Messrs K Wiseman and E Weinronk, Cape Metropolitan Council: Department of Planning, Environment and Housing.	The cumulative effective of the PBMR on the Koeberg site, is unlikely to change the scope and extent of the existing emergency plan and the restrictions on development in the area. This aspect will be discussed in the EIR in

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	network to determine the new capacity required. The capacity required must incorporate the future developments in the surrounding area. This implies that existing roads should be upgraded, new roads developed and alternative schemes implemented to accommodate the demand. The implication of this will be that if no adjustment is made to the existing affected road network, that future development in the West Coast area must be stopped.			terms of the co-operative governance agreement between DEAT and the NNR. Please refer to chapter 7 of the RFSR: issues number 26, 27 and 36.
4.22.	All major road links in the evacuation plan need to be addressed. The type of routes required must also be addressed.	18-05-01	Messrs K Wiseman and E Weinronk, Cape Metropolitan Council: Department of Planning, Environment and Housing.	Koeberg's emergency plan is re-evaluated every 18 months in consultation with external parties including the CMC. The NNR serves as the lead agent that governs this issue, in line with international standards (IAEA). It is the role of the NNR to evaluate and licence the PBMR demonstration plant. Please refer to chapter 7: Issues no 26 and 27.
4.23.	There seem to be no accountability towards the public in case of a Nuclear Disaster	18-05-01	Messrs K Wiseman and E Weinronk, Cape Metropolitan Council: Department of Planning, Environment and Housing.	This not true. There is an extensive and regularly update emergency response plan in pace for Koeberg.
4.24.	It is irresponsible to develop another reactor on a fault and so close to the city of Cape Town, who would not be able to evacuate on time in case of seismic activity?	30-01-01	Mr. M. Louwrens, IAP, Cape Town (Durban public meeting).	Health and safety aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1, 26, and 27.

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4.25.	Total infrastructure is unable to deal with an emergency.	14 Dec 05	Mr. W. de Pinho	Viewpoint noted. Please refer to chapter 7 of the RFSR: issues number 26 and 27.
4.26.	What responsibility does Eskom take if things go wrong with the PBMR DPP?	9 Nov 2005	Unknown participant	Eskom is and remains responsible for all of its power stations, which will include the PBMR DPP. In addition, the NNR Act requires Eskom to have liability insurance therefore the insurer underwrites the risk and not the South African government. Eskom has an insurer and will fund the proposed PBMR DPP proportional to the share that they hold.
4.27.	Will the PBMR be able to withstand a direct hit from a commercial airliner?	Various	Various IAPs	The reinforced concrete building, which has a double barrier around the Reactor Pressure Vessel and Power Conversion Unit, ensures that, irrespective the potential economic damage to the plant caused by the aircraft (for example a Boeing 777-200) impact and subsequent aviation fuel fire, the main reactor vessel containing the fuel will stay intact and protected from the fire. This ensures that public safety is maintained even without early intervention. Please refer to chapter 7 of the RFSR: issues number 28.
4.28.	Following the 11th September attach on the World Trade Centre, what precautions have been taken at Koeberg against thousands of litres of burning	Unknown	Messrs D Holm, J Walmsley and others.	The question of burning aviation fuel destroying the <u>intake ventilation filtration</u> is not a significant concern. The filters

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	(nuclear) fuel being drawn into the air intakes and destroying the filters before anything could be shut down?			that take fresh air into the nuclear auxiliary building only perform a function of filtering out particulates such as sand or salt in the air. If these filters were totally destroyed, there is no short-term or even medium-term safety concern. The main problem would be the ingress of smoke into the building that would be sucked into the building via the fans. These fans can be remotely stopped if necessary, and would be tripped by the operators in the event of such a requirement. From a nuclear safety perspective, it is the building's exhaust filters that are important, as they protect the public from a release. These filters are deep inside the nuclear auxiliary building and are unlikely to be impacted by a fire outside the building. It should also be noted that these filters are all duplicated into train A and train B to provide additional redundancy[12]. The containment building is likewise completely separated from the external environment by its own ventilation systems that are likewise remotely operated. These systems are also designed to totally isolate during any

[12] This method of providing independent backup to safety related systems are essential and common practice in nuclear installations.

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				nuclear event as per the containment isolation safeguard function, and hence the plant can function indefinitely with the sealed containment building. It has therefore not been necessary to undertake development of any special operating procedures or any special modifications to the intake or exhaust ventilation systems for the plant to combat a large external fire. Please refer to chapter 7 of the RFSR: issues number 28.

5. TECHNICAL ISSUES

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5.1.	It is important to note that the PBMR has safety and waste minimisation factors that represent large improvements over current water-cooled reactor (LWR) technology. The PBMR converts 44% of the nuclear energy to useful electricity, compared to 32% in normal water-cooled reactors. Furthermore, the process used in fuelling the PBMR makes much more effective use of neutrons generated from fission reactions, so that fewer long-lived heavy elements are produced per unit of energy generated. The combined effect is approximately a factor 2 reduction in high-level waste. The graphite fuel form is extremely inert. Tentative data suggests that corrosion rates may be as low as 1 mm per billion years, so that following placement in corrosion-resistant canisters in a deep geologic repository, essentially no releases could occur through the 10 mm thick graphite layer that covers each pebble.	04-10-01	Prof. PF Peterson	Comment noted.
5.2.	Concrete (or the quartz within it) begins to decompose at 900°C, which is well within the temperature range of jet A1 fuel. This would scald concrete, expose the reinforcing, and result in loss of containment.	Unknown	Mr. M Webber, Fire and Emergency Services, Durban Metro.	"The reinforced concrete building, which has a double barrier around the Reactor Pressure Vessel and Power Conversion Unit, ensures that, irrespective the potential economic damage to the plant caused by the aircraft (for example a Boeing 777-200) impact and subsequent aviation fuel fire, the main reactor vessel containing the fuel will stay intact and protected from the fire. This ensures that public safety is maintained even without early

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				intervention."
5.3.	There is a need to determine the seismic acceleration and compare this with the requirements for the PBMR plant.	19-03-02	Prof. P. Lloyd and Messrs. J. Walmsley and M. Longden-Thurgood	Indications are that a standardized structural design has been adopted for the PBMR, such that without modification, it will be marketable in all areas of the world, except those of most extreme seismic activity. The seismic value chosen to envelope 80% of all sites worldwide is 0.4 g horizontal acceleration. The seismic conditions at the proposed Koeberg site require a 0.3 g capability, and therefore pose no problems for the proposed demonstration plant. However, this aspect will be assessed during the EIA process. Please refer to chapter 7 of the RFSR: issue number 18.
	Why can't nuclear fuel for the PBMR be imported from somewhere?	03-04-02	Ms. D Ayers, Delta Environmental Centre.	There are no other manufactures of the PBMR fuel in this scale.
5.4.	If the project is successful what would the concentration of PBMRs be, where would they be built?	03-04-02	Clr. S. Kotze, Ward Councillor – City of Johannesburg.	This would only be an issue for discussion if and when the PBMR technology has proven itself as a possible option within the whole electricity planning in terms of supply side options.
5.5.	Other problems in West Germany included "bolt head" failures in the rector's gas channels. What steps have been taken to prevent similar failures?	28-03-02	Mrs. C.T. Garbett, Director: Watt Props (Pty) Ltd. Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd.	Indications are that the current PBMR design does not have any bolted gas ducts or other components that can be subject to radiation induced stress cracking.

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				However, safety matters will be addressed during the EIA process. Please refer to chapter 7 of the RFSR: issue number 28
5.6.	We understand that there will be no containment building for the PBMR. If not, what will provide the community with a last line of defence in the event of a radiological release following an accident?	28-03-02	Mrs. C.T. Garbett, Director: Watt Props (Pty) Ltd. Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd.	Because of its different characteristics, the proposed PBMR demonstration module does not have, a high pressure sealed containment as with a Light Water Reactor (LWR) such as Koeberg. The PBMR does, however, have a very solid double concrete building. The module building, which comprises the entire structure that houses the power plant and its ancillary systems, is designed to withstand significant external forces such as aircraft impacts and tornadoes. It is also highly resistant to explosions from potential saboteurs. The thickness of the reinforced concrete floor and walls (above ground level) of this structure is 1 m. Within – and internal with – the module building, is the reinforced concrete containment (or citadel) that encloses the Reactor Pressure Vessel (RPV) and the Power Conversion Unit (PCU). The thickness of the walls surrounding the RPV is 2,2 m. The PCU comprises the high- and low-pressure turbo-units, power turbine generator, a recuperator and coolers. It is also engineered, by geometry, to

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				limit any air ingress into the reactor area, thereby preventing any potential for a graphite fire or major plant damage. The existence of such a substantial building, linked to the very slow evolution of this kind of event, allows adequate time (many hours or even days) to seal the building to stop air ingress. (Note that "sealed building" means, for instance, to close the door or put a plastic bag over a breach, as there is no differential pressure issue.) On of the PBMRs key safety characteristics, as contained in its Safety Case Philosophy, are the all-ceramic fuel elements, of well-proven design, to ensure effective containment of fission products up to extremely high temperatures. Please refer to chapter 7 of the RFSR: issue number 28
5.7.	The PBMR also has unique safety features that are both robust and simple. The fission reactions shut off automatically if the core temperature rises above the normal operating temperature, and the systems that remove the residual heat have no moving parts and are always operating. The reactor systems are protected from external events by a robust reinforced concrete structure, which is partially below-grade. These features make the safety of the PBMR substantially simpler to analyse and demonstrate than for water-cooled reactors.	04-10-01	Prof. P. Petersen, Department of Nuclear Engineering, University of California.	Comment noted. Please refer to chapter 7 of the RFSR: issue number 28.

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5.8.	There is concern about the growing amount of irradiated fuel elements, which are additionally stored at Koeberg, adding to the current nuclear storage burden on site.	03-10-00	Mr. R. M. Longden-Thurgood, Representative: Institution of Nuclear Engineers South Africa Branch, Cape Town.	Issue for attention of the NNR during the licensing process.
5.9.	Are Koeberg and the surrounding area safeguarded the emissions of Strontium S90?	22-01-00	Prof. B. de Villiers, University of Stellenbosch. Mr. M. Kantey, Chairperson: Koeberg Alert, Cape Town.	Issue for attention of the NNR during the licensing process.
5.10.	How can one overcome monitoring of ambient radiation in real time?	23-08-00	Messrs. J. Minnie, G. Laskey, F. Schlaphoff, Disaster and Emergency Services: Cape Town. H. Linde, Pollution Control: Cape Metropolitan Council (CMC). Mr. H. Schrader, Municipal Health Services, Cape Metropolitan Council (CMC). Messrs. Z. Toefy, S. Granger; Ms. E. Weinronk; K. Pavers, Environmental Management Department: Cape Metropolitan Council (CMC). Mr. K. Hennessy, Spatial Planning: Cape	Monitoring of ambient radiation in real time may be achieved by continuous monitoring by radiation instruments. The ambient radiation measurements may be recorded in real time on chart-recorders for future reference. Please refer to chapter 7 of the RFSR: issue number 23 and 29.

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			Metropolitan Council (CMC). Mr. P. Tomalin, Cape Metropolitan Council (CMC).	
5.11.	Should the PBMR not be tested under sub optimal conditions rather than best case (i.e.: air rather than water-cooled) and were inland sites looked at all?	23-08-00	Messrs. J. Minnie, G. Laskey, F. Schlaphoff, Disaster and Emergency Services: Cape Town. H. Linde, Pollution Control: Cape Metropolitan Council (CMC). Mr. H. Schrader, Municipal Health Services, Cape Metropolitan Council (CMC). Messrs. Z. Toefy, S. Granger; Ms. E. Weinronk; K. Pavers, Environmental Management Department: Cape Metropolitan Council (CMC). Mr. K. Hennessy, Spatial Planning: Cape Metropolitan Council (CMC). Mr. P. Tomalin, Cape Metropolitan Council (CMC).	Proposed siting was done at a location of optimal conditions/site to enable simulation of sub-optimal conditions. However, the inverse is not true.

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5.12.	Why does the PBMR need to be built on the coast if it is not water-cooled?	28-03-01	Ms. H. Kingwill, Freelance Journalist, Big Issue News, Cape Town.	PBMR reactors do not, per se, need to be built on the coast. The PBMR DPP is proposed for Koeberg because Koeberg is the preferred site for the PBMR DPP. Please refer to Section 6.4 of the RFSR.
5.13.	Can the water become contaminated during cooling?	26-08-00	Attendant: Pelindaba Open Day.	Sea water can not become contaminated. It is very unlikely that intermediate cooling water can become contaminated. Plant wash water could be contaminated, but the plant operations provide for testing and disposal.
5.14.	The safeguard ability of the PBMRs during their operational cycle is not known. The safety challenges presented in the PBMR should be reflected in the documentation.	13-10-00 02-10-00	Mr. S. Thorne. Director: Energy Transformation CC, Cape Town. Afrikaanse Handelsinstituut, Bellville, Cape Town.	Safety and related aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 28.
5.15.	The PBMR should be planned to accommodate extreme and adverse weather conditions for the worst-case scenario.	26-05-01	Ms. L. McDaid, Member: Koeberg Alert, Earthlife Africa, Western Cape, Cape Town and also a Member of Koeberg Alert, Cape Town.	Emergency and safety aspects will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 16.
5.16.	Can the PBMR explode?	02-09-00	Attendant: Pelindaba open day.	Indications are that the PBMR, due to its specific design criteria, can not explode. Please refer to chapter 7 of the RFSR: issue number 28.

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5.17.	How far do Beta emissions go?	Undated	Anonymous.	Alpha, beta and gamma radiation as well as neutrons are emitted. Alpha rays are shielded by a piece of paper or the dead layer of the skin. Beta rays are shielded by a piece of thin metal or plastic plate. Gamma rays are similar to X-Rays but generally of higher energy. Depending on the energy they can be shielded by thin to massive layers of lead, steel or concrete. Neutrons are neutral particles that relatively easily pass through higher density material such as steel or lead but get scattered or moderated by lighter material such as concrete, wax or water. These lighter materials are used for shielding neutrons.
5.18.	What is the level of radiation at the filters?	Undated	Anonymous.	Very low and is managed as low level waste.
5.19.	Could you provide the name of a contact person explaining the negative temperature effect on heat generation during a coolant failure?	17-01-01	Dr. B. Jager, Process Development Consultant, SASOL: SASTECH, Sasolburg.	Tom Ferreira, PBMR company.
5.20.	Will the PBMR only be switched on during peak demand hours?	23-10-00	Mr. J.L. Mynhardt, Electro-technical Engineer, Local Municipality of Madibeng, Brits.	No. This is a Techno-economical feasibility evaluation. Different scenarios will be evaluated.
5.21.	What is the exact treatment for effluent and how	27-09-00	Mr. R. Worthington, Branch	Issues relating to effluent management

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	does this compare to international standards?		coordinator, Earthlife Africa, Johannesburg.	(hazardous and non-hazardous as well as radioactive) will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 24.
5.22.	Is there a one-to-one correspondence between the production of SR-90 and Ce-137 and pressurised water reactors?	07-05-01	Mr. M. Kantey, Chairperson: Koeberg Alert, Cape Town.	None. These substances are used in a number of applications other than PWRs
5.23.	Who is the overseas supplier of the enriched uranium oxide?	12-02-01	Ms. G. P. Watkins, Member: Earthlife Africa, Durban.	This has not yet been determined. The choice will be based on economic principle.
5.24.	How do we determine whether micro filtering is required?	19-01-01	Representative of the Department of Environmental Affairs and Tourism (DEAT).	This aspect is part of the safety assessment of the NNR.
	Intrigued by the removal of heat from the reactor during cooling failure.	17-02-01	Dr. B. Jager, Process Development Consultant, SASOL: SASTECH, Sasolburg.	Heat removal is a passive feature. Heat loss through radiation and convection is greater than heat production in the PBMR.
5.25.	Will the pilot plant become operational?	18-09-00	Mr. M.A. Ranoszek, General Manager: Pioneer Natural Resources of South Africa, Cape Town.	Yes. In its demonstration life cycle, the PBMR will generate electricity for the national grid.
5.26.	Would like information on: the level of radioactivity, expressed in becquerels per kilogram; the type of radiation emitted; the thermal power, expressed in kilowatts per cubic metre; the half-life; and the decay period to harmless levels.	18-09-00	Mr. M.A. Ranoszek, General Manager: Pioneer Natural Resources of South Africa, Cape Town.	This aspect is described in the scoping report. Please refer to chapter 7 of the RFSR: issues number 23 and 25.

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5.27.	Design stability should be a focus point.	28-09-00	Prof. B. de Villiers, University of Stellenbosch.	Comment noted.
5.28.	What are the physical dimensions of the PBMR?	27-09-00	Mr. F. Bekker, Director: Safrich, Johannesburg.	This aspect is described in the scoping report. Please refer to section 4.7 of the RFSR.
5.29.	How does the cooling mechanism of the PBMR work?	27-09-00	Mr. F. Bekker, Director: Safrich, Johannesburg.	This aspect is described in section 4.4 and 4.5 of the RFSR.
5.30.	What happens after the lifetime of the PBMR demonstration reactor is complete?	29-09-00	Professors K. Bennett and A.T. Bennett, University of Cape Town; Messrs. A. R. Kenny, Research Officer, Department of Mechanical Engineering, University of Cape Town (UCT); Messrs. T. Cloete and D. Findeis, Department of Mechanical Engineering, University of Cape Town (UCT).	It will be decommissioned, decontaminated, dismantled and disposed of.
5.31.	Is this technology developed locally or is it brought from elsewhere?	26-08-00	Attendant: Pelindaba Open Day.	The base technology has been developed in Germany, but the application thereof in the PBMR DPP is locally developed.
5.32.	How does the reactivity control cycle work?	26-08-01	Attendant: Pelindaba Open Day.	This aspect is described in section 4.4.2 of the RFSR.
	What happens if the helium cycle gets a leak and oxygen penetrates the pressure chamber?	26-08-001	Attendant: Pelindaba Open Day.	Air ingress into the reactor will be addressed in the EIR.

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5.33.	Who started the pebble bed technology?	02-09-00	Attendant: Pelindaba open day.	The late Prof. Schulten, Germany.
5.34.	Why is it called a pebble bed?	02-09-00	Attendant: Pelindaba open day.	It is called pebble bed after the tennis ball-sized fuel balls that resemble a bed of river pebbles.
5.35.	How many pebbles are there in the reactor?	02-09-00	Attendant: Pelindaba open day.	Indications are that there are: 452 000 fuel spheres, of which about 110,00 is graphite spheres.
5.36.	How long does the spent fuel pebbles last when stored? Where will they be stored and what ultimately will happen to them?	9 Nov 2005		The spent fuel will be stored on site in the specially constructed tanks within the reactor building for the life of the station i.e. 40 years plus. The coating around the uranium kernels are made of materials that will virtually last indefinitely. These coatings retain the radioactive materials within the pebbles and allow the pebble to cool down radioactively as well as thermally. The ultimate destination of the pebbles will be determined by National Policy on Radioactive Waste.
5.37.	Would more pebbles be used, and would the pebbles be redesigned?	15-03-06	Mashiule Phalane – ELA Fix number	More pebbles would be used. The pebbles are the same as would be used for the 302 MW(t) process.
5.38.	Can a PBMR replace Koeberg?	02-09-00	Attendant: Pelindaba open day.	The pebble bed modular reactor will not replace Koeberg. It could supplement electricity supplies in the Western Cape. At the end of Koeberg's life, a sufficient number of PBMR power plants could

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				replace its generating capacity.
	What is the gross efficiency of the plant?	02-09-00	Attendant: Pelindaba open day.	At this stage of the design, indications are that the gross efficiency is in the order of 40%
5.39.	What are the advantages of gas cooling to water-cooling?	02-09-00	Attendant: Pelindaba open day.	The use of helium, rather than water as the coolant, allows high operating temperatures to be achieved, which means that the plant is more efficient, as efficiency increases with temperature. The single (gaseous) phase in the helium-cooled system avoids the use of costly additional support systems. (Water cannot be used in this process.)
5.40.	Where does the water-cooling process take place?	02-09-00	Attendant: Pelindaba open day.	Please refer to the Brayton Cycle in the document Please refer to section 4.3.8 in this regard.
	How long does it take to increase the temperature from 900 degrees to 1600 degrees?	02-09-00	Attendant: Pelindaba open day.	This is an unlikely scenario's or abnormal events for the temperatures described, and would take a day or more to reach such temperatures.
5.41.	What happens when the water and waste is separated?	02-09-00	Attendant: Pelindaba open day.	Contaminated water is evaporated and the concentrated residue is treated.
5.42.	Is this technology appropriate for our country?	02-09-00	Attendant: Pelindaba open day.	
5.43.	Has helium been tested in a PBMR?	06-02-01	Mr. P. Lukey, Member: Earthlife Africa,	There are no other energy generators of this specific type. However, a reactor

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			Johannesburg. (Johannesburg public meeting).	has been developed in Germany. Helium in a direct cycle has been used with heat produced by non-nuclear means.
5.44.	Is it feasible to run a turbine on helium? Availability and cost of helium.	17-11-05	Mr. Murphy	Helium operated turbines have been built and operated and have been proven to work well.
5.45.	Without the nuclear part, only the helium powered turbine/generator is demonstrated. Is this of value?	17-11-054	Mr. Murphy	The DPP will demonstrate the integrated performance of reactor and the turbine for the efficient use of helium as a heat transfer agent.
5.46.	What does PBMR mean?	Undated	Anonymous.	The PBMR Technology is a high temperature, helium cooled nuclear electricity power generation technology with specific intrinsic safety features, tried and tested overseas but not yet investigated in South Africa. It is called pebble bed after the tennis ball-sized fuel balls that resemble a bed of river pebbles.
5.47.	What will the output of the demonstration module be?	Undated	Anonymous.	The output of the proposed PBMR DPP will be 400 MW(t)
5.48.	Are mixed oxide fuels going to be used in the PBMR?	Undated	Anonymous.	No.
5.49.	What is the normal commissioning time for a coal fired power station vs. a PBMR?	Undated	Anonymous.	Ten years vs. 4 to 6 years
5.50.	Do local educational institutions have the capacity to provide skilled staff to the PBMR?	Undated	Anonymous.	Yes
5.51.	Is the PBMR water-cooled?	Undated	Anonymous.	The PBMR DPP is helium cooled.

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5.52.	What is the lifetime of a reactor?	Undated	Anonymous.	The lifetime of a typical reactor is 40 years
5.53.	How does the turbine / electrical control cycle work?	Undated	Anonymous.	Electricity is generated by a direct-cycle helium turbine. Helium gas is heated in the reactor core to 900°C, and passes directly to the turbine, where its thermal expansion is transformed into rotational motion driving the electrical generator. The expanded helium is recycled into the reactor core by two turbo-compressors. Waste heat can be removed either by water cooling or air cooling.
5.54.	Is the turbine technology current, or must it be developed from scratch?	Undated	Anonymous.	The technology is well proven, although the techno-economical aspects and commercial application potential must be assed. There are also detail design aspects that have evolved from the original designs.
5.55.	What is the optimum grid arrangement?	Undated	Anonymous.	An optimum grid arrangement is based on economies of scale and is one in which the cost to produce the electricity and the cost to transmit the power to where the demand for the electricity is required, is in close proximity. An optimum grid is developed and maintained based on the evolutionary change in the demand for electricity and where this demand is required.

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5.56.	How do you measure the energy left in a pebble?	Undated	Anonymous.	The reactor will be continuously replenished with fresh and useable fuel from the top, while used fuel is removed from the bottom. When a pebble leaves the reactor it is analysed by means of a radiation sensor to determine whether it is fuel or graphite. Thereafter the fuel spheres are analysed by means of a burn-up measuring device to determine its level of burn-up, i.e. the remaining amount of U-235. If the pebble still contains a usable amount, it is returned to the reactor at the top for a further cycle.
5.57.	How can the reactor be decommissioned?	Undated	Anonymous.	Shutting the reactor down, removing the fuel, decontaminate the structure and dismantle.
5.58.	The design of the plant is evolving and will be left to a significant degree to outside contractors, which introduces uncertainties beyond Eskom's control.	Undated	Anonymous.	All contractors engaged in the construction phase, will be required to comply with the quality requirements as defined in the ISO 9000:1994 Quality Management Systems series. It will be a contractual requirement for all contractors to work in accordance with a formal quality plan, approved by PBMR (Pty) Ltd, Eskom and the National Nuclear Regulator (NNR). Formal audits and surveillances will be scheduled to monitor compliance with the formal quality plans. These will be conducted by the Contractor, as well as PBMR,

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				Eskom and the NNR.
5.59.	The use of a non-nuclear test to prove the effectiveness of the PBMR will not necessarily prove the operating performance of the components, which will experience high temperatures and thermal stresses in operation.	Undated	Anonymous.	Cold commissioning only refers to the absence of nuclear fuel. Helium will then be heated by electronic elements.
5.60.	Can the technology be made "smaller" – can it be brought down to the level that it can be placed in a home?	Undated	Anonymous.	Yes, size can be reduced but not recommended for household use.
	Are there any limitations on the size of a PBMR?	Undated	Anonymous.	The size of the plant has been optimised for the DPP. The operating experience of the DPP will confirm whether its current size is optimal. In theory there is no limit to what the size of the plant can be designed for it.
5.61.	Is nuclear defined as a renewable source?	Undated	Anonymous.	No.
5.62.	Will this reactor operate in the same manner as the current reactor at Koeberg?	Undated	Anonymous.	No. This is a PBMR reactor using helium as energy transfer medium, whilst Koeberg is a water cooled rector.
5.63.	How will the actual reactor operate?	Undated	Anonymous.	Please refer to section 4.3.8 of the RFSR.
5.64.	Where will the fuel be stored and how will the decontamination process take place?	Undated	Anonymous.	High radioactive waste will be stored on site at Koeberg, whilst intermediate and low level radioactive waste is proposed to be stored at Vaalputs. Please refer to section 4.3.8 of the RFSR. Decontamination is the removal of contaminents from an object, which can involve washing, treatment of wash

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				water, and disposal. Other means can include the use of ultra sonics or mechanical scrubbing.
5.65.	Why use the term demonstration model?	23-08-00	Messrs. J. Minnie, G. Laskey, F. Schlaphoff, Disaster and Emergency Services: Cape Town. H. Linde, Pollution Control: Cape Metropolitan Council (CMC). Mr. H. Schrader, Municipal Health Services, Cape Metropolitan Council (CMC). Messrs. Z. Toefy, S. Granger and Ms. E. Weinronk; K. Pavers, Environmental Management Department: Cape Metropolitan Council (CMC). Mr. K. Hennessy, Spatial Planning: Cape Metropolitan Council (CMC). Mr. P. Tomalin, Cape Metropolitan Council (CMC).	The PBMR DPP will be used to demonstrate techno-economical feasibility and commercial applicability.
5.66.	What are the international trends?	23-09-00	Messrs. D. Murray, Chairperson: Urban Planning and Environment;	There are indications of an international move towards nuclear as electricity

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			Blaauwberg Administration, City of Cape Town. D. Stoffberg, D.C. Bettesworth, Town planner, Blaauwberg Administration, City of Cape Town; R. Rodman; Ms. P. Titmus, Cape Town.	generator.
5.67.	Would the PBMR be an independent generator?	Undated	Anonymous.	No.
5.68.	What are "internationally acceptable standards? Is there an international body that decides upon these standards? Are they truly global standards, are they serving the interests of the nuclear industry, or, are they independent, and upon what basis are these standards arrived at?	02-05-02	Mrs. C.T. Garbett, Director: Watt Props (Pty) Ltd. Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd.	There are several international bodies that set relevant standards. The International Atomic Energy Agency (IAEA) is a United Nations Agency and as such has worldwide membership. Experts from many countries representing academic institutes, government, medical institutes, regulatory bodies and nuclear industry are involved. The IAEA promotes the peaceful use of nuclear technology in medicine, agriculture, industry etc. They have a whole section devoted to nuclear safety that continually monitors safety trends, proposes improvements, designs standards. These take several years to approve through a set of international workgroups and committees. Findings are presented at international conferences. Similarly, the International Commission on Radiological Protection (ICRP) is the body that recommends dose limits for

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				workers and the public. Their makeup is similarly wide as the IAEA. Their recommendations are adopted formerly by regulatory authorities of governments and passed into legislation sometimes with modification in individual countries. The recommendations after review are also adopted by World Health Organisation, the Agriculture and Food Organisations and passed into drinking water standards. By this it can be seen that the worldwide community interests are served by internationally acceptable standards.
5.69.	What are the un-desirable by-products that are being spoken about (as part of the process at the PBMR)? What will the effect of these be on the system? How will these products be removed from the system? What will they be composed of? To what degree will they be contaminated? Where will they be stored or disposed of once removed from the system?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	Undesirable by-products are chemical elements and compounds like hydrogen, methane, oxygen etc. If not removed they can cause, in the long run, deterioration of some materials used in the reactor. These products include some radioactive isotopes like tritium. They are removed and released as part of the wastewater returned to the sea.
5.70.	What is the safety margin on the steel containment vessel? It is our understanding that there could very well be a tendency for vibrations and oscillations to occur in the reactor core. What allowance has been made for mechanical wear of the graphite layer and then the core? What will happen if the graphite layer deteriorates or collapses, closing the passages for the	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	The pressure vessel will be designed and manufactured to internationally accepted standards for nuclear pressure vessels. These codes have made provision for large safety margins. There is no expectation of vibration problems in gas cooled reactors,

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	reactivity control units?			particularly not in the core. The graphite is expected to last the lifetime of the plant, but provision is made for midlife replacement of graphite layers most exposed to radiation. The graphite properties exclude a collapse of the material surrounding the control rod borings during the lifetime of the plant.
5.71.	When unloading the reactor, the fuel will be cooled with water. It is our understanding that the graphite will burn when it comes into contact with water. This could happen if the cooling jacket on the storage tank or the storage tank developed a hole or defect. What will happen if the cooling system used fails during the temporary storage	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	The fuel will never be cooled with water although the jacket of the used fuel tank is water cooled for the times of once every 12 years for 3 months when work on a defuelled core might be necessary. The used fuel tank will be inspected for water tightness before defuelling takes place. Water will not react with graphite when the temperature is below 800 deg C., a temperature not expected to be reached during storage.
5.72.	What happens if the "wrong" spheres are on the inside, or on the outside, of the core? I.e. if only active pebbles are in the core, or the positions of active and normal pebbles are reversed?	Answer provided on 22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	The design makes a wrong loading basically impossible. If a deviation occurs it will be noticed by operating parameters and the necessary correcting action taken or the reactor shut down.
5.73.	Control rods: Can the proposed control rods: Bend? Overheat? Stick? Break? What would the consequences of each of these be? What would the consequences of multiple failures be?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	Modes of control rod failure are considered in the designed and mitigation is introduced.

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5.74.	What would happen if the fuelling and de-fuelling system were to fail? What would happen if the fuel was subjected to significant mechanical wear? This could well compromise the containment of the fission products in the fuel. If the fission products were released from the fuel, the Helium would carry these products through the system, despite the nuclear transparency of Helium.	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	If the fuelling/defuelling system fails the reactor will lose power and shut down after a few weeks due to lack of fresh fuel. If fuel spheres undergo excessive wear they are discarded long before the fuel region of the spheres are exposed. There will always be a small fraction of the fuel particles that have damaged or failed coatings. Thus there will always be some fission products entering the coolant. These products will settle in the system and present a maintenance problem of known proportions. High quality in the design refers to the combination of design codes to be used, safety margins, skilled analysts and design reviews by peer groups, including overseas experts.
5.75.	This reactor will be installed in Africa. What will happen to the heat dissipation capacity if the ambient temperature were to rise significantly, to say 35 – 40°C?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	The reactor is designed for much higher ambient temperatures than Koeberg's. At temperatures above 30 deg C the efficiency will drop. The cooling water temperature has no influence what so ever on the fuel temperature.
5.76.	Why is there no "leak tight" requirement? What are the potential consequences of this, under all possible conditions, including multiple failures? What is the exact level of "gas borne activity? Quality and quantity. What portion of this activity is deposited? Per annum? What volumes may be	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	A leak tight requirement exists for LWRs as there is a finite chance for core damage with large releases to the containment. The PBMR is designed with the particular purpose of eliminating a core damage scenario. At the same

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	released into the reactor buildings? What are the levels of radioactivity of these? Will they escape into the outside environment? If the radiation released from the reactor is in a gas phase, how will the filters capture this radioactivity?			time the low radioactive inventory of the coolant also excludes large releases of such material in depressurisation events. Thus a containment system that allows venting of overpressure with the ability to close afterwards presents a better solution. Radiation releases from events are discussed in the SAR. Iodine is the main constituent that is biologically active. It is in the form of an aerosol and can be filtered successfully by an active charcoal filter. The other gaseous releases are mainly noble gases and C-14 with low biological effects.
5.77.	What are the impacts of fuel being overloaded? What happens if the wrong proportions of fuel spheres are placed into the core? How efficient are the control rods? How many movements will they make per annum? What is the anticipated failure rate of the rods? What will happen to the odd-shaped particles? Control of heat removal: "SBS and CCS are active systems" – how are these run? What plans are there to back these up?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	These aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 28.
	How could it happen that fuel could be 'erroneously loaded' into the graphite sphere system? What could damage the spheres? It has been repeatedly stated that these spheres can take all the punishment you anticipate.	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	These aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR : issue number 28.

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	"Irradiation experiments on fuel elements" Have these been carried out, or are they proposed? What are the results, and if not yet carried out, will the results be available? The "direct contact or closeness to neighbouring particles" implies that all the pebbles will be within this risk scenario, as they will always, according to information supplied, be in close contact. This implies that all particles will be damaged, lowering the safety of the reactor by a large magnitude. This appears to confirm the inherent lack of safety of the PBMR.			
5.78.	What are "peak ground seismic accelerations" and how does it compare to the history of the site (Koeberg)?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	The PBMR is designed for a Safe Shutdown Earthquake (SSE) acceleration of 0.4 g. For the Koeberg site the SSE is 0.27 g. Please refer to chapter 7 of the RFSR: issue number 18.
5.79.	How will the safety functions in the PCU provide assurance that water will not leak into the core? What happens if water enters the core? What is the scenario for various levels of water ingress into the core? How will missile generation and penetration into the core be achieved? What are the consequences under all scenarios if this were to happen? What would be "an unplanned core cool-down event"? How will the PCU prevent this? What are the consequences if this were not prevented?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	As soon as a gas to water leak occurs it will be detected. In case of larger leaks the helium entering the water system will blow out all the water through relief systems, thus preventing water entering the gas system. Graphite corrodes in water vapour at very high temperatures (> 800 °C), as a result only steam at partial pressure could possibly be a problem and the quantities are low enough that no significant damage to the graphite occurs A broken turbine blade is regarded as a

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				missile and should it penetrate the pressure boundary that is designed to retain it, the 2 m thick wall between the PCU and reactor will stop it. An unplanned cool-down would occur when, during start-up the helium blower circulates too much helium, thus cooling the core with the possibility of the reactor reaching criticality in an unplanned way. If this is not prevented by the control system it will cause a reactor trip and the need to start from the beginning again.
5.80.	How often will "erroneously discharged spheres" be discharged? What are the results of this? What is the level of potential error within this scenario? What happens under multiple failure conditions? How will this prevent graphite spheres from erroneously discharging, what happens if this fails? How will graphite spheres be recirculated? How will burn up of partially used spheres be measured? What are the possibilities of failure? What are the consequences of failure, including multiple failures?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	It is assumed that an instrument failure can lead to occasional fuel entering the graphite line. Consistent failure will be detected quickly. In the present design there is no mechanism that can cause beyond design stresses on the fuel spheres. The specification is a failure rate of 10-3 with a similar requirement for detection and subsequent removal. Thus 1 in a million fuel spheres could end up in the graphite column. Even a 1 in 1000 fraction will not present a challenge to the safety of the fuel. Graphite spheres are cycled through pneumatic transport as is the fuel. Partially burnt fuel is only identified as such, a fuel sphere will only be fully analysed if the initial test shows it to be nearing the end of its planned life.

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				The planned fuel life is 80 GWd/tonne. Fuel tests in Germany and elsewhere show that, up to at least 120 GWd/t, there is no risk of increased fuel damage. Keeping the fuel for so long in the reactor will cause it to become sub critical and cease to produce power. Failures of the burn up measurement system will be detected by either too high or too low fresh fuel being needed as well as by other means. Multiple failures are of no additional consequence.
5.81.	It is quite conceivable that the rotary valves can be blocked by broken fuel and damaged by parts of the fuel spheres. What will be done in this situation? How will maintenance personnel be protected from the radiation and heat? What will happen if the radiation sensors fail? What are the best and worst-case scenarios? What happens under conditions of multiple failures? How is the fuel handling system shielded, and at what level of efficiency? What would cause the shielding to break, or be damaged, or ineffective?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	The valves are so aligned that they cannot be blocked by broken fuel (which is anyway removed before they can enter the refuelling line). Repairing the fuel handling system, even with stuck fuel elements is an expected occurrence and personnel are protected by radiation protection measures.
	How can the fuel be kept in a sub-critical geometry? The approx. 4880 discharged spheres per day, and the 370 new spheres per day, will mean a total of how many spheres need to be moved per annum? What are the consequences measured by the given defect rate? What potential consequences would there be? (The 370 spheres are the used up fuel.)	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	These aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR : issue number 5, 24, 25 and 29

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	It is stated that the fuel that was un-loaded from the reactor will be stored under helium to prevent corrosion. What would happen if the helium system failed? What happens if the following fail: Isolation valves? Rotary feed valve? Rotary pressure locks? What happens if there are multiple failures? What are the worst-case scenarios?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	These aspects will be addressed during the EIA phase. Please refer to chapter 7of the RFSR: issue number 28.
5.82.	What happens if there is horizontal movement of fuel spheres to the centre of the core? And if adequate core volume is not maintained? What are the potential consequences if the radiation sensor devices fail? What is the worst-case scenario?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	Tests and simulations show that fuel will not move to the centre. Pebble movement is in a straight line downwards till the defuelling area is reached. Core volume is maintained by ensuring every sphere extracted is again replaced. Any malfunction will immediately be noticed and reported. The sensors are self-testing and major failures are detected by fuel/graphite balancing checks.
	What emergencies could result in the fuel handling system needing to be isolated? What if these valves failed? These systems could fail if the emergency situation damaged the valves or the systems that would activate them. What would happen if the fuel went critical in the water-cooled storage tank? What happens if air gets into it? What happens under multiple failure conditions?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	These aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR : issue number 28.
5.83.	What is the exact chemistry in the inter-cooling	22-10-01	Mr. M. Lakhani, Anti-	The inter-cooler uses de-mineralised

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	system? What are the potential hazards associated with this? What could the potential impact be on seawater and life in the ocean?		nuclear Co-ordinator: Earthlife Africa.	water and seawater. The two do not come into contact.
5.84.	How does the HVAC system work? How do you ensure that this system is always operational? Who checks the performance of this system?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	The HVAC system is a combination of systems that collectively provide the following functions: • to supply fresh air to the building; • to maintain specified environmental parameters, temperature and (where required) humidity; • to maintain sub-atmospheric pressure and direction of flow in the controlled zone; • to maintain positive pressure in the control rooms; • to remove heat from mechanical and electrical equipment; • to remove heat from the Spent Fuel storage area; • to remove airborne radioactive gases, aerosols and dust particles by purging and filtering; • to minimize environmental impact by filtering exhaust air; and • to minimize internal building contamination by filtering, re-circulation and local extract air. System performance is according to individual system requirements. Detail descriptions of individual systems and

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				their performance is contained in the SAR that will be reviewed by the NNR. Answers to subsequent questions regarding the HVAC systems are also contained in the SAR.
5.85.	What happens if the "control/monitoring system" of the decontamination system fails? Is there a backup / redundancy built in? How do the systems listed remove radiation? What happens to the radiation, as it cannot be destroyed?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	Different decontamination methods are used to remove or reduce radiation to acceptable levels. Application of methods is dependent upon the type of contamination.
5.86.	Pg 32 of the DSR: Tunnels: Why would underground tunnels connect the reactor building with the services and ancillary buildings?	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	This is part of the safety design of the PBMR DPP and will contain infrastructure elements such as cables, etc.
5.87.	In the event that the reactor cooling system fails, and the steam is released to atmosphere, what level of radiation can be expected to be released? What happens when a rupture occurs inside the reactor cavity? What could cause such a rupture? If the triple RCCS caters for 50% each, giving a total of 150%, what happens if more than this is generated in heat, for example, under accident conditions, such as explosion or fire? What happens if the backup diesel generators fail?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	The water-cooling systems work at temperatures well below the boiling point and there can be no steam leaks. The water is free of contamination. There is no water in the reactor cavity except that in the RCCS. That water is not under pressure and ruptures are very unlikely. The 100% load is calculated on the basis of decay heat to be removed. Explosions or fires are not possible in the reactor cavity and would anyway add little to the heat load. The reactor is designed to be safe without any electrical supply. The

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				generators are there to allow a fast recovery from any upset.
5.88.	Regarding the water supply and purification: How and why would it be possible for water to leak from the modules? How often will this happen? What are the health and safety implications? How radioactive will this water be? What will happen to this water? How will the discharged water be checked and a guarantee available that the water is safe for discharge?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	Water leaks in cooling systems are not unknown and any such water is treated as being potentially contaminated which it could be if a gas to water leak infused radioactive helium into the water. This water will be treated as any other liquid waste. Liquid waste (water) is stored in hold up tanks and the liquid is tested for contaminants (radioactive and others) before being released.
5.89.	In the event of rapid depressurisation, how will this air be cleaned?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	In a rapid depressurisation, the released coolant gas is not cleaned. The amount of radioactivity present in the gas is monitored continually to ensure that any possible release of radioactivity carried with the helium will not cause exceedances of regulations.
5.90.	What are the consequences if the HVAC system fails?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	There is no danger to the reactor from HVAC failure, but some plant equipment will have to be shut down to prevent overheating.
5.91.	The monitoring systems on the HVAC must not be able to be tampered with. These instruments must be electronically connected to the control systems and alarm systems to automatically raise the alarm should there be a problem. This data should also be recorded onto a hard copy so that if the electronic	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	Monitoring, recording and safe storage of all plant data is a requirement from the regulator and will be rigorously enforced.

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	data is lost there will still be a back up. This question of the safe storage of data is one that must be applied throughout the PBMR and FUEL processes. This data must be made available to the NNR and other regulatory bodies.			
5.92.	What are the percentage levels of efficiency of the various operations of the HVAC system (heat removal, aerosol removal, smoke control, contamination issues, positive and negative pressure, and fresh and uncontrolled air). What are the consequences if any or some or all of these fail? What happens under multiple failure scenarios? How will the exhaust air radioactivity be measured, and what will prevent radioactive air from being exhausted? Will there be a "mass balance" system in place for radioactivity? Will the daily, weekly, monthly and annual discharges, from all sources, be reported on?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	System performance is according to individual system requirements. Detail descriptions of individual systems and their performance is contained in the SAR that will be reviewed by the NNR. Answers to subsequent questions regarding the HVAC systems are also contained in the SAR.
5.93.	As the design criteria events and the design basis to address them have not been determined, how can any of the statements made be regarded as authoritative?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	Internally and externally induced events that can affect the civil design have been identified and are part of the design base.
5.94.	Local environment: What are the proposed (atmospheric) analyses and laboratory tests? What will they be looking at? What will be excluded? Geology: What is the history as recorded at Koeberg?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	The wind speed, rainfall and temperature data recorded at the Koeberg NPS weather station over the past 20 years have been processed statistically in order to obtain estimates of these parameters for design basis events, having low probabilities of occurrence. These parameters are then used in the design of the civil structures.

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				The reinforced concrete structures at the Koeberg NPS have been tested to quantify their durability over the remaining life of the plant. The tests include chloride ion profiles, half-cell potential measurements, resistively measurements and measurements to quantify the cover to the reinforcement. These parameters are then processed in the analytical models developed for marine environments. The results of the durability analysis are used as a basis for the development of the concrete mix for the PBMR taking into account other parameters such as strength, workability, heat of hydration, creep and shrinkage. Extensive geological, geotechnical and seismotectonic investigations have been performed on the Koeberg NPS site for both the original Koeberg plant and the PBMR. Detailed descriptions of the geological history of the site are included in the Koeberg Site Safety Report. These aspects will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issues number 18, 21 and 28.
5.95.	What are the risks of explosion? What methodology and assumptions are made in this regard?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator:	Transformers have been known to explode and the intent is to protect buildings and equipment near

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			Earthlife Africa.	transformers from such incidents.
5.96.	Although the dispersion calculations for the PBMR must still be done, a disaster at the reactor would not be particularly bad. The percentage of escape radiation would not necessarily be harmful. In case of a disaster, evacuation might prove to be unnecessary.	04-04-02	Prof. P. Lloyd, Industrial and Petro-chemical consultants.	Opinion noted.
5.97.	The PBMR should not affect Melkbosstrand, since containment would sustain the event. The worst that could happen is an earthquake and tsunami – the reactor has to be designed to sustain such events. Possible impacts would be contained to the 400m exclusion zone.	04-04-02	Prof. P. Lloyd, Industrial and Petro-chemical consultants.	Opinion noted. Please refer to chapter 7 of the RFSR: issues number 16, 18 and 28.
5.98.	What will the total emissions; solid waste; effluents; unserviceable plant equipment; be for each year? What will their individual and cumulative levels of radioactivity be?	22-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	These aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 21 and 24.
5.99.	It does not make sense that the reactor is able to passively loose all excess heat, but still provide enough heat to drive a MWe turbine. This needs to be clearly explained. A negative co-efficient of reactivity also needs to be explained.	19-10-01	Mr. M Lakhani, Anti-nuclear Coordinator: Earthlife Africa.	Please refer to section 4.3.8 and chapter 7 of the RFSR: issue number 28.
5.100.	What distance is the evacuation boundary for the PBMR?	10-11-05	Unknown participant	The design objective is 400 meters exclusion zone from the reactor building
5.101.	An increase of 30% in generation is indicated. What effect does this have on the fuel requirements?	15 Nov 2005	Mr. Barker	Increase in the fuel requirement will be of the same order.
5.102.	Pg 145 of the DSR: Meteorological analysis: The report	6-03-06	City of Cape Town: Keith	The meteorological analyses will be

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	indicates that further work is needed. Is this to be addressed in the EIA?		Wiseman (Manager: Integrated Environmental Management) for City Manager	addressed ion the EIA phase. Please refer to chapter 7 of the RFSR: issue number 21.
5.103.	Pg 147 of the DSR: Geohydrological investigation: It is stated that further geohydrological work is required before construction. Is this information not required for the EIA and EMP?	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	This aspect will be addressed during the EIA phase and will be reflected in the EMP. Please refer to chapter 7 of the RFSR: issue numbers 13 and 22.
5.104.	Future desalination plants: The Directorate: Water Services has requested that future planning by Eskom should take into consideration that the City of Cape Town may require desalination plants alongside the Cape west coast.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	This issue must be taken up with Eskom directly and not through the EIA process. However, Eskom will be notified of the request.
5.105.	What is the construction time and how many jobs will it create?	10-11-05	Unknown participant	The PBMR is a small Plant (165 MW(e)) and the construction time will be from 2007 to 2010 (about 3 years). At any one time during construction about 400 to 500 persons will be employed on the site. During operation only a small number of persons will be needed (about 100).

6. LEGISLATIVE AND REGULATORY RELATED ISSUES

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6.1.	The EIA must address the waste issues – how much waste, what types, where it will be stored, how much it will cost, how long must it be stored, what impact (health and other) will this have on surrounding communities, both along the transport routes and those who live near such a site (wherever it may be).	09-10-01	Ms. L. McDaid, Member: Koeberg Alert, Earthlife Africa, Western Cape.	As indicated before, all aspects of waste management will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24 and 25.
6.2.	There is a need for life cycle costing as part of the EIA process.	20-09-01	Mr. A. Murphy, Member: eThekwini ECOPEACE	Life cycle costing is the subject of a strategic environmental assessment or a life cycle assessment, and not an EIA.
6.3.	The DEATs major concern revolves around the legal mandates of the other authorities on aspects such as nuclear waste issues (DME), safety issues (NNR).	13-03-02	Mr. C. Agenbach, National Department of Environmental Affairs & Tourism (DEAT)	The policy and regulatory aspects of the EIA process will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24, 25 and 35.
6.4.	The feasibility process must be very comprehensive. It must address issues such as potentially linked impacts (Would failure of the one affect the other?), the cumulative impacts and issues relating to security (How has the World Trade Centre bombings influenced the security of nuclear sites?).	18-03-02	Mr. G.S. Visser, Blaauwberg and West Coast Chamber of Trade and Industry (BWCCTI)	It is the purpose of the EIA to assess both the positive and negative environmental impacts of this proposed development and to determine if adverse aspects can be mitigated, managed or avoided. The findings of the environmental assessment will be addressed in the EIR. Please refer to chapter 7 of the RFSR: issues number 13, 28 and 36.
6.5.	What parts of the EIA act as checks and balances for the PBMR project?	03-04-02	Clr. S. Kotze, Ward Councillor - City of Johannesburg.	The entire EIA including the EMP that will ensure implementation of prescribed mitigation measures.
6.6.	Who decides whether the PBMR is constructed or	30-01-01	Mr. R. Makroti, Member:	Various competent authorities including

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	not?		Goodlife Initiative Africa, Durban (Durban public meeting).	DEAT, the NNR, DWAF, DPE and Treasury have decision making competence. Only once approvals from each one of these statutory bodies are granted, can construction take place. Authorisation by one does not entail authorisation by others. Please refer to chapter 7 of the RFSR: issue number 35.
6.7.	The application is dealing with a demonstration plant and not a commercial implementation request/application. However the proposal is for a full-scale Nuclear Reactor, which is to be attached to the National Electricity grid as a commercially operating power station, and it is intended as a prototype to be sold as a commercial concern both nationally and internationally.	20-09-01	Mr. A. Murphy, Member: eThekwini ECOPEACE	It is indeed part of the demonstration purpose. The nature of this demonstration project is to validate the techno-economic feasibility. Until this is established, no commercial activity can be undertaken.
6.8.	Is the National Nuclear Regulator a government body?	03-04-02	Clr. S. Kotze, Ward Councillor – City of Johannesburg.	Yes, it falls under the Department for Minerals and Energy. Please refer to chapter 7 of the RFSR: issues number 33 and 34
6.9.	Does nuclear waste management form part of the licensing requirements and where would it be stored? South Africa does not have a nuclear waste repository.	30-01-01	Mr. A. Murphy, Member: eThekwini ECOPEACE, Durban (Durban public meeting).	Nuclear waste management does form part of the NNR mandate. Please refer to chapter 7 of the RFSR: issues number 24 and 25.
6.10.	Which Government Department oversees NNR decisions? It would not be in the NNR's best interest to advice against nuclear power because they would lose licensing fees.	30-01-01	Attendant: Durban public meeting.	DME oversees the NNR. Further comment noted. Please refer to chapter 7 of the RFSR: issue number 34.

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6.11.	There is no repository for High Level Waste – is the government fulfilling its environmental constitutional responsibilities by even considering a proposal such as the PBMR which would effectively leave a hazardous legacy for generations in future?	09-10-01	Ms. L. McDaid, Earthlife Africa, Western Cape.	High level waste management and related aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24 and 25.
6.12.	The continued disregard for civil society to be given a fair opportunity to read, digest, research, and make meaningful comment, mainly due to a lack of commitment to balanced capacity building and short timelines, is seen as working against the letter and spirit of the relevant South African legislation.	01-10-01	Mr. M. Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	The consultants do not believe there is a disregard for civil society. As an example, the plan of study for scoping approved by DEAT, indicates 30 calendar days public review period for the draft scoping report, and 45 calendar days for the draft EIR. These timelines are deemed fair. The EIA process is in compliance with the letter and the spirit of the relevant South African legislation.
6.13.	Compliments to the NNR for looking at the possible loopholes that could have developed over the years.	01-02-01	Mr. A. Holm, Member: Hartbeespoort Erfenis en Omgewingsvereniging, Hartbeespoort (Pelindaba public meeting),	It must be noted that the PBMR DPP EIA is conducted within the relevant policy and legislative frameworks.
6.14.	The Polluter Pays principle is enshrined in our constitution. Passing the responsibility for the effects caused by the main activity of the proposed project (i.e. radioactive waste) goes against the letter and the spirit of the law.	01-10-01	Mr. M Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	Eskom does take responsibility for the waste and any effects of it. To this effect it makes financial provision to deal with this. Please refer to chapter 7 of the RFSR: issue number 24 and 25.
6.15.	Are components of the EIA being authorised by the relevant Provincial Departments?	01-02-01	Attendant: Pelindaba public meeting.	Yes, with DEAT National. Please refer to chapter 7 of the RFSR: issue number 35.

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6.16.	Who does the NNR issue licences to and, do they make a profit?	Undated	Anonymous.	The NNR issues licenses to activities managing, handling or processing nuclear materials. The NNR is a government structure and as such not profit oriented or profit making. Please refer to chapter 7 of the RFSR: issues number 33 and 34.
6.17.	What will happen with the sub-structure plan vis-à-vis the retention of the nuclear site?	Undated	Anonymous.	Please refer to chapter 7 of the RFSR: issues number 1 and 2.
6.18.	The NER feels that even pilot plants will have to apply for a licence from the authority.	18-09-00	Attendant from the National Electricity Regulator (NER).	This aspect will be addressed in the EIA phase of the process. Please refer to chapter 7 of the RFSR: issue number 33.
6.19.	The credibility of the EIA depends on the independence of the consultants, yet we are hearing that the consultants are bowing to Eskom, i.e. not considering alternative proposals to the development. This casts doubt on the independence of the consultants and stress, on the credibility of the EIA.	16-02-01	Dr. D. Fig, Representative: Leadership for Environment and Development Southern Africa (LEAD), Johannesburg.	The independence of the consultants is enshrined in this process through NEMA and via the undertaking of the consultants signing a declaration of independence. The EIA process is vetted by DEAT by means of the various plans of studies. This ensures that the process is fair and unbiased.
6.20.	Will the PBMR demo go ahead no matter what happens in the EIA?	13-10-00	Mr. S. Thorne, Director: Energy Transformation CC, Cape Town.	A negative record of decision prevents any activity from taking place. In addition to DEAT authorisation, there are other licensing bodies such as the NNR, and NECSA. Authorisation from all of these bodies will allow the project to

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				continue Authorisation from one body does not imply authorisation from all the bodies
6.21.	Has there been any formal EIA done for Koeberg?	16-01-01	Ms. O.A. Ismael, Senior Professional Officer: Greater Johannesburg Metropolitan Council, Johannesburg (Megawatt Park capacity building workshop).	No, Koeberg was developed before promulgation of the Environment Conservation Act (73 of 1989).
	Who are the National Nuclear Regulator's licensees?	30-01-01	Ms. C. Christopher, Member: eThekwini ECOPEACE, Durban (Durban public meeting).	Please refer to the NNR website http://www.nnr.co.za For nuclear installations there are two licencee's Eskom and NECSA.
6.22.	The Urban Planning Branch of the Blaauwberg Administration is of the opinion that a rezoning of the proposed site of the PBMR is required. The rezoning approval has not been addressed by the Consortium and no application in this regard has been received.	18-05-01	Messrs K Wiseman & E Weinronk, Cape Metropolitan Council: Planning, Environment & Housing – Environmental Management.	The zoning issue will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1 and 2.
6.23.	What is Eskom's mandate in terms of electricity generation?	17-11-05	Mr. Moulton	The ability to develop and manage the entire extended electricity value chain. In terms of the Electricity Act, no 41 of 1987, Eskom is required to supply electricity under the control of the National Electricity Regulator. The regulator stipulates areas to be supplied, tariffs, and quality of supply.
6.24.	Details of international purchases (past present and future) should be detailed. Reasons why purchases	7-3-5	RCH Garbett	Comment noted. The EIA deals with the environmental impacts of this project

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	and orders were placed prior to EIA completion should be detailed.		CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	and not the commercial aspects.
6.25.	Would the ROD be issued under the old regulations, and would the new regulation be taken into account.	15-11-05	Mieke Barry	This application is done under the old regulations but would consider aspects of the new regulations.
6.26.	To whom should appeals be directed to?	1-12-05	Mr. Garbett	Appeals should be lodged with DEAT in this case.
6.27.	Who judges the EIA process and determines if the activity can proceed?	1-12-05	Ms. Garbett	The DEAT has the authority to decide on the EIA application.
6.28.	Legal Framework: The draft Scoping Report (section 6.2.2) lists the Land Use Planning Ordinance (Ordinance 15 of 1985) as relevant to the current application. However, the fact that a rezoning application to the City of Cape Town is required is not mentioned. This requirement has been raised by the City during the previous EIA process. The City of Cape Town would be the relevant authority for an application in terms of LUPO for a PBMR demonstration plant to be located at Koeberg. In terms of the relevant legislation, the decision-making authority would be elevated to the Provincial Government of the Western Cape only if an objection or appeal is submitted by another government body.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager.	The land use and related aspects will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1 and 2. Although the requirement of application for rezoning to the CCT will be explicitly addressed in the EIR, it is not part of this Application and remains the prerogative of the Eskom (applicant) as to when such application will be lodged with the CCT.
6.29.	We submit that the applicant's approach is erroneous	7-03-06	Legal Resources Centre	There is no intention to rely on decisions

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	and bad in law. It is an established principle of administrative law that, where a fresh application is made to a decision-maker, the decision-maker cannot rely on decisions it made in some earlier application dealing with the same or a related subject-matter. This principle also has an important procedural dimension because interested and affected parties ('IAPs') must be given a proper opportunity to participate in the fresh application. Even if it could be argued that some matter in issue in the fresh application was the same as one assessed or decided as part of the earlier application, then fresh evidence or fresh perspectives may be adduced on that issue in the course of the fresh application. The scoping report should provide for this but fails to do so.		(Cape Town) on behalf of Earthlife Africa (Cape Town)	from the previous EIA. It is stated that baseline data sets that were generated during the previous EIA and recorded in the environmental impact report (EIR), that are considered to be valid in the context of the proposed 400 MW(t) DPP will be validated and reassessed as part of the 400 MW(t) PBMR DPP EIA process.
6.30.	The applicant points out in respect of social aspects that 'the conclusions of the 302MW(t) PBMR DPP are regarded as valid for the 400MW(t) PBMR DPP and no further assessment will be required (p88 of the DSR). A similar approach is taken in respect of economic aspects, in respect of which it is stated that 'Vecon Economic and Development Consultants assessed the validity of the conclusions for the 302MW(t) PBMR DPP and conclude that the findings remain valid'.	7 March 2006	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	There is no intention to rely on decisions from the previous EIA. It is stated that baseline data sets that were generated during the previous EIA and recorded in the environmental impact report (EIR), that are considered to be valid in the context of the proposed 400 MW(t) DPP will be validated and reassessed as part of the 400 MW(t) PBMR DPP EIA process
6.31.	The applicant has pursued a new and different application for authorisation, namely for approval to construct a 400 MW(t) PBMR DPP. This is clear from the DSR… (refer p2 and p7 of DSR). In our view, the applicant had no choice but to make a new application given the change in the subject matter	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	There is no intention to rely on decisions from the previous EIA. It is stated that baseline data sets that were generated during the previous EIA and recorded in the environmental impact report (EIR), that are considered

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	of two applications. The extract from the judgment quoted at page 2 of the DSR (namely that the DG's decision was to be set aside as flawed but should not result in the whole process having to commence afresh) applies only to the EIA for the 302 MW(t) PBMR DPP. We submit that the applicant cannot lawfully rely on any reports or assessments conducted during the EIA for the 302MW(t) PBMR DPP in support of its new and legally distinct application for authorization to construct a 400 MW(t) PBMR DPP. Any and all such reports must be updated and included in the EIR for the 400 MW(t) PBMR DPP, and IAPs must have a full opportunity to comment and make representations on these reports. Failure to do so will render the current EIA irregular and procedurally unfair, and any decision on scoping or on authorization would fall to be set aside on review.			to be valid in the context of the proposed 400 MW(t) DPP will be validated and reassessed as part of the 400 MW(t) PBMR DPP EIA process. The public will have an opportunity to comment and make representations on these reports as part of the EIR review process.
6.32.	Identity of the Applicant: The current Applicant, Eskom Holdings Limited (Eskom) is not the proper or correct applicant. We say so because, on the information available, it is PBMR (Pty) Limited that owns the technology and intends to construct the PBMR DPP. According to the Detailed Feasibility Report (DFR) made available during the previous EIA, Eskom's purchasing of the PBMR DPP from PBMR (Pty) Limited is conditional upon it being successfully commissioned (p32 of the DFR). In our view, until such time as Eskom decides to purchase the PBMR DPP, it is PBMR (Pty) Limited that will be the owner of the PBMR DPP and would be the correct applicant for authorisation.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	PBMR (Pty) Ltd is the developer of the technology, and Eskom is a client of the technology.

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	If PBMR (Pty) Limited is not the applicant, the following difficult questions arise: How can any conditions of an authorisation granted to Eskom be enforced against PBMR (Pty) Limited in the period prior to successful commissioning i.e. before Eskom purchases the PBMR DPP from PBMR (Ply) Limited? If Eskom is authorised to build the PBMR subject to conditions, who will be responsible for complying with these conditions in the event that commissioning of the PBMR DPP is not successful and if Eskom declines to purchase it? For example, who will be responsible for decommissioning the unsuccessful plant?	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	Eskom is the applicant of the EIA as it is the person causing the activity to be undertaken on its own site and will be the operator of the plant. Eskom has an understanding of the responsibilities associated to causing such an activity to be undertaken and will enforce compliance to contractual, legal, and environmental requirements by PBMR in a similar way it does with any other contractor whose services are employed to construct a power plant or any structure.
6.33.	We submit that the correct identity of the applicant and its capacities are material issues. The applicant has to fulfil any conditions set as part of the environmental assessment process. The responsibilities of a particular applicant are recognised in the White Paper on Energy Policy (the White Paper) which states (at p68) that in respect of nuclear installations: "the potential exists for acute exposures and catastrophic accidents and therefore require a special liability regime with compulsory financial security (and) sophisticated safety assessment to ensure that the risk is engineered to acceptably low levels…" (emphasis added) We point out that the Environment Conservation Act (ECA) makes no provision for the transfer of EIA authorisations from one proponent of an activity to another. In addition, in terms of section 25 of the National Nuclear Regulator Act, nuclear	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	PBMR (Pty) Ltd is the developer of the technology, and Eskom is a client of the technology. Eskom does not intend to transfer any responsibility. As the license holder in terms of the NNR Act, it retains all responsibilities for the plant from day one of the development.

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	authorisations are not transferable. It is therefore not possible for Eskom to transfer its authorisation to PBMR (Pty) Limited pending its conditional purchasing of the PBMR DPP.			
6.34.	The applicant has pursued a new and different application for authorisation, namely for approval to construct a 400 MW (t) PBMR DPP. This is clear from the DSR… (refer p2 and p7 of DSR). In our view, the applicant had no choice but to make a new application given the change in the subject matter of two applications. The extract from the judgment quoted at page 2 of the DSR (namely that the DG's decision was to be set aside as flawed but should not result in the whole process having to commence afresh) applies only to the EIA for the 302 MW (t) PBMR DPP. We submit that the applicant cannot lawfully rely on any reports or assessments conducted during the EIA for the 302MW (t) PBMR DPP in support of its new and legally distinct application for authorization to construct a 400 MW(t) PBMR DPP. Any and all such reports must be updated and included in the EIR for the 400 MW(t) PBMR DPP, and IAPs must have a full opportunity to comment and make representations on these reports. Failure to do so will render the current EIA irregular and procedurally unfair, and any decision on scoping or on authorization would fall to be set aside on review.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	There is no intention to rely on decisions from the previous EIA. It is stated that baseline data sets that were generated during the previous EIA and recorded in the environmental impact report (EIR), that are considered to be valid in the context of the proposed 400 MW(t) DPP will be validated and reassessed as part of the 400 MW(t) PBMR DPP EIA process. The public will have an opportunity to comment and make representations on these reports as part of the EIR review process
6.35.	Application for exemption: It is noted that Eskom's EIA Application under section 21 of the Environment Conservation Act 73 of 1989 (ECA) includes a reference to an application for exemption in terms of	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape	The application was withdrawn. A notice of the withdrawal of the application was forwarded to registered

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	s28A of ECA. In terms of this application, Eskom sought exemption from the process to assess energy/technology alternatives and site alternatives, and from the associated public participation process. We are advised that Eskom has withdrawn this application. This fact should be recorded in the DSR in order for it not to be misleading.		Town)	IAPs. Please refer to section 8.6 of the FRSR.
6.36.	Details of the content of all applications for permits required by the PBMR should be disclosed.	7-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	All affected legislation that may require authorisation or action for the PBMR are disclosed in the final scoping report. Please refer to the RFSR section 2.2, 2.3 and 2.5.

7. QUESTIONS ABOUT THE RATIONALE FOR THE PBMR

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7.1.	What is the purpose of the PBMR?	29-09-00	Mr. S. Thorne, Director: Energy Transformation CC, Cape Town.	To demonstrate the techno-economic characteristics of the PBMR technology. This is not a testing process but a demonstration of performance.
7.2.	Concerns expressed regarding the PBMR that the first world has decided that nuclear technology are inappropriate, dangerous and uneconomic.	12-02-01	Ms. B Stolper, IAP, Cape Town.	Comment noted.
7.3.	Why build a demonstration model?	Undated	Anonymous.	The rationale for the PBMR DPP is described in sections 4.3 and 6.4.6 of the RFSR.
7.4.	The recognition of the need for technology transfer in terms of human resource development in the nuclear industry is not an argument to make a case for the PBMR! This needs to be based on principle and not expediency.	17-05-01	Mr. G. Mpufane, Environmental Officer: National Union of Mineworkers (NUM), Johannesburg.	The rationale for the PBMR DPP is described in sections 4.3.7 and 6.4.6 of the RFSR..
7.5.	The PBMR project amounts to a survival plan of the global nuclear energy industry, which has been drifting into stagnation. Since vast usage of fossil fuel is the largest scapegoat, nuclear proponents see a window of opportunity to punt a reborn fission energy industry.	Feb. 01	eThekwini ECOPEACE.	Comment noted.
7.6.	Why was the test programmes stopped?	Undated	Anonymous.	The German test programmes were stopped because of changes in the German government's nuclear polices, and due to the fact that the research

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				programmes were completed.
7.7.	Why did Germany and other countries stop investing in the PBMR technology?	26-08-00 27-09-00 30-01-01 01-02-01 06-02-01 08-02-01	Attendant: Pelindaba Open Day. Dr. L. Platzky, Deputy Director-General: Department of Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town. Mr. A. Tregenna, IAP, Cape Town (Durban public meeting). Prof. Roon, IAP, Broederstroom (Pelindaba public meeting). Ms. B. M. Blignaut, Secretary: Green Belt Action Group, Roodepoort. Ms. A. Alba, IAP, Johannesburg.	Siemens was negotiating with the German authorities for the Siemens Modular reactor design, which employed pebble bed technology. Negotiations broke down as a result of the Chernobyl accident. At the same time the West German government came under severe political pressure to start closing down existing plants. They chose to close down two small research reactors rather than existing commercial nuclear stations. This aspect is described in section 4.3 of the RFSR.
7.8.	The West German government closed down their experimental PBMR (THTR300) (which was also offered as accident proof) because they found the design unsafe. Why the same or similar technology is considered safe for the South African Public? (The PBMR is based on the same West German design that in May '86 (9 days after Chernobyl) resulted in accidental radiation releases as far as 2 kms following the accident.)	28-03-02	Ms. CT Garbett, Director: Watt Props (Pty) Ltd. Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd.	High-Temperature Reactor technology was successfully applied and demonstrated in the mid-1980s in Germany with the building and operation of the 15 MW Arbeitsgemeinschaft Versuchsreaktor (AVR) (German for the Jointly-operated Prototype Reactor) research reactor and the 300 MW Thorium High-temperature Reactor (THTR).

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				The AVR was a research reactor built to illustrate the characteristics of high-temperature reactors using pebble bed fuel and successfully demonstrated extended and stable reactor operation, and validated the use of Triple-coated Isotropic (TRISO) fuel particles over a period of 21 years. The 300 MW THTR was built as a first-of-a-kind production plant and was aimed at demonstrating subsystem designs with specific emphasis on plant availability and maintainability. It was to be the forerunner of a commercial machine, namely the HTR-500 and aimed to have an operating life of 40 years and an availability of 80% to 90%. The plant achieved 100% power in 1986. This aspect is described in section 4.3 of the RFSR.
7.9.	Why has the PBMR viability not been tested elsewhere in the world?	29-09-00	Mr. S Thorne, Director: Energy Transformations CC. Cape Town.	The PBMR technology has been tested widely. Over and above the German reactor indicated above, the following activities took place: The 20 MWth Dragon and 115 MWth/40 MWe Peach Bottom 1 plants commissioned in the UK and the USA in the 1960s demonstrated the feasibility of the THGR technology, using helium gas. The Dragon reactor was an Euratom plant located at Winfrith in the UK and operated from 1964 to 1977. It was a

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				pure test reactor and had no power conversion system. It used block fuel and demonstrated the performance of TRISO fuel up to very high burn-up levels. It was shut down upon completion of the test programme in 1977. Peach Bottom 1 was a power generation plant operated by Philadelphia Electric Power Company (PECO) from 1967 to 1974 and demonstrated the potential for high availability (87% was achieved during its operation phase). It was shut down as it was seen to have achieved its technical targets and was too small to be commercially viable. Although most of the foregoing plants suffered technical problems in one way or another, each served to confirm the suitability of one or more key elements that now constitute part of the overall PBMR conceptual design. The previous research programmes and operational experience have therefore provided confidence in the technical basis of the PBMR design, especially in instances where the coated particle pebble bed fuel had been adopted as the primary energy source. <u>Competing research programmes and technologies</u> HTR research and development are being conducted in the following

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				countries/regions: ❖ China (HTR-10 reactor) ❖ Japan (HTTR reactor) ❖ USA in collaboration with Russia, Japan and France (GT-MHR project) ❖ European Union (HTR-TN under the 5th framework).
7.10.	Why are we developing this technology? Why is it not developed in Germany / America?	16-01-01	Mr. C. van Noordwyk (Megawatt Park capacity building workshop).	The German's initiated the PBMR technology development, but was ceased in the context of overall nuclear programming closing down. The Americans are investigating this technology for different applications e.g. electricity generation or process heat plant.
7.11.	What was the deciding factor that made the PBMR appealing to Eskom seeing that the technology was old?	16-01-01	Mr. P. Mimmack (Megawatt Park capacity building workshop).	Eskom investigated the option of nuclear high temperature gas reactors during the 1990's, under its supply side research and development program for potential application as a power source in South Africa and as a viable South African export product. The detailed feasibility study t investigate the PBMR technology as a viable supply side option for Eskom, considering both ISEP planning framework and further marketing and commercialization of the PBMR technology into the energy sector, was finalized. Eskom is particularly interested in the PBMR plant, since it is regarded as a so

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				called Generation IV plant. The generation IV International Forum (GIF) defines Generation IV plants as those reaching the objectives of improved nuclear safety, improved proliferation resistance, minimized waste and natural resource utilisation and decreased cost to build and run such plants. Please refer to sections 4.3.7 and 6.4.6 of the RFSR.
7.12.	What are the advantages of the PBMR?	26-08-00 02-09-00	Attendant: Pelindaba Open Day. Attendant: Pelindaba Open Day.	❖ The PBMR, through its demonstration, is expected to facilitate a flexible approach to plant location and electricity planning. PBMRs can potentially be built close to where the electricity is needed. ❖ Because the construction period for a module should be only two years (this will be verified during the detailed feasibility study), modules can be built, not only where, but also when they are required. The modules can be configured to the size required by the loads they serve and therefore have the potential to provide power far from the national grid. The PBMR power output is flexible. Units can be used either to generate base-load or load-following (mid-merit) electricity. It is small, modular and adaptable. A single PBMR module would be sized to produce about 110 MW, which is

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				about 10 percent of the output of one of the nuclear reactors at Koeberg. ❖ The PBMR has a simple design basis with passive safety features that require no short-term human intervention and that cannot be bypassed or rendered ineffective. If a fault occurs during reactor operations the system will, at worst, come to a standstill and passively dissipate heat without any failure. This provides for an inherently safe design. ❖ Nuclear power generation produces no carbon dioxide emissions or smoke. ❖ It has the potential to be suited for desalination purposes. ❖ It has export potential.
7.13.	Is the PBMR part of the EIP / IRP for regional planning or for export markets?	26-08-00	Attendant: Pelindaba Open Day.	Eskom's ISEP process considers the South African and Southern African region only, and the PBMR is considered as an option to serve those markets. We would not be in a position to comment on whether other parties, in probable export markets, have considered the PBMR in their own IEP/IRP planning process.
7.14.	Where is Eskom thinking of using the technology if it proves to be effective?	02-09-00	Attendant: Pelindaba open day.	Eskom intends to use this technology to supplement other forms of generation. The location could depend upon number of factors, which are not

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				assessed in the process.
7.15.	Does Eskom believe that this technology will replace coal or other forms of electricity supply?	02-09-00	Attendant: Pelindaba open day.	This technology is intended to enhance Eskom's generation mix through, supplementing other forms of generation.
7.16.	Why is this programme going ahead given the extreme pressure to disband throughout the world?	Undate d	Anonymous.	The decommissioning of some nuclear sites mainly stemmed from the economies of aging plants and public pressure following the Three Mile Island and Chernobyl accidents. The majority of nuclear plants continued operation. In fact, some utilities, such as Exelon (merger between PECO Energy and Unicom Corporation) Energy in the United States, bought up nuclear plants. Some 450 nuclear plants are still operating throughout the world and a number are on order and some under construction. The development of the proposed project is based on the premises of efficient use of natural resources and the inherent safety design of the PBMR. This, coupled with the increasing demand for electricity, creates a potential market for nuclear, in particular the PBMR concept. As the world economy continues to expand due to the increased use of new technologies, so will demand for electricity. As electricity demand increases, new plants will be needed both to accommodate the new demand

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				and to replace plants built 40 to 50 years ago. Public, world over seeks reduction in the level of sulphur dioxide, nitrous oxides and other "greenhouse" gases. To this end, the PBMR could provide an economic mitigation strategy for greenhouse gas reductions, since nuclear power generation produces no carbon dioxide emissions. Indications are that France's carbon dioxide emissions from electricity generation fell by 80 percent between 1980 and 1987 as its nuclear capacity increased, and Germany's nuclear power programme has saved the emission of over two billion tons of carbon dioxide from fossil fuels since it began in 1961. Currently, there has been a resurgence of interest in nuclear power by many countries, including Finland, USA, and UK. Please also refer to section 4.3 of the RFSR.
7.17.	Has the PBMR technology been proven elsewhere in the world?	10-11-05	Unknown participant	The reactor and fuel technology was extensively tested and proven in Germany. The Chinese are currently demonstrating a similar German Pebble Bed Fuel and reactor design.
7.18.	If the technology was proven in Germany, why was the PBMR not commercialised in Germany?	17-11-05	Mr. Murphy	Germany was in the process of commercialising this technology when

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				the government at the time stopped the process. Please refer to sec 4.4.2 of the RFSR.
7.19.	How does nuclear fit into the national and international energy options scenario?	Undated	Anonymous.	This aspect is described in the RFSR. Please refer to section 4.2 of the RFSR.
7.20.	I'm not persuaded that the PBMR is a proven technology seeing that it was an abandoned technology in Europe.	06-02-01	Mr. J. Clark, Project Facilitator: Greenhouse Project, Johannesburg (Johannesburg public meeting).	Comment noted. The abandonment of the technology was not based on its technical capabilities but on the socio-political environment existing at the time. Please refer to sec 4.3 of the RFSR.
7.21.	Is the need for the PBMR related to energy needs?	23-09-00	Messrs. D. Murry, Chairperson: Urban Planning and Environment; Blaauwberg Administration, City of Cape Town; D. Stoffberg, D.C. Bettesworth, Town planner, Blaauwberg Administration, City of Cape Town; R. Rodman; Ms. P. Titmus, Cape Town.	The need for the PBMR DPP is related to future energy needs. It is one of a suite of technologies being assed in this regard to supply future new generation and replacement capacity. Please refer to chapter 4.3.7 of the RFSR.
7.22.	Why are we investigating the PBMR?	19-01-01	Messrs. L. Serobatsi, D. Fisher, L. Bothma and H. Crous, Department of Agriculture, Conservation and Environment (GDACE), Gauteng Province, Johannesburg. S. Enele and M. Mathegana, Department of Water	The need for the PBMR DPP is related to future energy needs. It is one of a suite of technologies being assed in this regard to supply future new generation and replacement capacity. Please refer to chapter 4.3.7 of the RFSR.

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			Affairs and Forestry (DWAF).	
7.23.	Eskom has 20 years of experience with the operation of the Koeberg Nuclear Power Station. Why change to an unproven design?	10-11-05	Unknown participant	Eskom is evaluating new generation options on an ongoing basis, including the PBMR Technology.
7.24.	Failure to establish need: The applicant's claim that there is a need for a demonstration module PBMR is disputed. There are alternative energy sources available to meet the country's energy needs (the National Electricity Regulator states that electricity needs for the next 25 years can be met without new nuclear power). It is also pointed out that the applicant's rationale is contradictory: it claims that the PBMR design is inherently safe and is based on technology proven elsewhere in the world, but then claims that the demonstration module is required to test its technical feasibility. Nuclear specialists have cast doubt on the economic feasibility of the plant. One critic is Steve Thomas, whose initial report on the PBMR in South Africa is in the public domain but finds no mention in the DSR. Thomas is one of the experts on the Department of Minerals and Energy's International Panel of Experts, who have reviewed the technical and economic feasibility of the proposed PBMR. This review has never been made available to the public, despite a formal application made under the Promotion of Access to Information Act 2 of 2000.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	Thomas report is attached to this RFSR in section 8.8.3 and this information will be considered during the EIA. The consultants also have not received the international review results.

8. COMMENTS REGARDING THE SCOPE OF THE EIA PROCESS

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8.1.	A desktop study is insufficient, proper studies specific to the communities of the Western Cape who could be affected must be carried out.	09-10-01	Ms. L McDaid, Member: Koeberg Alert, Earthlife Africa, Western Cape.	This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1.
8.2.	We (Habitat Council) must insist that a full EIA be undertaken on the decommissioning phase, including dealing with the nuclear waste that would be generated.	11-10-01	Ms. M Roux, Executive Officer: Habitat Council.	Aspects relating to the decommissioning phase will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 9.
8.3.	The scope of the study must include, at a minimum, a full socio-economic study, and full epidemiological study, as well as all the others requested in our various submissions. Any exclusion from the detailed studies will be seen as an infringement on our rights.	01-10-01	Mr. M Lakhani, Anti-nuclear Coordinator: Earthlife Africa.	Please refer to section 7.3 and 7.4 of the RFSR for the aspects that will be considered in the EIA phase.
8.4.	The PBMR debate should be inclusive of the fully informed technical, economical, political, environmental and historical perspective.	27-09-00 09-05-01 14-05-01	Dr. L. Platzky, Deputy Director-General: Department of Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town. Mr. A. Murphy, Member: eThekwini ECOPEACE, Durban. Mr. W.A.J. Nel, Acting Director: City Parks, Greater Johannesburg Metropolitan Council, Johannesburg	The PBMR design is still in progress and cost-efficiency is still to be proven. Indications are that the PBMR output cost will not be much higher than the cost of electricity produced by a new coal-fired plant located at the pithead. The cost to build a PBMR is expected to be comparable with other energy generators. The cost figures will be determined through the detailed feasibility study. The demonstration module would obviously be slightly more expensive due to the learning curve and the establishment of technology. The estimated cost is in the range of 2 to 3 US

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				cents/kWh. The costing is based on building more than one unit. For comparative purposes, the approximate expenditure of some of the other supply-side options is set out below. These are all at different stages within their research, development and demonstration phases: Wind energy – R 3 million for 2000 and an estimated R 98 million for 2001. Solar thermal – R 2,5 million for 2000 and a projected figure of R 800 million up to the year 2003. Parabolic dish/Stirling technology – R 4,5 million for 2000/2001. One reason for the relative cheapness of the PBMR is that the operating staff requirement is estimated to be low. However, if the PBMR achieves its export potential, the job-creation possibilities could be significant
8.5.	In the previous EIA, health and epidemiological studies were of a desktop nature. This EIA will need more information.	9-11-05	Unknown participant	Health and epidemiology aspects will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1, 23 and 29.
8.6.	The issues of Health, safety and alternatives were poorly addressed in the previous EIA.	9-11-05	Ms. O Andrews	Statement noted. Health and safety aspects will be assessed during the EIA phase. The aspects relating to alternatives are addressed in the RFSR.

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				Please refer to chapter 7 of the RFSR: issue number 1, 23 and 29 .
8.7.	This new EIA has not given us enough essential information for one to make a proper decision.	14-12-05	Mr. W de Pinho	Please refer to the finals scoping report, which provides additional information. The output of the EIA phase, specifically the EIR, must provide sufficient information on the environmental impacts to enable the authorities to make a decision.
8.8.	Place on record that the BID is insufficient when compared to the information level requested in the previous EIA, as well as the potential importance of the proposed activity from an environmental point of view. Demands more information, more detail, especially on issues such as the economics.	17-11-05	Mr. Lakane	Viewpoint noted. The BID is sufficient for its purpose to give information to IAPs to decide whether they want to participate or not. It is not the purpose of the BID to be the comprehensive source of information. The PBMR EIA web site and the RFSRs contain more information.
8.9.	What specialist studies will be undertaken for the EIA phase?	14-03-02	Mr. S van der Woude, National Nuclear Regulator (NNR).	To be defined in the Pos-EIR.
8.10.	Mining must be part of the life cycle EIA study and costing as well as High-Level Waste long-term management and disposal.	20-09-01	Mr. A Murphy, Member: eThekwini ECOPEACE	Long term high level waste management and disposal will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: Issues number 24, 25 and 37.
8.11.	The management an/d disposal of High Level Waste must be included in the EIA: (The unilateral decision to exclude radiological and waste issues is unacceptable and must be included.)	20-09-01 19-10-01	Mr. A Murphy, Member: eThekwini ECOPEACE Mr. M Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	High level waste management and related aspects will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: Issues number 24 and 25.

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8.12.	There is a need to determine the seismic acceleration and compare this with the requirements for the structure of the PBMR plant.	19-03-02	Attendant at the Focus Group Meeting with Prof. Lloyd and Messrs Longden-Thurgood and Walmsley.	This aspect will be assessed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 18.
8.13.	What solicited the specialist geology studies?	19-03-02	Attendant at the Focus Group Meeting with Prof. Lloyd and Messrs Longden-Thurgood and Walmsley.	The advice of the EIA Consultants.
8.14.	The hydrological studies should indicate where the supply of water would be sourced from, for cooling.	26-05-01	Ms. L McDaid, Member: Koeberg Alert, Earthlife Africa, Western Cape.	This aspect will be assessed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 22.
8.15.	The negative impact of the PBMR on the tourism industry has to be investigated.	19-03-02	Attendant at the Focus Group Meeting with Prof. Lloyd and Messrs Longden-Thurgood and Walmsley.	This aspect is noted. A tourism impact assessment will be undertaken during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 7.
8.16.	The continued avoidance of the acceptance of the legal requirement to include alternatives is considered illegal.	01-10-01	Mr. M Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	Comment noted. The issue of alternatives is addressed in the RFSR. Please refer to chapter 6 of the RFSR.
8.17.	Will the EIA look at what will happen if the PBMR is successful? What will the larger international and related implications be, i.e. nuclear non-proliferation treaties, expanding nuclear into uncertain areas, etc.?	29-09-00	Professors K. Bennett and A.T. Bennett, University of Cape Town. Messrs. A. R. Kenny, Research Officer: Department of Mechanical Engineering, UCT. Messrs. T. Cloete and D. Findeis, Department of Mechanical Engineering,	The EIA is activity and site specific and will not address international strategic issues.

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8.18.	Cognizance needs to be taken of the international, political, policy and social trends.			
8.19.	Potential impacts on the "ordinary man" living adjacent to the proposed activity should receive pertinent attention within the EIA process.	Undated	Anonymous.	This aspect will be addressed in the EIA phase to be conducted during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1.
8.20.	The impact of directly affected parties should be studied in the EIA.	28-09-00	Prof. B. de Villiers, University of Stellenbosch.	This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1.
8.21.	The process of high-risk communication is important and should be addressed.	28-09-00	Prof. B. de Villiers, University of Stellenbosch.	This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1, 26 and 27.
8.22.	Risk perception should be addressed in the EIA.	Undated	Anonymous.	This aspect will be addressed in the EIA phase to be conducted during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1.
8.23.	Has a level 3-probability risk assessment been performed?	18-09-00	Ms. C. de Villiers, Senior Government and Media Liaison Practitioner: Eskom, Cape Town; Mr. J.A. Bright, Director: Nuclear Advisory Services, Cape Town.	This issue will be best addressed during the Licensing process of the NNR.

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8.24.	The safety studies on the PBMR infrastructure should investigate the possible impacts of natural disasters.	19-03-02	Attendant at the Focus Group Meeting with Prof. Lloyd and Messrs Longden-Thurgood and Walmsley.	Safety and related aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 28.
8.25.	Information on fundamental safety principles is needed.	Undated	Anonymous.	This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 28.
8.26.	The cooling mechanism of the PBMR reactor needs to be further explained.	02-10-00	Afrikaanse Handelsinstituut, Bellville, Cape Town.	Please refer to chapter 7 of the RFSR: issue number 28 as well as sections 4.3.8 and 4.6 of the RFSR.
8.27.	The establishment of an exclusion zone around the PBMR site should be investigated.	19-03-02	Attendant at the Focus Group Meeting with Prof. Lloyd and Messrs Longden-Thurgood and Walmsley.	Comment noted. This is an aspect that will also be considered by the NNR in the licensing process.
8.28.	The concept "fitness for duty" is very important and should be addressed in the EIA.	28-09-00	Prof. B. de Villiers, University of Stellenbosch.	This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1 and 28.
8.29.	The EIA report should be able to compare elements of nuclear with the other components of the energy suite.	28-09-00	Representative of the Department of Community Health, University of Cape Town (UCT).	This aspect falls outside scope of this EIA.
8.30.	Eskom must provide more qualified information on job creation.	01-02-01	Mr. R. Sherman (Pelindaba public meeting).	This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1.

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8.31.	The global problem of helium supply was not considered or addressed in the EIA.	23-01-01	Prof. P. Lloyd, Industrials and Petrochemical Consultant, Cape Town (Milnerton public meeting).	This aspect will be assessed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 20.
8.32.	Summary of issues identified: Paragraph 7.1.1 of the DSR incorrectly reflects the economic issues identified in the scoping report for the 302MW(t) PBMR DPP. In terms of this report Para 7.4.4 economic aspects were limited to: ❖ the economic potential of a local based nuclear industry ❖ impact on eco tourism in the region around Koeberg ❖ impact on supply site management based on the assumption that the plant proves viable. The issue of life cycle costing was added later at the request of the Department of Environment Affairs & Tourism. The plan of study for the first EIA reflected the following issues under the title "Economic Aspects" and included those issues mentioned above as well as life cycle costing and markets for PBMR. It thus denied that the items: ❖ impacts on spatial planning and land use; and ❖ economics of the technology were raised as an issue under the heading "Economic Aspects" in the first EIA. Impacts on spatial planning were mentioned without reference to land use under "social impacts". The plan of study for the first EIA did not simply include as an issue "safety and security impacts". This issue was stated In a restricted form,	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The following aspects will be addressed during the EIA phase: ❖ the economic potential of a local based nuclear industry – not within the scope of EIA. ❖ impact on eco tourism in the region around Koeberg ❖ impact on supply site management based on the assumption that the plant proves viable. ❖ the issue of life cycle costing ❖ impacts on spatial planning and land use; and ❖ economics of the technology ❖ safety and security impacts Please refer to chapter 7 of the RFSR: issue numbers 2, 7, 9, 11, 12 and 28 as well as section 4.5 of the RFSR for a description of the safety features of the PBMR technology.

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	namely "conventional safety and security impacts (i.e. excluding radiological aspects for which the NNR findings will Inform the EIR)".			
8.33.	It is <u>recommended</u> that the description of the affected environment be expanded to include the City of Cape Town and adjacent areas; and that the potential costs and benefits of the PBMR will be assessed for the full lifecycle of the proposed plant, including the potential export market and related aspects.	18-05-01	Messrs K Wisemand & E Weinronk, Cape Metropolitan Council: Planning, Environment & Housing – Environmental Management.	Recommendation noted.
8.34.	It is recommended that the EIA include the full lifecycle costs of nuclear waste management, storage and final disposal. Any decision to proceed with the PBMR must take these costs into account, including the cost of establishing a final repository for nuclear waste.	18-05-01	Messrs K Wisemand & E Weinronk, Cape Metropolitan Council: Planning, Environment & Housing – Environmental Management.	The study is limited to the demonstration module PBMR.
8.35.	Please provide information about any upgrading of transmission networks and new lines that may need to be constructed if this demonstration module proves to be successful.	Aug 01	Messrs P Hardcastle & C le Roux, Provincial Department of Environment and Cultural Affairs and Sport, Western Cape Province.	Discussions have and continue to take place with Eskom Transmission and Eskom Distribution with regard to the electrical infrastructure requirements. All proposed activities would have to conform to appropriate legislation.
8.36.	Details concerning the environmental and security implications associated with the 40-year storage of the nuclear waste at the selected site should be provided. The current international terrorist activities requires that issues related to security of the facility and transport of fuel, as well as any future PBMR that may be constructed are clearly identified in the scoping process and assessed in detail in the EIA.	Aug 01	Messrs P Hardcastle & C le Roux, Provincial Department of Environment and Cultural Affairs and Sport, Western Cape Province.	Waste management aspects will be addressed during the EIA process. Please refer to chapter 7 of the RFSR: issues number 5, 23 and 24.

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8.37.	Examining the full life of reactors and the spent material is required. Taking these aspects into account, the infrastructural costs of the PBMR project may far outweigh its viability. The implications to taxpayers and consumers of electricity of infrastructural costs must be carefully examined through the full life cycle of the PBMR project, which includes the costs of radioactive waste management and disposal by future generations.	22-05-01	Dr. L. Platzky, Deputy Director General: Department of Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town	The long term financial provision for waste and spent fuel management and decommissioning is taken into account in the determination of the viability of the project and this is assessed in terms of PFMA by the Department of Finance.
8.38.	An extensive environmental monitoring programme, both on and off-site, including an overall site emergency plan for accidents, with regular exercises between the on-site emergency services and fire brigade should be instituted.	17-10-01	Mr. D Louw, Director, Department of Health – Western Cape.	This is an aspect that will be addressed in the EMP as well as the NNR licensing process. Please refer to chapter 7 of the RFSR: issue number 1, 26, 28 and 29.
8.39.	Cumulative impacts should be addressed as it is a legal requirement.	17-10-01 Aug 01 01-10-01	Dr. P Hanekom, Head of Department, Department of Agriculture, Conservation, Environment and Land Affairs – Gauteng Province. Messrs P Hardcastle & C le Roux, Provincial Department of Environment and Cultural Affairs and Sport, Western Cape Province. Mr. M Lakhani, Anti-nuclear Coordinator: Earthlife Africa.	Cumulative impacts will be assed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 36.
8.40.	Issues that are significant but fall outside of the scope	7-03-06	Legal Resources Centre	The strategic aspects have been

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	of the DSR for the PBMR DPP: The DSR states that certain issues of a strategic nature cannot be addressed in the EIA due to the site and activity's specific nature of the process. These so-called strategic issues are not specified. It is therefore not clear whether these issues are limited to those contained in table 6, DSR page 70.		(Cape Town) on behalf of Earthlife Africa (Cape Town)	included in the RFSR and will be dealt with in the EIA phase. Please refer to chapter 7 of the RFSR, section 7.4.
8.41.	Issues that are significant but fall outside of the scope of the DSR for the PBMR DPP: Items 1, 6 and 9 of table 6 pertain to the issue of economic impacts. The NEMA principle in section 2(3) requires development to be socially, environmentally and economically sustainable. NEMA principles must be taken into account in the preparation of environmental impact reports required for the granting of permission of certain prescribed activities. Furthermore NEMA section 23(2)(b) refers to the general objective of integrated environmental management which is to identify potential impacts on the environment, socio-economic conditions and cultural heritage with a view to minimizing negative impacts and promoting compliance with the principles of environmental management set out in section 2.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The strategic aspects have been included in the RFSR and will be dealt with in the EIA phase. Please refer to section 2.2, 2.3 and 7.4 of the RFSR.
8.42.	Impacts would be visible for approximately 2 km but would not necessarily be harmful. A dispersion modelling must be done which could be based on three models, namely: ❖ Release of minor doses of radiation into the atmosphere; ❖ Release of massive doses of radiation into the atmosphere; and	04-04-02	Messrs D Bettesworth and T Kotze, Blaauwberg Administration.	Meteorological and dispersion modelling will be addressed as part of the EIA phase. Cumulative impacts will also be assessed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 13 and 21.

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	❖ Total destruction.			
8.43.	A decommissioning plan, environmental rehabilitation plan and decommissioning date for the PBMR is required. Such a plan must include on-going environmental monitoring until decommissioning and rehabilitation is completed.	18-05-01	Messrs K Wiseman and E Weinronk, Cape Metropolitan Council: Department of Planning, Environment and Housing.	Suggestion noted. The requirement for these aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 9.
8.44.	Does electro-magnetic radiation (EMR) from power lines form part of the EIA?	9-11-05	Unanimous	The position of the Department of Health on electro-magnetic radiation originating from power lines is that it has no effect on exposed persons or the environment. As such this will not be included in the EIA. Reference: www.doh.gov.co.za.
8.45.	Most of the consultants/specialists that worked on the previous EIA were ex employees of Eskom. For the current EIA totally independent consultants must be employed.	9-11-05	Mrs. L McDaid	The consultants sign a sworn declaration of independence and previous employment record does not disqualify a consultant from acting professionally and objectively.
8.46.	How will the current EIA address nuclear safety issues, since the High Court Ruling directed that the DG for Environment Affairs cannot abdicate his responsibility in this regard to the DG of DME?	9-11-05	Mrs. L McDaid	The High Court did not rule on this issue. However, the DEAT and the NNR have reached an agreement on how radiological and nuclear safety issues will be dealt with within the EIA. This agreement is included in section 8.14 of the RFSR.
8.47.	The ELA & public will require timeous information generally and on safety issues to participate in the EIA and to make decisions. The EIA cannot direct or address policy issues e.g. nuclear waste policy given the EIA's status	9-11-05	Ms. O Andrews	The public will receive information timeously in the reports and will have sufficient time for review. The POS for Scoping approved by DEAT indicates 30 calendar days public review period for the draft scoping report, and 45 calendar

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				days for the Draft EIR. While the EIA cannot direct policy issues, mechanisms exist whereby the Director General of the Department (e.g. DME) can be sensitised to public concerns for his/her pressure. This, however, does not take place on obligations on the EIA process to resolve the issue and to report on the out come but merely to state that issue has been passed on.
8.48.	What is the purpose of the project?	9-11-06		The project will assess the integrated functional integrity and operability of a full scale reactor/power generation unit. Please refer to section 4.3.7 of the RFSR.
8.49.	Would the PBMR EIA and the NNR processes run in parallel?	15-11-05	Mashiule Phalane - ELA	Some aspects of the processes would run in parallel. However, there would be cross referencing between the two processes. Please refer to the RFSR (section 2.5.1) for a description of the interdepartmental coordination and section 8.14 for a copy of the memorandum of agreement between the DEAT and the NNR.
8.50.	How will the fuel transport be addressed? Will it be addressed as part of this EIA?	15-11-05	Mr. Barker	The fuel manufacturing process, including the transportation thereof, is the subject of a separate EIA.
8.51.	How is transport and fuel manufacturing going to be addressed?	17-11-06	Mr. Lakane	The issue of fuel manufacture and transport (FM&T) was dealt with in the previous EIAs for the PBMR (Eskom) and FM&T (NECSA).

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8.52.	Would the EIA consider alternative energy forms and are the impacts compared?	15-11-05	Dr. van As	Yes, the scoping phase considered and contextualized alternative energies. However, alternatives have been dealt with in the scooping report and will therefore not be carried forward to the EIA phase. Please refer to chapter 6 of the RFSR in this regard.
8.53.	While studies from the previous EIA may be a useful starting point to inform this EIA process, WESSA urges that this new process be used as an opportunity to rectify and improve on the shortcomings of the previous EIA. WESSA trusts that information from the previous EIA will be critically reviewed and that the opportunity to update and supplement specialist information previously provided will be used.	6-03-06	WESSA Western Cape Region: Samantha Ralston (Environmentalist)	Information that will be used will be revaluated and supplemented to inform the EIR for the 400 MW(t) PBMR DPP Baseline data sets that were generated during the previous EIA and recorded in the environmental impact report (EIR), that are considered to be valid in the context of the proposed 400 MW(t) DPP will be validated and reassessed as part of the 400 MW(t) PBMR DPP EIA process..
8.54.	The lack of a comprehensive and holistic energy strategy and a lack of transparency have, and will undoubtedly continue to, cloud this EIA process. This must not be allowed to happen. As the Draft Scoping Report (DSR) rightly points out, this EIA process is not the correct forum to address broader strategic issues around energy supply alternatives. However, these issues do need to be addressed and debated somewhere as they directly inform the need and desirability of the proposed development of the PBMR DPP.	6-03-06	WESSA Western Cape Region: Samantha Ralston (Environmentalist) Fix number	Energy supply alternatives will be addressed by the IEP, NIRP and ISEP processes which are discussed on chapter 6 of the RFSR .
8.55.	Failure to establish need: The DSR fails to require that the EIA establish that there is indeed a legitimate	7-03-06	Legal Resources Centre (Cape Town) on behalf of	Please refer to section 4.3.7 of the RFSR in

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	need for the construction of the PBMR DPP.		Earthlife Africa (Cape Town)	this regard.
8.56.	Failure to establish need: Chapter 3 of the submission made by Earthlife Africa in respect of the draft EIA for the 302 MW(t) PBMR pointed out that the construction of a demonstration model PBMR will require the expenditure of a considerable amount of public funds, and may also expose taxpayers to future decommissioning and clean-up costs. In addition, the hazardous nature of a nuclear installation means that the building of such a plant will increase the risk of a nuclear accident, while there will be unavoidable adverse impacts on the environment resulting from increased discharges of radioactive material and radioactive waste, and the production of high level radioactive waste. In the case of the current EIA we likewise argue that as a result of the cost, risk and increased environmental impact associated with the establishment of a new nuclear power plant, the scoping report for the EIA should set out a legitimate purpose and need for a new plant. This is required in order to ensure that the decision-maker can properly assess whether the possible benefits of the proposed development outweigh its potential environmental and socio-economic impacts.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	It is one of the purposes of an EIA to assess whether the possible benefits of a proposed development outweigh its potential environmental and socio-economic impacts. Please refer to section 4.3.7 of the RFSR in this regard.
8.57.	It is noted with concern that the applicant seems to take the approach that certain issues that were considered during the EIA for the 302MW(t) PBMR do not need not be considered in the current scoping process for the proposed 400 MW(t) PBMR DPP because these issues had been considered during	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	It appears that there is a misinterpretation regarding the utilisation of previous information. Only valid base datasets would be utilised.

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	the earlier EIA, or alternatively that some issues assessed under the previous EIA do not need to be reassessed in the current EIA (refer page 7 of DSR).			
8.58.	The applicant states at p68 of the DSR that 'A number of issues for consideration were identified through the EIA processes for both the 302MW(t) PBMR DPP (undertaken in 2001 and 2002) and the 400MW(t) PBMR DPP (current process). From the evaluation of these issues, recommendations are made regarding further detailed studies that are required to be undertaken in the environmental impact assessment phase." The applicant sets out issues identified as potentially having a detrimental impact on the environment on pages 70 to 88 of the DSR. For some of these issues, the applicant refers to studies or assessments that were conducted during the EIA for the 302MW(t) PBMR DPP, and reaches the following conclusion in respect of a number of these issues: "No further assessment required" (refer p86 & 87 of DSR).	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	This aspect has been amended. Please refer to chapter 7 of the RFSR report for the process and identified significant impacts to be assessed and addressed.
8.59.	Assumptions of the Study: The DSR states that it is assumed that where relevant and appropriate studies undertaken during the 302MW PBMR EIA are acceptable for use in the current EIA process. It is disputed that any study and in particular the economics and safety studies of the first EIR are acceptable for use the current EIA process. … The current report is defective in that it does not provide for the proper assessment, nor does it disclose for comment and debate foundational documents. LRC refer to the following documents which should	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	It is stated that baseline data sets that were generated during the previous EIA and recorded in the environmental impact report (EIR), that are considered to be valid in the context of the proposed 400 MW(t) DPP will be validated and reassessed as part of the 400 MW(t) PBMR DPP EIA process. Safety aspects will be addressed in the EIA phase. Relevant information will be included in the environmental impact report in accordance with the NNR/DEAT

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	be disclosed: • The Safety Report • The Detailed Feasibility Report • The report of the International Panel of Experts Technical and Economic Feasibility Report • General Operating Rules • Operating Technical Standards • Probabilistic Risk Assessment			cooperative agreement. In addition, safety aspects will be evaluated as part of the NNR safety case. Please refer to chapter 7 of the RFSR: issue number 28.
8.60.	Mitigation measures to manage environmental impacts: the application for authorization states that 'the EIR for the 302 MW (t) PBMR DPP contained a comprehensive environmental management plan for the construction and operation/maintenance of the proposed project. The mitigation measures and recommendations regarding management of environmental impacts will be amended/augmented, as appropriated for the 400 MW (t) PBMR DPP." This approach is objectionable. Mitigation, which is a requirement for an EIA should take place before authorization. However it is being deferred to an environmental management plan, which presumably is drawn up after the record of decision. Regulation 8(a)(ii) of GNR1183 states that an environmental impact assessment must contain a description of each alternative including particulars on the possibility of mitigation of each identified impact. The practice of deferring mitigation to an environmental management plan, which usually is located in one of the conditions of the record of decision, is legally improper.	7 March 2006	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	Mitigation measures will be developed for the various impacts. These mitigation measures will be described in the EIR and reflected in the EMP. An EMP for the proposed 400 MW(t) PBMR DPP will be submitted as part of the EIR for public consideration. Regulation 8 (a) (ii) refers to feasible alternatives which the scoping report considered, and concluded that the Koeberg site is the preferred site.

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8.61.	NEMA requires environmental, social and economics to be included in EIA's. This is demanded in this process by ELA, placed formally on record	15-11-05	Mr. Lakane	The EIA does consider environmental, social and economic aspects. Some financial and commercially sensitive information, including the marketing components etc, does not fall within the scope of the EIA. A number of social and economical aspects will be assessed in the EIA phase. Please refer to section 7.3 of the RFSR.

ALTERNATIVES: TECHNOLOGY AND RELATED

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9.1.	Alternatives to the PBMR are not given enough attention and funding. No comparison can be made if this persists.	14-03-02 14-03-02	Adv. D Barnard, Director: Duard Barnard and Associates. Ms. M Wentzel, Chairperson: Sustainable Energy Society of Southern Africa (SESSA).	Comment noted. The demonstration module is intended to inform the consideration of energy alternatives.
9.2.	Why did Eskom as a possible electricity alternative not investigate solar chimney technology?	14-03-02	Adv. D Barnard, Director: Duard Barnard and Associates.	Eskom is not assessing the technology currently. However, Eskom is undertaking an EIA for a Concentrated Solar Thermal project in order to initiate a feasibility study. Details are available on the Eskom website http://www.eskom.co.za/eia
9.3.	The PBMR and all of its alternatives (solar and wind) should be assessed in terms of safety, technology and cost.	14-03-02 12-11-01	Dr. R Wedlake, Director: Endangered Wildlife Trust. Dr. TA Fasheun, Director – Pollution and Waste Management: KwaZulu-Natal Department of Agriculture and Environmental Affairs.	Feasibility studies of alternatives are being undertaken in accordance with the White Paper.
9.4.	More focus should be on comparative research and development of alternatives for the PBMR. (We have other sources of energy, which are always available, and which are not costly to the environment.)	14-03-02 01-09-00	Adv. D Barnard, Director: Duard Barnard and Associates. Ms. M. Costanza, Managing Director: International Institute for Energy Conservation,	Comment noted. This aspect falls outside the scope of the EIA.

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			Johannesburg.	
9.5.	Alternatives (technology) must be reviewed within the framework of the Energy Policy on a life cycle basis:	20-09-01	Mr. A Murphy, Member: eThekwini ECOPEACE.	The aspect of alternatives is addressed in the RFSR. Please refer to chapter 6 of the RFSR in this regard.
9.6.	Alternative energy sources have clearly not been properly considered.	2-08-06	C T Garbett R C H Garbett	The aspect of alternatives is addressed in the RFSR. Please refer to the chapter 6 of the RFSR in this regard.
9.7.	"There is currently a national lack of renewable energy data, and information on renewable energy system applications, system specifications, system standards, installation and performance guides, technical and economic characteristics and many other related issues." There is a clear under-funding of R&D regarding renewables at Eskom.	20-09-01 01-10-01	Mr. A Murphy, Member: eThekwini ECOPEACE. Mr. M Lakhani, Anti-nuclear Coordinator: Earthlife Africa.	This aspect does not form part of the EIA process. Eskom has however undertaken demonstration projects for renewable energy sources. This has included a wind facility and is currently undertaking an EIA to initiate a feasibility study on Concentrated Solar Thermal Power (CSP)r. information is available on the Eskom website i.e. http://www.eskom.co.za/eia
9.8.	What alternatives are Eskom investigating for electricity generation?	03-04-02	Clr S Kotze, Ward Councillor, City of Johannesburg.	The next 25 years Eskom would like to see more diversification in energy options for electricity generation. Eskom would therefore like to see more variety in the technologies it uses – hydro, renewables, nuclear, coal and natural gas. Eskom would like to maintain its low electricity prices, continually improve efficiency in consumption and contribute towards South Africa's development. As part of an ongoing effort to evaluate

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				the viability of all supply-side options a number of other power generation technologies, not yet implemented in South Africa on a commercial basis, are being evaluated in terms of technical, socio-economic and environmental aspects - research, development and demonstration projects. The proposed demonstration module pebble bed modular reactor (PBMR) electricity-generating power station is one of these demonstrations. Other demonstration plants currently in the feasibility stage include those associated with fluidised-bed combustion technology, large-scale solar thermal technology, and wind technology. The South African Bulk Renewable Energy Generation (SABRE-Gen) programme was initiated in 1998 by Eskom. There are currently four components under the SABRE-Gen programme. They are: • SABRE-Gen BioEnergy • SABRE-Gen Solar Thermal Electric • SABRE-Gen Wave • SABRE-Gen Wind Of the four, the Wind and Solar Thermal Electric components are the most advanced, with demonstration projects in or near implementation. The BioEnergy and Wave initiatives are still in the early

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				stages of project development. Eskom has established test wind facility in Klipheuwel. Eskom is busy undertaking an EIA for the CSP in order to initiate a feasibility study on a 100MW solar thermal plant. Details are available on the Eskom website http;//www.eskom.co.za/eia
9.9.	It seems as if renewable resources are not being pursued seriously. Much less resources is being used in research and development regarding renewable energy resources.	25-09-01	Mr. J & Ms. L Stevens, Member: Pelindaba Working Group.	Comment noted. This aspect falls outside the scope of this EIA. Eskom has established test wind facility in Klipheuwel. Eskom is busy undertaking an EIA for the CSP in order to initiate a feasibility study on a 100MW solar thermal plant. Details are available on the Eskom website http;//www.eskom.co.za/eia
9.10.	Why does ESKOM not promote wider use of alternative power by connecting private users to the grids and purchasing their excess capacity, in order to bridge the potential short supply before embarking further on a project that may well not turn out to be economically viable, in particular when applying responsible corporate governance principles?	20-09-01 27-9-01	Mr. A Murphy, Member: eThekwini ECOPEACE. Messrs RCH & TAHH Garbett, Ms. CT Garbett, Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd., The Karee Trust, Wat Props (Pty) Ltd.	Legislation has changed and this is now a possibility.
9.11.	Given that vast financial resources are being ploughed into the PBMR despite cautionary comments in the White Paper, it is imperative that alternatives be properly assessed. These include	09-10-01	Ms. L McDaid, Earthlife Africa, Western Cape.	The aspects relating to alternatives are addressed in the RFSR and contextualized. Please refer to chapter 6 of the RFSR in

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	alternatives in terms of energy sources, different sites and aspects of technology.			this regard.
9.12.	The Eskom viewpoint on primary energy resources and renewables should be put in writing.	02-09-00	Attendant: Pelindaba open day.	This is indicated in NIRP 2. Please refer to section 8.16.
9.13.	No feedback on evaluation of a number of power generation technologies.	17-05-06	Mr. W F M de Pinho	The aspects relating to alternatives are addressed in the RFSR and contextualized. Please refer to chapter 6 of the RFSR in this regard.
9.14.	Will this assessment compare the safety record of nuclear with those of other energy sources (i.e. gas)?	29-09-00	Representative from the Department of Mechanical Engineering, University of Cape Town.	No. A comparative assessment falls outside the scope for this EIA.
9.15.	What assurances can be given that alternative proposals will be considered by the EIA?	16-02-01	Dr. D. Fig, Representative: Leadership for Environment and Development Southern Africa (LEAD), Johannesburg	The aspects relating to alternatives are addressed in the RFSR and contextualized. Please refer to chapter 6 of the RFSR in this regard.
9.16.	Alternatives must be argued. (DEAT guideline document "EIA Regulations: Implementation of Sections 21, 22 and 26 of the Environment Conservation Act", April 1998).	09-02-01	Mr. F. Friend, Senior Lecturer, University of Pretoria.	The aspects relating to alternatives are addressed in the RFSR and contextualized. Please refer to chapter 6 of the RFSR in this regard.
9.17.	Fluidized Technology has proved to be highly efficient using various products including brown coal. It is also very environment friendly.	17-05-06	Mr. W F M de Pinho	The aspects relating to alternatives are addressed in the RFSR and contextualized. Please refer to chapter 6 of the RFSR in this regard.

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9.18.	The EWT asks Government and Eskom to pursue an energy policy that speedily reduces South Africa's heavy reliance on fossil fuels for electrical power generation.	30-10-00	Dr. J.A. Ledger, Director: Endangered Wild Life Trust (EWT), Johannesburg.	Comment noted.
9.19.	Resources targeted to the PBMR, should be re-directed to alternative energy technologies like hydro, biomass, solar, wind, etc.	17-05-01	Mr. G. Mpufane, Environmental Officer, National Union of Mineworkers (NUM), Johannesburg.	Comment noted.
9.20.	Why are we looking at nuclear energy when we have proven so many non-toxic non-pollutant forms of providing energy?	30-04-01	Ms. A. Morkel, National Marketing Manager, Spectramed, Johannesburg.	The global community, including South Africa, is looking anew at nuclear for base load electricity generation and other commercial applications. However, the full suite of supply (including renewables) and demand side management options will be considered to determine the optimal energy mix to sustain the economy and energy requirements of a country. One assumes the comment refers to renewables, which forms part of Eskom's R&D program.
9.21.	The reason for pursuing this nuclear folly, is given as an urgent need to increase capacity due to the limited life of the existing coal-fired power stations. The apparent looming gap between supply and demand, is exaggerated by conveniently ignoring the mitigating effects of: demand management; supply efficient management;	Feb. 01	eThekwini ECOPEACE.	The global community, including South Africa, is looking anew at nuclear for base load electricity generation and other commercial applications. However, the full suite of supply (including renewables) and demand side management options will be considered to determine the optimal energy mix to sustain the economy and energy

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	commissioning of mothballed 'white elephant' power stations; developing fluidised bed power stations; developing gas-fired power stations; and investment in renewable energy power generation.			requirements of a country. One assumes the comment refers to renewables, which forms part of Eskom's R&D program.
9.22.	What are the real energy alternatives, and how much effort is spent on investigating these? Eskom does a lot of window dressing on alternatives.	10-10-00 29-09-00	Messrs. Mr. S. Thorne, Director: Energy Transformations CC, Cape Town, and S. Raubenheimer Cape Town Mr. S. Thorne, Director: Energy Transformations CC, Cape Town.	The global community, including South Africa, is looking anew at nuclear for base load electricity generation and other commercial applications. However, the full suite of supply (including renewables) and demand side management options will be considered to determine the optimal energy mix to sustain the economy and energy requirements of a country. One assumes the comment refers to renewables, which forms part of Eskom's R&D program.
9.23.	Wesgro sees PBMR as a threat to the Kudu gas project.	23-08-00	Cape Metropolitan Council.	Comment noted.
9.24.	More capital is being spent on PBMR than other renewable energy sources	01-09-00	Ms. M. Costanza, Managing Director: International Institute for Energy Conservation, Johannesburg.	This is correct. Eskom is investigating a suite of energy generating alternatives. Each of these has different characteristics, is in different phases of development or even commercialisation and requires different investments.
9.25.	Have other sources of energy been taken into consideration?	23-09-00	Dr. L.T. Dube, Lecturer, University of Zululand, KwaDlangezwa	Eskom is investigating a suite of energy generating alternatives. Please refer to section 6.4 of the RFSR in

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				this regard.
9.26.	We should consider solar energy. In the long run it is the cheapest and most natural option.	10-09-00 01-02-01	Dr. J. Naude, IAP, Cape Town. Mr. A. Holm, Member: Hartbeespoort Erfenis en Omgewingsvereniging, Hartbeespoort (Pelindaba public meeting).	Opinion noted. Eskom is investigating a suite of energy generating alternatives, including solar. Please refer to section 6.4 of the RFSR in this regard.
9.27.	More information is needed on the demand side of electricity.	23-08-00	Messrs. J. Minnie, G. Laskey, F. Schlaphoff, Disaster and Emergency Services: Cape Town. H. Linde, Pollution Control: Cape Metropolitan Council (CMC). Mr. H. Schrader, Municipal Health Services, Cape Metropolitan Council (CMC). Messrs. Z. Toefy, S. Granger and Ms. E. Weinronk; K. Pavers, Environmental Management Department: Cape Metropolitan Council (CMC). Mr. K. Hennessy, Spatial Planning: Cape Metropolitan Council (CMC). Mr. P. Tomalin, Cape	Demand side management is an aspect that is extensively addressed by Eskom as part of its ISEP. The specifics of this falls outside of the scope of this EIA.

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			Metropolitan Council (CMC).	
9.28.	This seems to be an old technology that has been abandoned, why are we going ahead with it? Why is the international community so keen to develop the technology in South Africa? Is it the NIMBY syndrome? How many nations are considering this technology?	23-08-00	Messrs. J. Minnie, G. Laskey, F. Schlaphoff, Disaster and Emergency Services: Cape Town. H. Linde, Pollution Control: Cape Metropolitan Council (CMC). Mr. H. Schrader, Municipal Health Services, Cape Metropolitan Council (CMC). Messrs. Z. Toefy, S. Granger and Ms. E. Weinronk; K. Pavers, Environmental Management Department: Cape Metropolitan Council (CMC). Mr. K. Hennessy, Spatial Planning: Cape Metropolitan Council (CMC). Mr. P. Tomalin, Cape Metropolitan Council (CMC).	PBMR technology is a 4th generation nuclear technology that is more advanced than the PWR technology in the sense of safety, operability and cost.
9.29.	There is a need for international conceptualisation of PBMR technology and its operation, as this would be the means by which to satisfy the concern about the pursuit of "old technology". Is the international community indeed keen to see the technology	06-11-00	Mr. S. Granger, and Ms. E. Weinronk, Environmental Management Department, Cape Metropolitan Council	South Africa is entering a highly competitive industry with the PBMR-DPP. Please refer to section 4.3 of the RFSR.

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	developed in South Africa? Why does it appear that the technology is being developed in South Africa and not elsewhere?		(CMC), Cape Town.	
9.30.	Does the EIA have a say in the choice of the technology?	23-09-00	Messrs. D. Murry, Chairperson: Urban Planning and Environment; Blaauwberg Administration, City of Cape Town; D. Stoffberg, D.C. Bettesworth, Town planner, Blaauwberg Administration, City of Cape Town; R. Rodman; Ms. P. Titmus, Cape Town.	No. The specific technology demonstration PBMR DPP is being assessed.
9.31.	Have other sources of energy been taken into consideration?	23-09-00	Messrs. D. Murry, Chairperson: Urban Planning and Environment; Blaauwberg Administration, City of Cape Town; D. Stoffberg, D.C. Bettesworth, Town planner, Blaauwberg Administration, City of Cape Town; R. Rodman; Ms. P. Titmus, Cape Town.	Although the suite of energy generation options is mentioned in the RFSR, this issue falls outside the scope of this project.
9.32.	Who will decide if this technology is safe?	23-09-00	Messrs. D. Murry, Chairperson: Urban Planning and Environment; Blaauwberg Administration, City of Cape Town; D. Stoffberg, D.C. Bettesworth, Town planner, Blaauwberg Administration, City of	The NNR – this aspect is assessed as part of the nuclear licensing process.

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			Cape Town; R. Rodman; Ms. P. Titmus, Cape Town.	
9.33.	How does PBMR compare to gas?	19-09-00	Mr. R. Karotti, H. Winkler: Energy and Development Research Center (EDRC).	This comparison falls outside the scope of the EIA. One of the purposes of the demonstration PBMR DPP is to address aspects such as this.
9.34.	How much money is spent proportionally on the development of new technologies?	19-09-00	Mr. H. Winkler: Energy and Development Research Centre (EDRC).	Please refer to sections 6.4.3 and 6.4.4 of the RFSR.
9.35.	Would alternatives be considered in the EIA?	23-01-01 30-01-01	Prof. P. Lloyd, Industrial and Petrochemical Consultant, Cape Town. Mr. R. Ferguson, IAP, Durban (Durban public meeting).	The issue of alternatives is addressed on the RFSR. Please refer to chapter 6 of the RFSR in this regard.
9.36.	IAPs should have a say in what energy alternatives must be investigated.	23-01-01	Ms. L McDaid, Member: Koeberg Alert, Earthlife Africa, Western Cape. (Milnerton public meeting).	This EIA does not assess various technologies, but focuses on the PBMR DPP. The public cannot therefore determine that another technology should be assessed in this EIA.
9.37.	Alternatives should be investigated in terms of location.	26-08-00 23-01-01	Attendant: Koeberg open day Ms. L McDaid, Member: Koeberg Alert, Earthlife Africa, Western Cape. (Milnerton public meeting).	The issue of location alternatives is addressed in the RFSR. Please refer to section 6.5 of the RFSR in this regard.
9.38.	Was concerned with the dropping of the other sites – feels that they should be part of the EIA.	02-09-00	Attendant: Pelindaba open day.	The issue of location alternatives is addressed in the RFSR. Please refer to section 6.5 of the RFSR in

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				this regard.
9.39.	Would there be enough time to convert to other electricity options if the PBMR is a failure?	01-02-01	Mr. A. Holm, Member: Hartbeespoort Erfenis en Omgewingsvereniging, Hartbeespoort.	The PBMR is not the only energy generating option currently under consideration by Eskom. Other options are being assessed and in some cases, implemented on an ongoing basis. Please refer to sections 6.4.3 and 6.4.4 of the RFSR.
9.40.	The basis of comparison for alternatives should be financial.	Undated	Anonymous.	Opinion noted.
9.41.	The EIA should not merely be seen as the allowance for the development of one PBMR demonstration model, but that the PBMR project was a turning point in South Africa's nuclear industry and that the credibility of the process would be doubted if alternatives were not investigated.	06-02-01	Dr. D. Fig, Representative: Leadership for Environment and Development Southern Africa (LEAD), Johannesburg (Johannesburg public meeting).	The issue of alternatives is addressed in the RFSR. Please refer to chapter 4 of the RFSR in this regard.
9.42.	Who evaluates the alternative power sources to determine if they are more effective than nuclear power?	30-01-01	Attendant: Durban public meeting.	Eskom is undertaking a number of demonstration projects which includes UCG, CSP, and includes the PBMR. They are all assessed to validate long-term technical, operational, environmental and socio-economic aspects as well as their place in the generation mix. The integrated energy plan (IEP) and the National Integrated Resource Plan (NIRP) will do the assessments and conclusions.
9.43.	Alternative locations have been investigated in the past and include Thyspunt and Bantamsklip. Whereas	18-05-01	Messrs K Wisemand & E Weinronk, Cape	The consultants believe it is not necessary to go into further assessment and

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	both these sites were previously found by Eskom to be suitable for the development of a PBMR, they are excluded from the Scoping Report and EIA on the basis that Koeberg is more suitable or has fewer constraints. This assessment is based on a qualitative and simplistic evaluation of the alternative sites. No details of potential impacts at each alternative site are provided. In particular, the assessment of Koeberg concludes that the site has "No sensitivities" in terms of land use or socio-economic aspects and is "acceptable" in terms of demographic aspects. This assessment and selection of alternatives is inadequate since potentially significant impacts have not been identified or assessed in a systematic or comprehensive way. It is therefore recommended that alternative sites be addressed comprehensively and objectively in the EIA.		Metropolitan Council: Planning, Environment & Housing – Environmental Management.	analysis to prove that Koeberg is the preferred site over other greenfield sites In the case of the greenfield sites, logic dictates that the bio-physical impacts will be far more severe and that the cost of setting up the necessary infrastructure can not be justified for the purpose of the demonstration PBMR DPP. Please refer to section 6.5 of the RFSR.
9.44.	If the PBMR project goes ahead, are there other sites being considered for the manufacture of the PBMR units and PBMR fuel?	02-05-02	Ms. CT Garbett, Director: Watt Props (Pty) Ltd. Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd.	No, at this stage there are no other sites being considered. If the PBMR demo proves viable, further studies will be undertaken to identify and investigate options.
9.45.	The Directorate does not believe that the comparison of alternatives can be done adequately without considering all aspects of the project – from cradle to grave.	Aug 01	Messrs P Hardcastle & C le Roux, Provincial Department of Environment and Cultural Affairs and Sport, Western Cape Province.	A number of the alternative technologies lack this information. The PBMR demonstration results will add to the ability to make such comparisons.
9.46.	WESSA recognises that there is an urgent need to reduce the production of greenhouse gases. However, implementation of alternate programmes,	Feb 01	Mr. K Cooper, Director: Conservation. Wildlife and Environment Society of	The role and position of renewables and nuclear in a future energy electricity mix will be advised when the demonstration

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	which reduce greenhouse gases but result in other potential long-term environmental hazards, needs to be avoided. There is growing recognition internationally of the potential for renewable energy sources to meet energy needs while achieving the objective of reducing greenhouse gas emissions, as well as reducing pollution and safety hazards.		South Africa.	plants have provided the full set of results.
9.47.	SA is richly supplied with renewable power sources. Insufficient attention has been paid to the development and implementation of renewable energy programmes. Nuclear energy is at a more advanced stage of implementation than renewable energy in SA and while research is continuing into renewable sources of energy, we have thus far not seen the implementation of a commercial renewable energy programme. Many countries around the world have successfully implemented renewable energy programmes; examples include Denmark, Germany and India. Small-scale renewable energy facilities are likely to produce greater employment opportunities than the highly mechanised nuclear power industry. Given their modular nature, renewable energy facilities are also convenient for use in rural areas not connected to the electricity grid. WESSA calls for the expansion of South Africa's renewable energy programme and the active encouragement by government and parastatals for private initiatives to generate power using renewable energy sources.	Feb 01	Mr. K Cooper, Director: Conservation. Wildlife and Environment Society of South Africa.	Both wind and solar is under investigation and demonstration by Eskom. Please refer to section 6.4.3 and 6.4.4 of the RFSR.

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9.48.	Issues that are significant but fall outside of the scope of the DSR for the PBMR DPP: Item 9 deals with the issue of an international market for the future PBMR technology. As stated in the first EIA "the purpose of the proposed plant is to assess the techno economic viability of the technology of the South African and international application for electricity generation and other commercial applications". In the previous EIR it is stated, "the stated commercial potential of the PBMR for global application although outside of the scope of the EIA will be addressed to some degree within the EIR". It is inconsistent to totally exclude this consideration in current EIA. If local markets and real economic potential are identified as issues under economic aspects then by implication international markets should not be excluded from the EIA.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The 400 MW(t) PBMR DPP is a demonstration of the techno-economic and commercial applicability of a specific technology application, one of a suite of energy generation technologies investigated by Eskom. It is the purpose of the demonstration to determine the pricing, costing, etc. for a demonstration plant. The issue of international markets is beyond the scope of the EIA.
9.49.	Has an exhaustive assessment of energy alternatives been considered?	15-11-05	M Phalane - ELA	The issue of alternative technologies is addressed in the RFSR. The 400 MW(t) PBMR DPP is a demonstration of the techno-economic and commercial applicability of a specific technology, one of a suite of energy generation technologies investigated by Eskom. Please refer to section 6.3 and 6.4 of the RFSR in this regard.
9.50.	Have other competitive technologies been considered?	15-11-05	Dr. R Wedlake	Eskom has considered other technologies such as the European Pressurised Water Reactor, as well as various coal alternatives.
9.51.	Would there be a comparison of nuclear	15-11-05	Dr. R Wedlake	A comparison of nuclear technologies

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	technologies?			fall outside the scope of this EIA The techno-economic and commercial applicability of the specific PBMR technology (400 MW(t) PBMR DPP) is being demonstrated by Eskom. Please refer to section 6.4 of the RFSR in this regard.
9.52.	Where would the PBMR technology fit in relation to other technologies?	15-11-05	Dr. R Wedlake	According to the energy Policy, the PBMR is one of a suite of energy generation technologies investigated by Eskom. Please refer to section 6.4 of the RFSR in this regard.
9.53.	Where would the PBMR design fit in relation to other designs used in other countries?	15-11-05	Dr. R Wedlake	The proposed PBMR DPP is the first of the 4th generation technologies which encompasses passive safety systems. This technology will have application in any country, which has an existing nuclear infrastructure.
9.54.	Why does Eskom, according to the presentation by T Stott, not consider wind as a significant future contributor to the energy mix? According to ELA by utilizing 2% of our coast line, wind could double the current generating capacity.	17-11-05	Mr. Lakane	Eskom does consider wind as a contributor to the energy mix. However, wind generation is significantly more expensive than conventional power generation and wind has a low capacity factor, in other words the wind only blows for a relatively little time per year in SA. The typical average per annum would be about 20% for moderate areas and 25-30% for high wind areas. The rest of the time little or no power will be generated. In addition, coastal areas are sensitive; as

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				such land use is quite restricted.
9.55.	Eskom wind tests were not done in accordance with the international standards, only 50m high as opposed to 80m internationally.	17-11-05	Mr. Lakane	The largest turbine at Klipheuwel has a rotor at 60m. At the time of installation the largest mobile crane could only manage a rotor at 60 m high. At that stage it was not possible to install an 80m rotor. In addition, 80m is not an international standard. The turbine size depends on the wind conditions, capacity etc.
9.56.	Not all renewables are reflected in information on presentation.	17-11-05	Mr. Lakane	Comment noted. Eskom has a research programme managed by its Research and Technology Services International (TSI) division, looking at renewable energy sources for power generation. The two major areas under investigation are solar and wind power.
9.57.	What about other nuclear technologies? Amongst others Fusion.	17-11-05	Mr. Murphy	Fusion at this stage is an experimental technology. Eskom is however keeping track of this and all other developing energy generation alternatives for future potential.
9.58.	Why does the graph of future generation only reflect coal generation and not other renewable and technologies?	17-11-05	Mr. Murphy	The purpose of the graph is to reflect current generating capacity. Future generation capacity and options are illustrated and discussed in the National Integrated Resource Plan.
9.59.	Alternatives should be assessed and not only the PBMR DPP.	1-12-05	Mr. Phalane, Ms. Garbett.	The issue of alternative technologies is addressed in the RFSR. The 400 MW(t) PBMR DPP is a demonstration of the

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				techno-economic and commercial applicability of a specific technology, one of a suite of energy generation technologies investigated by Eskom. Please refer to chapter 6 of the RFSR in this regard. In addition, Eskom has a research programme managed by its Research and Technology Services International (TSI) division, looking at renewable energy sources for power generation. The major areas under investigation are renewables, coals and nuclear.
9.60.	Alternatives: Consideration of alternatives is a cornerstone of the EIA process. This is an important mechanism to help identify the best practical environmental option, as required by NEMA. This means that the option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term must be perused. Given that the purpose of the proposed development is not to supply energy, but to test technology, we agree with the assertion in the DSR that the range of alternatives that should be considered here is indeed limited. We are nevertheless concerned that the consideration of alternatives, as suggested in the DSR, is far too limited. We also reiterate our suggestion that the alternative methods of energy production and demand reduction must be explored at a strategic level as a matter of urgency.	6-3-06	WESSA Western Cape Region: Samantha Ralston (Environmentalist)	The issue of alternative technologies is addressed in the RFSR. The 400 MW(t) PBMR DPP is a demonstration of the techno-economic and commercial applicability of a specific technology, one of a suite of energy generation technologies investigated by Eskom. In addition, Eskom has a research programme managed by its Research and Technology Services International (TSI) division, looking at renewable energy sources for power generation. Please refer to chapter 6 of the RFSR in this regard.

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9.61.	Technology alternatives: What, if any, technology alternatives are available that will fall within the limited scope of the stated purpose of the project? This needs to be discussed and explored further. DEAT's Criteria for Determining Alternatives in EIA (2004) states that "Failure to consider alternatives adequately from the outset is symptomatic of a biased process…."	6-3-06	WESSA Western Cape Region: Samantha Ralston (Environmentalist)	The issue of alternative technologies is addressed in the RFSR. It must be stressed that the 400 MW(t) PBMR DPP is a demonstration of the techno-economic and commercial applicability of a specific technology, one of a suite of energy generation technologies investigated by Eskom. Please refer to chapter 6 of the RFSR in this regard.
9.62.	Failure to consider alternatives: The Draft Scoping Report appears to identify three categories of alternatives to the proposed PBMR DPP. It then attempts to preclude the further investigation of two of these alternatives (the energy / technology option and the 'no-go' option), and also presents an assessment of the third alternative (site alternatives) as a fait accompli.	7-3-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The issue of alternative technologies is addressed in the RFSR. It must be stressed that the 400 MW(t) PBMR DPP is a demonstration of the techno-economic and commercial applicability of a specific technology, one of a suite of energy generation technologies investigated by Eskom. Please refer to chapter 6 of the RFSR in this regard.
9.63.	Failure to consider alternatives: It is submitted that the relevant authority must exercise the powers granted to it in regulation 6(2) of the EIA Regulations and request the applicant to amend the Draft Scoping Report by listing all alternatives identified, including energy I technology options, the 'no-go' option and site alternatives. The applicant should also be requested by the relevant authority to remove the comparative assessment of site alternatives from the Draft Scoping Report. Should	7-3-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The issue of alternative technologies is addressed in the RFSR. Please refer to chapter 6 of the RFSR in this regard. The request to the authorities is noted. However, a number of alternative sites were comprehensively considered in the previous EIA and Koeberg NPS site was found to be best suited for the

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	the relevant authority fall to do so, any decision under regulation 6(3)(a) or (b) will fall to be set-aside on judicial review.			demonstration module PBMR. This conclusion has been validated during the current scoping phase. Only validated base dataset were utilised.
9.64.	The Applicant's suggestion that comparisons will be made with other technologies should the PBMR DPP prove viable does not satisfy legal requirements. The EIA regulations require that all identified alternatives be described in the Scoping Report. Feasible alternatives must then be described in the Plan of Study for impact assessment phase. The EIR must then include a description of each alternative and a comparative assessment of each alternative.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The issue of alternative technologies is addressed in the RFSR. Please refer to chapter 6 of the RFSR in this regard.
9.65.	Failure to consider alternatives – Energy and Technology Alternatives: The DSR fails to describe energy and technology alternatives identified during the scoping phase of the EIA. Instead, the applicant presents information regarding the energy policy, the DME's integrated energy plan, the NER's national integrated resource plant, and the applicant's own strategic electricity planning process. It is submitted that none of this information is relevant to the DSR, nor does this information justify the applicant's disregard of Regulation 6(d) of the EIA Regulations.	7-3-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The issue of alternative technologies is addressed in the RFSR. Please refer to chapter 6 of the RFSR in this regard.
9.66.	Failure to consider alternatives – Energy and Technology Alternatives: the applicant has made the assumption that other energy and technology alternatives are not relevant to the scope of the entire EIA process for the proposed PBMR DPP. It is stated at page 55 of the DSR under the heading	7-3-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The issue of alternative technologies is addressed in the RFSR. It must be stressed that the 400 MW(t) PBMR DPP is a demonstration of the techno-economic and commercial applicability of a specific technology, one of a suite of

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	'Assumptions of the Study' that "This report and its investigations are project-specific for a demonstration plant, and consequently the environmental team did not evaluate any other energy or technology alternatives". It is submitted that this assumption is ill founded. There is no provision in the ECA or the EIA regulations that empowers an applicant to ignore alternatives because of the 'project specific' nature of an EIA application. In fact, it is submitted that most EIA applications are project specific. For example, if an applicant were to apply for authorisation to construct a medical waste incinerator, does the 'project specific' nature of the application preclude a description of identified technology alternatives (such as autoclaving or sterilisation) in the DSR? The answer is clearly that it does not. The term "project specific" is also improperly manipulated in the DSR, which seeks to hive off "project specific" radiological matters to the NNR.			energy generation technologies investigated by Eskom. Please refer to section 6.4 of the RFSR in this regard.
9.67.	Failure to consider alternatives – Energy and Technology Alternatives: energy and technology alternatives were raised during the Scoping process. For example, the following alternatives are identified: • wind electricity generation; • solar electricity generation; • pumped storage generation; • non-PBMR nuclear technology options. We submit that other alternatives that should also be described in the Scoping Report include solar thermal chimneys and tidal current (as these have the	7-3-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The issue of alternative technologies is addressed in the RFSR. It must be stressed that the 400 MW(t) PBMR DPP is a demonstration of the techno-economic and commercial applicability of a <u>specific technology</u>, one of a suite of energy generation technologies investigated by Eskom. Please refer to section 6.4 of the RFSR in this regard.

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	potential to provide 24-hour energy).			
9.68.	Failure to consider alternatives – Energy and Technology Alternatives: By failing to describe all the alternatives identified, the Applicant has not complied with the mandatory legal requirements of the EIA Regulations. In the circumstances, it is submitted that the relevant authority must exercise the powers granted to it in regulation 6(2) of the EIA Regulations and request the applicant to amend the Draft Scoping Report by listing all alternatives identified, including energy and technology options. Should the relevant authority fail to do so, any decision under regulation 6(3)(a) or (b) will fall to be set-aside on judicial review.	7-3-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The LRC's viewpoint is noted. However, the issue of alternative technologies is addressed in the RFSR. It must again be stressed that the 400 MW(t) PBMR DPP is a demonstration of the techno-economic and commercial applicability of a <u>specific technology</u>, one of a suite of energy generation technologies investigated by Eskom. Please refer to section 6.4 of the RFSR in this regard.
9.69.	We reject the exemption applied for in respect of disregarding alternative energy sources and alternative sites.	7-3-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	The application for exemption has been withdrawn. Please refer to section 8.6 of the RFSR in this regard.
9.70.	We do not accept that the motivations of alternative energy assessments developed in terms of Eskom's ISEP process were either satisfactory or valid as alleged by the applicant. We do not believe that any policy overrides the necessity and good sense for a properly conducted EIA. The applicant is morally duty bound not to try to use sharp tactics to avoid their obligations towards the public.	10-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	The issue of alternative technologies is addressed in the RFSR. The 400 MW(t) PBMR DPP is a demonstration of the techno-economic and commercial applicability of a specific technology, one of a suite of energy generation technologies investigated by Eskom. Please refer to section 6.4 of the RFSR in

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				this regard.
9.71.	We intend to oppose and reject the scoping report and to enforce our rights should the applicant refuse to incorporate direct and accurate comparisons between alternative energy technologies and the PBMR into the EIA; such alternatives to be fully assessed and publicly and impartially debated.	10-3-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	The viewpoint is noted. Please refer to section 6.4 4 of the RFSR in this regard. The 400 MW(t) PBMR DPP is a demonstration of the techno-economic and commercial applicability of a specific technology, one of a suite of energy generation technologies investigated by Eskom.
9.72.	Sustainable renewable alternatives will be cleaner and will have a kinder footprint on the planet and its people and have developed considerably both technologically and in competitiveness since the previous EIA. To disregard these vital attributes in order to sustain a notional number of technologies is not rational – to refuse to consider them as a replacement at all is disingenuous.	10-3-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	Comment noted. Eskom is considering a number of alternative technologies and has put up demonstration plants to decide their future role in the overall generation suite. Please refer to section 5.4, on page 26 of NIRP 2, for the supply side options under consideration by Eskom. NIRP 2 is attached in section 8.16 of the RFSR.
9.73.	Consideration of alternatives (full life cycle costing) - How does the PBMR compare with e.g. wind farms (cost per unit of electricity) if full future costs of managing nuclear waste disposal sites are considered?	27-3-06	Wilhelm Alheit	Refer to figure 7 and 8 on page 30 of NIRP 2, in section 8.16. The NIRP2 compares lifecycle levelled costing of building and operating base load and peaking plants.
9.74.	The PBMR has been identified by the applicant and government in the White Paper on energy as one potential energy source. However this does not justify blindly continuing with a project without prudently & diligently assessing other energy sources that may be proven, commercially viable, superior, less hazardous, may accomplish the PBMR function efficiently and	10-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation	The issue of alternatives is addressed in the scoping report. Please refer to section 6.4 of the RFSR for the aspects relating to technology alternatives

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	more economically, at least within a more acceptable timeframe than the PBMR's scheduled commercial roll out date of 2015 (assuming there are no unforeseen delays and the experiment actually works)		Services (Pty) Ltd	
9.75.	Failure to properly consider the "no-go" option: No application has been made under Section 28A of the ECA for exemption from the requirement to consider the 'no-go' option.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The "no-go" option will be addressed in the EIA phase for the 400 MW(t) PBMR DPP. Please refer to chapter 7 of the RFSR: issue number 8.
9.76.	The NO-GO option: the proponent's argument is irrational as there is no point in spending R14 billion (of taxpayer's funds) on a demonstration plant that is not commercially viable. Similarly to wait until it is known if the PBMR DPP is viable or not, before making detailed comparisons with other technologies makes no sense whatsoever. This should more appropriately be called the NO-SENSE option.	7-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	The "no-go" option will be addressed in the EIA phase for the 400 MW(t) PBMR DPP. Please refer to chapter 7 of the RFSR: issue number 8.
9.77.	Legally the no-go option must be assessed, it is not up to the consultants to choose to flout the law and their comments are astoundingly arrogant in this regard.	09-10-01	Ms. L McDaid, Earthlife Africa, Western Cape.	The "no-go" option will be addressed in the EIA phase for the 400 MW(t) PBMR DPP. Please refer to chapter 7 of the RFSR: issue number 8.
9.78.	The no-go alternative: We believe that the dismissal of the 'no go' alternative is unjustified at this early stage of the EIA process. According to the DSR "…the no-go option was not considered during the scoping process as the no-go option would imply that the technology would be lost from the suite of actions included in the White Paper on Energy". We	6-3-06	WESSA Western Cape Region: Samantha Ralston (Environmentalist)	The issue of alternative technologies is addressed in the RFSR. The 400 MW(t) PBMR DPP is a demonstration of the techno-economic and commercial applicability of a specific technology, one of a suite of energy generation technologies investigated by Eskom.

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	suggest that the logic of this is flawed. The White Paper, a policy document, cannot dictate the decisions made in terms of other legislation (in this case NEMA and the Environmental Conservation Act (Act 73 of 1989)). Furthermore, the 'no go' in terms of this application would not necessarily mean that the technology would be lost from the suite of actions included in the White Paper on Energy. An application to implement the technology elsewhere could be successful. Implementing the no go would not necessarily spell the end of all nuclear technology in South Africa as it is specifically PBMR technology that is in question here. It is worth noting that the White Paper does not specifically prescribe the construction of a PBMR demonstration plant. We therefore suggest that the no go alternative continues to be included and considered in this impact assessment process, as is legally required.			Please refer to section 6.4 as well as chapter 7 of the RFSR: issue number 8.
9.79.	Failure to properly consider the "no-go" option: The White Paper on Energy states that it would not be prudent to exclude nuclear energy as a supply option. The policy suggests the evaluation of all candidate energy supply and demand resources in an unbiased fashion but, importantly, does not seek to prescribe the construction of demonstration plants for specific options, let alone the specific technology of the PBMR.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The "no-go" option will be addressed in the EIA phase for the 400 MW(t) PBMR DPP. Please refer to chapter 7 of the RFSR: issue number 8.
9.80.	Failure to properly consider the "no-go" option: The White Paper instead refers to the need to utilize integrated resources planning (IRP) methodologies to evaluate future energy supply option, and these are described as methodologies for decision making	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The "no-go" option will be addressed in the EIA phase for the 400 MW(t) PBMR DPP. Please refer to chapter 7 of the RFSR: issue number 8.

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	which are concerned with the acquisition of least cost energy resources, taking into account the need to maintain adequate, reliable, safe and environmentally sound energy services for all customers. The IRP approach includes: the evaluation of all candidate energy supply and demand resources in an unbiased manner; the systemic consideration of a full range of economic environmental social and technological factors; the consideration of risks and uncertainties posed by different resource portfolios and external factors, and external factors such as the fluctuations in fuel prices in economic conditions; and the facilitation of public consultation in the utility planning process.			
9.81.	Failure to properly consider the "no-go" option: The fact that the proposed activity is for a demonstration PBMR is not a valid reason for excluding the 'no go' option. Neither the ECA nor the EIA regulations contemplate excluding the 'no-go option' from consideration. To do so would defeat the entire object of having to apply for authorisation to undertake an activity identified under GN R1182.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The "no-go" option will be addressed in the EIA phase for the 400 MW(t) PBMR DPP. Please refer to chapter 7 of the RFSR: issue number 8.
9.82.	Failure to properly consider the "no-go" option: The exclusion of the "no-go" option seeks to improperly limited the range of relevant matters to be considered and to in effect fetter the discretion expressly afforded to the decision maker to refuse to authorise the proposed activity under section 21(3) of the ECA.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The "no-go" option will be addressed in the EIA phase for the 400 MW(t) PBMR DPP. Please refer to chapter 7 of the RFSR: issue number 8.

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9.83.	Failure to properly consider the "no-go" option: the applicant states in the DSR that "...the no-go option was not considered during the scoping process, as the no-go option would imply that the technology will be lost from the suite of actions included in the White Paper on Energy". We submit that this approach is wrong. The White Paper on Energy ('the White Paper') is a policy document and it cannot lawfully change the scope of legislation or obviate enquiries to be made or decisions that have to be taken in terms of legislation. Moreover, and importantly, the White Paper in any event does not seek or purport to do that in respect of the "no-go. option. In short, the White Paper offers no support for excluding consideration of the "no-go" option in respect of PBMR DPP, as the DSR does.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The "no-go" option will be addressed in the EIA phase for the 400 MW(t) PBMR DPP. The issue of alternatives is addressed n the RFSR. Please refer to chapter 6 for the alternatives and chapter 7 of the RFSR: issue number 8 for aspects relating to the "no-go" option.
9.84.	Investigation of mitigation measures to keep adverse impacts at a minimum as well as the option not to implement the activity: The 'no go' option is necessary to assist in determining whether the PBMR should be included in the suite of options for energy supply. Even though this is a 'demonstration plant', it will run for a full life cycle with the associated costs and benefits and is therefore very similar to a commercial plant. The ISEP identifies options to be investigated – not only in terms of techno-economic feasibility, but also in terms of environmental impact and social acceptability. Therefore the no go option must remain part of the EIA.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager.	The "no-go" option will be addressed in the EIA phase for the 400 MW(t) PBMR DPP. Please refer to chapter 7 of the RFSR: issue number 8.
9.85.	Failure to properly consider the "no-go" option: Section 24(4) (c) of the NEMA requires that procedures for the investigation, assessment and	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape	The "no-go" option will be addressed in the EIA phase for the 400 MW(t) PBMR DPP.

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	communication of the potential impact of activities must ensure, as a minimum, with respect to every application for an environmental authorization, the investigation of mitigation measures to keep adverse impacts to a minimum, as well as the option of not implementing the activity.		Town)	Please refer to chapter 7 of the RFSR: issue number 8.
9.86.	Failure to properly consider the "no-go" option: It is submitted that the relevant authority must exercise the powers granted to it in regulation 6(2) of the EIA Regulations and request the applicant to amend the Draft Scoping Report by listing all alternatives identified, including the 'no-go' option. Should the relevant authority fail to do so, any decision under regulation 6(3)(a) or (b) will fail to be set-aside on judicial review.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The "no-go" option will be addressed in the EIA phase for the 400 MW(t) PBMR DPP Please refer to chapter 7 of the RFSR: issue number 8.
9.87.	Why is Eskom moving against the global trend to phase out nuclear power?	29-03-01	Mr. P. and Mrs. E. Kruger.	The nuclear falls outside the scope of this EIA. It should be noted that there has been a resurgence of interest in nuclear power by many countries, including Finland, USA and UK.

10. ECONOMIC/FINANCIAL ISSUES

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10.1.	What amount has been set aside for the cost of storage and disposal of the 2.5 million fuel elements that will be created during the 40-year cycle of the (110 MWe) PBMR. For what future period beyond the 40-year life will these costs be projected into the current cost?	28-03-02	Ms. CT Garbett, Director: Watt Props (Pty) Ltd. Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd.	The proposed PBMR demonstration module will generate about 19 tons of spent fuel pebbles per annum, of which less than one ton is depleted uranium. The fuel's silicon carbide coating keeps the radioactive particles isolated. The cost for decommissioning, long-term storage of radioactive waste and insurance is included in the costing of this proposed plant.
10.2.	The cost of management of pollution, not only in the immediate short-term, but future costs that will escalate potentially to a level that will render the entire project unviable	27-09-01	Messrs RCH & TAHH Garbett, Ms. CT Garbett, Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd., The Karee Trust, Wat Props (Pty) Ltd.	This is one of the aspects to be demonstrated by the proposed PBMR DPP.
10.3.	Has a detailed financial feasibility study been completed at this stage? If so, when will it be available?	27-09-01	Messrs RCH & TAHH Garbett, Ms. CT Garbett, Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd., The Karee Trust, Wat Props (Pty) Ltd.	This will be addressed in the EIR please refer to section 7.3.3 of the RFSR.
10.4.	What guarantees are ESKOM and the other investors in the PBMR giving to ensure that should the project go ahead there are sufficient funds for any compensation that may be pursued.	27-09-01	Messrs RCH & TAHH Garbett, Ms. CT Garbett, Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd., The	The PBMR DPP EIA is conducted within the relevant policy and legislative frameworks. In accordance with SA nuclear law, which in itself is fully in line with

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			Karee Trust, Wat Props (Pty) Ltd.	international practice, the licensed operator of a nuclear facility is strictly liable for any damage resulting from an accident at a facility. Eskom has 3rd party insurance of approximately US$ 400 million, which is in line with the Vienna Convention of 3rd party liability Please refer to chapter 7 of the RFSR: issue number 11.
10.5.	Definite detailed information is needed to compare different technologies before there can even be a thought of commercialisation of this technology. It is of utmost importance that the basis of the analysis (cost/ benefit analysis) be made known/available already during this study to ensure that it is acceptable to all involved. This must be included in the EIR report.	11-10-02	Mr. Gxaba, Head of Department: DEAT (Free State)	The demonstration module is intended. to inform the consideration of energy alternatives. The issue of alternative technologies is addressed in the RFSR. Please refer to section 6.5 of the RFSR.
10.6.	Information in support of the marketability of the PBMR, should be made available.	28-09-00	Representative from the University of Cape Town (UCT). Representative from the Department of Community Health.	Comment noted. This falls outside the scope If the EIA.
10.7.	Would there be an opportunity to evaluate the costing; the contents of the project and its assumptions?	Undate d.	Anonymous.	No, the feasibility study is confidential for the Cabinet.
10.8.	Full-cost accounting for all economics aspects must be considered. This includes, for example, the costs of health impacts on people over the lifetime of the plant (including commissioning and	9-10-01	Ms. L McDaid, Member: Koeberg Alert, Earthlife Africa, Western Cape.	The requirement for financial provisions for these events will be addressed during the EIA phase. It is the purpose of the EIA to assess

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	decommissioning) and the costs of extreme events such as evacuations.			positive and negative environmental, social and economic impacts of this proposed development. In accordance with SA nuclear law, which in itself is fully in line with international practice, the licensed operator of a nuclear facility is strictly liable for any damage resulting from an accident at a facility. Eskom has 3rd party insurance of approximately US$ 400 million, which is in line with the Vienna Convention of 3rd party liability. Please refer to chapter 7 of the RFSR: issues number 1, 12, 28, 29
10.9.	Also, if this test or demonstration module proves not be economically viable, will it be decommissioned, dismantled and decontaminate immediately, and will sufficient funding be available? What will be done after 4 years with the spent fuel? EMPs are requested for each and every phase and an EMP must be included in the report to address the what, how, when, liability and funding available for the decommissioning or closure in the event that this plant is proven not economically viable. Each EMP must be in the format of a legally binding document to ensure compliance and liability in the case of non-compliance.	11-10-01	Mr. Gxaba, Head of Department: DEAT (Free State)	Financial provisions required for the PBMR-DPP will be assessed in the EIA. Please refer to chapter 7 of the RFSR: issue number 11.
10.10.	Dissemination of information: the costs and future availability of imported enriched uranium make it difficult to predict the future costs of operating the	7-03-06	RCH Garbett CT Garbett Wat Props Pty	However, base load options in this instance are being evaluated in the National Integrated Resource Plan and

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	PBMR. It is clear that costs of power fuelled by enriched uranium will grow progressively more expensive and renewable such as wind, solar, small hydro, geothermal which will costs zero to fuel and will only bear a relatively minor cost of maintenance.		Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	Eskom Integrated Strategic Electricity Programme. In addition to this, wind, solar, and pump storage schemes are all being assessed as part of Eskom's demonstration initiatives in order to evaluate the best energy options for providing the country with electricity. Uranium costs are a small component of the overall plant costs and are predictable.
10.11.	Expenditure on nuclear research is biased.	20-09-01	Mr. A Murphy, Member: eThekwini ECOPEACE	The comment has no bearing on the subject under consideration. The statement is best addressed to the DME.
10.12.	"On a pro rata basis South African public sector expenditure on non-nuclear energy research is much lower than that of countries at the same level of development, or in relation to the contribution or potential contribution of these technologies to the country's energy economy."	20-09-01	Mr. A Murphy, Member: eThekwini ECOPEACE	Comment noted. Please refer to section 4.2 and 4.3 of the RFSR in this regard.
10.13.	Manufacturing of components for the PBMR should be done locally.	13-03-02	Mr. J Becker, Member: Afrikaanse Handelsinstituut (AHI).	Comment noted. Whilst many of the high tech components will be imported, local contractors will be utilised during the construction process.
10.14.	The project's cost projection should take the disposal of spent fuel into account. Detail of this has to be made public.	14-03-02	Adv. D Barnard, Director: Duard Barnard And Associates.	The long term financial provision for waste and spent fuel management and decommissioning is taken into account in the determination of the viability of the project and this is assessed in terms of PFMA by the Department of Finance. This aspect will be assed during the EIA

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				phase. Please refer to chapter 7 of the RFSR: issues number 9, 12 and 24.
10.15.	Have such activities been costed and discounted into the current costing of the project/electricity or would future generations have to bear the costs?	27-03-06	Wilhelm Alheit	NER Determines pricing and not Eskom. This single proposed PBMR DPP will not have effect on the electricity price.
10.16.	Will specialist studies and findings be reviewed by DEAT for technical correctness?	14-03-02	Mr. S van der Woude, National Nuclear Regulator (NNR).	DEAT has appointed a review panel to assess the EIA process and the findings.
10.17.	The nuclear industry is subsidised internationally to the tune of billions of dollars a year (excluding much of its financial responsibilities for the present and future disposal of toxic nuclear waste, the cost in human lives and suffering from nuclear disasters). Why should this scenario be any different in South African and why should the South African taxpayer subsidise an industry that is fraught with dangers that could be better spent in clean renewable energy that will be safe, create more jobs and give our economy medium and long-term advantages?	28-03-02	Ms. CT Garbett, Director: Watt Props (Pty) Ltd. Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd.	The PBMR is a commercial venture for which no subsidies would be required. It should be noted that the nuclear industry is not the only energy source that is subsidised internationally. A report published in January 2002 by the Cato Institute in the US found that, over the past 20 years, renewable energy technologies have received (in inflation-adjusted 1996 dollars) US$24,2 billion in federal research and development subsidies, while nuclear energy has received $20,1 billion and fossil fuels $15,5. Despite these subsidies, solar, wind, geothermal and biomass energy are used in about 2% of total US electricity generation, compared with the nuclear component of about 17%.
10.18.	Where are the preliminary results of research and development studies that show that the assumptions and modelling of some of these	20-09-01	Mr. A Murphy, Member: eThekwini ECOPEACE	Eskom and PBMR Limited have done pre-feasibility and feasibility studies.

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	options should be validated through a demonstration or pilot plant?			
10.19.	The SA taxpaying public will then (when the costs of managing pollution have become too costly for Eskom to bear) have to bear the enormous expense of dealing with the costs of dealing with the pollution management.	27-09-01	Messrs RCH & TAHH Garbett, Ms. CT Garbett, Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd., The Karee Trust, Wat Props (Pty) Ltd.	The long term financial provision for waste and spent fuel management and decommissioning is taken into account in the determination of the viability of the project. This is assessed in terms of PFMA by the Department of Finance Appropriate financial provisions will be evaluated during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 9, 10,11 and 12.
10.20.	The disaggregated lifecycle costs that itemize all components in a lifecycle cost analysis should be made public in the documentation.	13-10-00	Mr. S. Thorne, Director: Energy Transformations CC, Cape Town.	The costs of decommissioning, long-term storage of radioactive waste and insurance are included in all cost estimates for the PBMR project. Part of the criteria of the demonstration project is to assess the lifecycle costs of the PBMR DPP. Please refer to chapter 7 of the RFSR: issue number 9.
10.21.	The cost of dealing with radioactive waste for hundreds or thousands of years is prohibitive and renders the experiment uneconomic at the onset, if such costs and risks are borne by the PBMR Company and not passed to the taxpayers, as is currently the case.	2-08-06	C T Garbett R C H Garbett	Viewpoint noted. Financial provision is made for the handling and disposal of waste.
10.22.	Where and at what expense will the helium gas needed for cooling be obtained?	28-03-01	Ms. H. Kingwill, Journalist, Cape Town.	This has not yet been determined. This aspect will be assessed during the EIA phase.

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				Please refer to chapter 7 of the RFSR: issue number 20
10.23.	The NNR process excluded a comprehensive health-based analysis. This should be addressed.	25-04-01	Prof. L. London, Department of Public Health and Primary Health Care, University of Cape Town (UCT).	This issue will be best addressed during the licensing process of the NNR.
10.24.	Have differences in cost estimates between Eskom and MIT anything to do with compromising the safety of the reactor?	13-10-00	Mr. S. Thorne, Director: Energy Transformation CC, Cape Town.	This issue will be best answered by the NNR and DME.
10.25.	Eskom and the PBMR consortium have repeatedly claimed that the applied technology has export potential, but this claim is not validated.	25-04-01	Prof. L. London, Department of Public Health and Primary Health Care, University of Cape Town (UCT).	The export potential of the PBMR DPP falls outside the ambit of this EIA.
10.26.	The technology will pass you by, before you can make any money with your market segment. This is another tax payer's white elephant.	14-12-05	Mr. W de Pinho	Viewpoint noted. The commercial a market related aspects falls outside the scope of this EIA.
10.27.	Eskom's cost estimates for the PBMR are unrealistic in a number of ways, i.e.: The rate of return on assets (6% is far too low). Money invested in projects with such a poor rate of return – will there be sufficient capital to go ahead. The assumed lifetime of the plant is too long and does not reflect the fact that facilities are generally retired not when they wear out, but when new plants are available with better	Undate d.	Mr. S. Thomas, Senior Researcher: Science and Technology Policy Research, University of Sussex, United Kingdom.	The PBMR DPP EIA is conducted within the relevant policy and legislative frameworks. It is the purpose of the EIA to assess positive and negative environmental, social and economic impacts of this proposed development.

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	economics. Data from Britain's nuclear endeavours clearly indicates that nuclear power went from being competitive to costing about 3 x that of the cheapest electricity alternative. Eskom's estimates of construction cost and operating performance for the PBMR, seem hopelessly out of line with the experience of nuclear technology. The PBMR could prove to be a world-beater in respect of capital costs, operating performance and running costs. But it could still turn out to be more expensive than new gas-fired plants. Eskom's evaluation of the PBMR is based on projections of an annual market of 30 units, 10 units for installation in South Africa and 20 units in the rest of the world. However, it seems likely that the world market for nuclear power plants may be no more than 1 or 2 units a year. Buyers have a strong incentive to stick with tried and tested designs. Buying a new design from a country with no track record in nuclear reactor technology appears an unjustifiable risk. The issue of waste disposal has been neglected throughout the world. Few modern facilities exist for even the most easily handled waste and for the most difficult waste, plans remain tentative. Until modern working facilities for disposal of all types of waste are demonstrated, it will not be clear whether waste disposal and hence nuclear power, is a sustainable technology.			

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10.28.	It costs more to dispose of a 25 – 40 year old contaminated nuclear power plant, than what the nuclear power plant can generate in electricity in the first 20 years of its life, because the area taken up by the contaminated building can never be re-used again.	02-05-01	Anonymous.	In accordance with SA nuclear law, which in itself is fully in line with international practice, the licensed operator of a nuclear facility is strictly liable for any damage resulting from an accident at a facility. Eskom has 3rd party insurance of approximately US$ 400 million, which is in line with the Vienna Convention of 3rd party liability Decommissioning is an aspect that will be assessed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 9.
10.29.	Lack of subsidies for renewable energy resources increases the relative demand for non-renewable sources.	30-03-01	Mr. M.P. Grosskopf, IAP, Pretoria.	Eskom has undertaken demonstration projects for renewable energy sources. This has included a wind facility and is currently undertaking an EIA to initiate a feasibility study on Concentrated Solar Thermal Power (tCSP). Eskom is also undertaking demonstration of a UCG power plant. Information is available on the Eskom website i.e. http://www.eskom.co.za/eia Please refer to chapter 6 of the RFSR on the aspect of alternatives.
10.30.	Resorting to nuclear energy does not display a commitment to either renew ability or energy efficiency. It is assumed that energy demand will continue to grow and that we have to resort to	30-03-01	Mr. M.P. Grosskopf, IAP, Pretoria.	Eskom has undertaken demonstration projects for renewable energy sources. This has included a wind facility and is currently undertaking an EIA to initiate a

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	extra-ordinary measures to meet it. Nuclear technology is not inexpensive and the waste disposal will become more and more prevalent.			feasibility study on Concentrated Solar Thermal Power (CSPr. Eskom is also undertaking a demonstration of a UCG power plant Information is available on the Eskom website i.e. http://www.eskom.co.za/eia The long term financial provision for waste and spent fuel management and decommissioning is taken into account in the determination of the viability of the project and this is assessed in terms of PFMA by the Department of Finance. Waste management and long term financial provision are aspects that are included for assessment in the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24 and 25.
10.31.	The rapid development of the PBMR is vital, whilst government can pursue a policy of delaying the imposition of carbon taxes, while actively and rapidly reducing the dependence of Eskom on fossil fuels.	30-10-00	Dr. J.A. Ledger, Director: Endangered Wildlife Trust (EWT), Johannesburg.	Comment Noted.
10.32.	Eskom and its investment partners appear to be asking the public fraternity to believe their claims for PBMR export potential, without expecting to provide any evidence to this effect. This claim must be critically scrutinised.	26-08-00 25-04-01	Attendant: Pelindaba Open Day. Prof. L. London, Department of Public Health and Primary Health Care, University of Cape Town (UCT).	Comment Noted. The export potential of the PBMR technology does not form part of the scope of this EIA.
10.33.	The notion of the availability of the potential	17-05-01	Mr. G. Mpufane,	The demand for coal due to electricity

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	abundance of cheap energy supply as an ideal promised by nuclear energy, is not the full picture of today's reality. Two billion people or one-third of the world's population uses wood and animal dung for fuel without access to commercial forms of energy.		Environmental Officer: National Union of Mineworkers (NUM), Johannesburg.	generation has increased to such an extent that the PBMR DPP is not anticipated to have a noticeable impact on the coal mining industry. This aspect will be considered during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1.
10.34.	What is the future and role of coal reserves of South Africa and the imperatives for economic growth, given the threat to jobs posed by nuclear generated electricity?	17-05-01	Mr. G. Mpufane, Environmental Officer: National Union of Mineworkers (NUM), Johannesburg.	The government has aspirations to ensure that everybody has access to affordable electricity by 2012, and this project would contribute to achieving that goal Issue noted. This issue falls outside the scope of this project. This issue will be best addressed by Eskom.
10.35.	Was there an issue that Eskom was charging consumers a premium to build power stations? Does this mean that the costing issue is as clear-cut as is indicated?	16-01-01	Mr. L. Louw, Executive Director: Free Market Foundation, Johannesburg (Megawatt Park capacity building workshop).	This issue falls outside the scope of this project. This issue will be best addressed by Eskom.
10.36.	With the unbundling of Eskom will the PBMR technology also be sold off?	18-09-00	Mr. M. A. Ranoszek, General Manager: Pioneer Natural Resources of South Africa, Cape Town.	Unbundling of Eskom is currently still under review.
10.37.	PBMR is first world technology. The South African government has financial vested interests, and will not budge.	12-02-01	Anonymous.	The motivation of this project is to create a benefit for South African communities. The government has aspirations to ensure that everybody has access to affordable electricity by 2012, and this project would contribute to achieving that goal.

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				The PBMR DPP will also be the very latest nuclear technology (Generation IV) and designed to have minimal impact. This aspect will be assessed discussed in the EIR in terms of the co-operative governance agreement between DEAT and the NNR.
10.38.	It seems inappropriate that public money should be gambled on such a risky technology.	Undate d.	Mr. S. Thomas, Senior Researcher: Science and Technology Policy Research, University of Sussex, United Kingdom.	The PBMR DPP EIA is conducted within the relevant policy and legislative frameworks. The motivation of this project is to create a benefit for South African communities. The government has aspirations to ensure that everybody has access to affordable electricity by 2012, and this project would contribute to achieving that goal. The PBMR DPP will also be the very latest nuclear technology (Generation IV) and designed to have minimal impact. This aspect will be assessed in the EIR in terms of the co-operative governance agreement between DEAT and the NNR.
10.39.	Could Eskom provide compatible life cycle cost estimates per kWh (peak and off-peak) for all the technologies listed, so public spending can transparently and optimally be allocated?	13-10-00	Mr. S. Thorne, Director: Energy Transformations CC, Cape Town.	One of the demonstration criteria of this PBMR DPP is to assess the life cycle costs. This will information will only be available once the demonstration has been completed.
10.40.	Eskom and MIT show different first-cost estimates for the PBMR. The difference is $1000 / kWe (an Eskom estimate) and $2090 / kWe (MIT) – what has	13-10-00	Mr. S. Thorne, Director: Energy Transformations CC, Cape Town.	One of the demonstration criteria of this PBMR DPP is to assess the life cycle costs. This will information will only be available

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	Eskom left out off their costing that MIT has included?			once the demonstration has been completed.
10.41.	The ringing promises of "power too cheap to meter" have come back to haunt the nuclear industry. With most successful new technologies, people confidently expect that successive designs become cheaper and offer better performances. This, however, has not been the case with nuclear power. Costs have consistently increased, processes continue to throw up technical difficulties and waste processing and disposal remains neglected.	Undated.	Mr. S. Thomas, Senior Researcher: Science and Technology Policy Research, University of Sussex, United Kingdom.	It is the purpose of the EIA to assess the environmental impacts of this proposed development and to determine if adverse aspects can be mitigated, managed or avoided. The findings of the environmental assessment will be addressed in the EIR.
10.42.	It is understood that the PBMR programme is in process of being re-assessed in respect of cost and benefit figures by the end of the EIA process. Earthlife Africa wants: to have on record the figures Eskom have been using, and continues to use, to promote the project simultaneously locally, national and internationally; oversight of the process by which the new figures are calculated, as well as the details of all peer reviews.	27-09-00	Mr. R. Worthington, Branch Co-ordinator, Earthlife Africa, Johannesburg.	One of the demonstration criteria of this PBMR DPP is to assess the life cycle costs. This will information will only be available once the demonstration has been completed.
10.43.	There is a need to present a critical analysis of the economic and financial projections.	27-09-00	Dr. L. Platzky, Deputy Director-General, Department of Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town.	Economic and financial issues will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issues number 10, 11 and 12.
10.44.	There is a MITT report that indicates that the PBMR	29-09-00	Mr. S. Thorne, Director:	One of the demonstration criteria of this

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	technology is very expensive. Is it possible to do it more cheaply and more cost-effectively? How will affordability be determined?		Energy Transformations CC, Cape Town,	PBMR DPP is to assess the life cycle costs. This will information will only be available once the demonstration has been completed.
10.45.	Requests the sources of information regarding total cost of nuclear power, nuclear waste disposal and decommissioning costs, to be included in documentation.	18-01-01	Mr. T.M. Barbour, Senior Environmental Consultant: Environmental Evaluation Unit, University of Cape Town (UCT).	Provision is made for a decommissioning fund and for the storage of waste. Please refer to chapter 7 of the RFSR: issues number 9, 11, 12 and 24.
10.46.	Requests that Vaalputs operational costs and storage costs at Koeberg of spent fuel be included in documentation.	18-01-01	Mr. T.M. Barbour, Senior Environmental Consultant: Environmental Evaluation Unit, University of Cape Town (UCT).	Vaalputs accommodates Koeberg's and NECSA's low and intermediary level waste. This aspect falls outside of this EIA.
10.47.	Indicate the "direct" capital expenditure costs associated with establishing a single PBMR, including Eskom's research and development costs till date.	18-01-01 24-04-01	Mr. T.M. Barbour, Senior Environmental Consultant: Environmental Evaluation Unit, University of Cape Town (UCT). Ms. H. Kingwill, Journalist, Cape Town.	Eskom has spent R226,7M in the last financial year on R&D, which as included renewables such as wave, wind, solar thermal, bio mass power and gas generation technologies Please refer to table 6.1 of the RFSR
10.48.	Provide information on Eskom's expenditure on alternative energy over the last ten years.	18-01-01	Mr. T.M. Barbour, Senior Environmental Consultant: Environmental Evaluation Unit, University of Cape Town (UCT).	Eskom has spent R226,7M in the last financial year on R&D, which as included renewables such as wave, wind, solar thermal, bio mass power and gas generation technologies.
10.49.	Provide Eskom's R & D budget for nuclear power over the last ten years.	18-01-01	Mr. T. M. Barbour, Senior Environmental Consultant: Environmental Evaluation Unit, University of Cape	Over the past financial year Eskom total R&D budget was 35M out of a total R&D budget of R262M (Annual report). Eskom total expenditure for nuclear power over

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			Town (UCT).	the past 10 years will be addressed in the EIR. Please refer to table 6.1 of the RFSR and chapter 7: Issue number 12.
10.50.	The development and comparable costs of alternative locations are not included in the process of investigation.	14-05-01	Mr. W.A.J. Nel, Director: Johannesburg City Parks, Greater Johannesburg Metropolitan Council, Johannesburg.	The issue of site alternatives is addressed in the RFSR. Please refer to chapter 6.5 of the RFSR in this regard and chapter 7: Issue number 12
10.51.	The economic viability of the PBMR proposal is questioned, i.e. direct or indirect benefits should be indicated.	14-05-01	Mr. W.A.J. Nel, Director: Johannesburg City Parks, Greater Johannesburg Metropolitan Council, Johannesburg.	A pre-feasibility and feasibility study preceded the decision to implement the proposed PBMR DPP. The issue of financial scenarios will be addressed in the EIA phase. Please refer to section 7.3.2 and 7.3.3 of the RFSR in this regard.
10.52.	The financial quantification of environmental impacts is of paramount importance and that it is important to consider all costs involved in the project, i.e. if enriched uranium was to be imported, the environmental study should also consider the cost of the extraction and enrichment operations, although it occurs offshore.	04-12-00	Adv. D. Barnard, Director: Duard Barnard and Associates.	A pre-feasibility and feasibility study preceded the decision to implement the proposed PBMR DPP. The issue of financial scenarios will be addressed in the EIA phase. Please refer to section 7.3.2 and 7.3.3 of the RFSR in this regard.
10.53.	The risk exists that the PBMR process can cause a non-tariff trade barrier for our exports, make us less attractive as a foreign investment and tourist destination	02-10-00	Dr. L. Platzky, Deputy Director General: Department of Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town. Mr. M. Botha,	This aspect will be assessed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 7.

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			Conservation Officer: Botanical Society of South Africa (Kirstenbosch), Cape Town.	
10.54.	There is a need to present a critical analysis of the economic and financial projections – a reality check on the proposed scenario and figures.	02-10-00	Dr. L. Platzky, Deputy Director General: Department of Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town	A pre-feasibility and feasibility study preceded the decision to implement the proposed PBMR DPP. The issue of financial scenarios will be addressed in the EIA phase. addressed in the EIA phase. Please refer to section 7.3.2 and 7.3.3 of the RFSR in this regard.
10.55.	The Government is unlikely to listen to any rational arguments against PBMR because of the money invested.	12-02-01	Ms. B Stolper, IAP, Cape Town.	Opinion noted. Government decision-making processes are comprehensive and well structured and must be accountable.
10.56.	The nuclear industry is very good at dividing the costs associated with its multiple operations; mining uranium, enrichment, fuel fabrication, power generation, waste management, decommissioning, etc. and often power generation, is the only part of the nuclear lifecycle that is reflected in the lifecycle costing. Would like to see disaggregated lifecycle cost that itemises all of these components in a lifecycle cost analysis	13-10-00	Mr. S. Thorne, Director: Energy Transformations CC, Cape Town.	One of the demonstration criteria of this PBMR DPP is to assess the life cycle costs. This will information will only be available once the demonstration has been completed.
10.57.	Does the performance and cost of Koeberg suggest that we should even consider another nuclear plant?	12-02-01	Mr. A. Sztab, Managing Director: Foundation of Freedom, Johannesburg.	This aspect falls outside the scope of this EIA. However, the increased need for electricity in the Western Cape has highlighted the need for additional generation capacity to ensure security of

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				supply.
10.58.	Concern that the opportunity cost of locating the PBMR at Koeberg has not been adequately evaluated.	23-08-00	Cape Metropolitan Council (CMC).	This aspect will be assessed during the EIA phase. Please refer to sections 7.3.2 and 7.3.3 of the RFSR.
10.59.	How much did it cost to set up the Eskom Technology Company and where did this money come from?	29-09-00	Representative from the Department of Mechanical Engineering, University of Cape Town (UCT)	This issue falls outside the scope of this EIA.
10.60.	Who will carry the sunken and / or stranded costs regarding the restructuring of Eskom, as it relates to the PBMR?	19-09-00	Mr. R. Karotti, Mr. H. Winkler, Senior Researcher: Energy and Development Research Centre (EDRC), University of Cape Town (UCT).	This issue falls outside the scope of this EIA. However, since PBMR is the developer of the technology, they would carry the sunken costs. Eskom however is the applicant to both DEAT and NNR. The responsibility of ensure environmental and nuclear safety lies with Eskom.
10.61.	Nuclear, even when subsided is not cheap power, neither is it a clean power when full cycle is taken into account, it is barely better on emissions than coal.	02-08-06	C T Garbett R C H Garbett	Opinion noted. These issues will be addressed by the National Electricity Regulator of South Africa.
10.62.	How much is being invested in renewables vs. nuclear?	23-08-00	Messrs. J. Minnie, G. Laskey, F. Schlaphoff, Disaster and Emergency Services: Cape Town. H. Linde, Pollution Control: Cape Metropolitan Council (CMC). Mr. H. Schrader, Municipal Health Services, Cape	This comparative investment is provided in the RFSR. Please refer to table 6.1, section 6.4.2 of the RFSR.

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		16-01-01	Metropolitan Council (CMC). Messrs. Z. Toefy, S. Granger and Ms. E. Weinronk; K. Pavers, Environmental Management Department: Cape Metropolitan Council (CMC). Mr. K. Hennessy, Spatial Planning: Cape Metropolitan Council (CMC). Mr. P. Tomalin, Cape Metropolitan Council (CMC). Ms. O.A. Ismael, Senior Professional Officer: Greater Johannesburg Metropolitan Council, Johannesburg (Megawatt Park capacity building workshop). Ms. H Kingwill, Journalist, Cape Town	
10.63.	Are there other PBMR electricity generators operating?	23-08-00	Messrs. J. Minnie, G. Laskey, F. Schlaphoff, Disaster and Emergency Services: Cape Town. H. Linde, Pollution Control: Cape Metropolitan Council (CMC).	There are no other energy generators of this specific type. However, a reactor has been developed in Germany. Helium in a direct cycle has been used with heat produced by non-nuclear means.

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			Mr. H. Schrader, Municipal Health Services, Cape Metropolitan Council (CMC). Messrs. Z. Toefy, S. Granger and Ms. E. Weinronk; K. Pavers, Environmental Management Department: Cape Metropolitan Council (CMC). Mr. K. Hennessy, Spatial Planning: Cape Metropolitan Council (CMC). Mr. P. Tomalin, Cape Metropolitan Council (CMC).	
10.64.	The cost and process implications for long-term waste disposal, must be addressed.	28-09-00	Prof. B. de Villiers, University of Stellenbosch.	Waste management aspects will be re assessed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 24 and 25.
10.65.	It is important to maintain the current level of skill – without that decommissioning would be an expensive and risky process.	28-09-00	Prof. B. de Villiers, University of Stellenbosch.	Comment noted. This aspect will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1.
10.66.	Where will the money for the PBMR come from?	29-09-00	Professors K. Bennett and A.T. Bennett, University of Cape Town; Messrs. A. R. Kenny, Research Officer, Department of Mechanical	This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 10.

10.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
			Engineering, University of Cape Town (UCT); Messrs. T. Cloete and D. Findeis, Department of Mechanical Engineering, University of Cape Town (UCT).	
10.67.	How much of the taxpayer's money is being used for this project?	02-09-01 29-09-00	Professors K. Bennett and A.T. Bennett, University of Cape Town; Messrs. A. R. Kenny, Research Officer, Department of Mechanical Engineering, University of Cape Town (UCT); Messrs. T. Cloete and D. Findeis, Department of Mechanical Engineering, University of Cape Town (UCT).	This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 12.
10.68.	Is South Africa in a position to spend this amount of money on nuclear research when we have enough coal and other energy reserves? Why not spend this money on the alleviation of poverty and related issues?	29-09-00	Professors K. Bennett and A.T. Bennett, University of Cape Town; Messrs. A. R. Kenny, Research Officer, Department of Mechanical Engineering, University of Cape Town (UCT); Messrs. T. Cloete and D. Findeis, Department of Mechanical Engineering, University of Cape Town (UCT).	This issue falls outside the scope of this EIA. This is an aspect to be addressed by the policy makers. However, Eskom is aligned with Government's policy on diversification of the South African energy mix and is integrated into its investment strategy.
10.69.	Will total production of the PBMR eventually take place in South Africa?	19-09-00	Mr. R. van der Toorn (Vice Chairperson), Mr. P.M. Jewell, Ms. W. van	This issue falls outside the scope of this project.

10.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
			Schalkwyk, Ms. L. Nolte, Ms. D. Moore, Ms. V.A. Jewell, Sgt. J.T. Grobbelaar (SAPS), Duynefontein Community Policing Forum (Duynefontein). Mr. R. Karotti, Mr. H. Winkler, Senior Researcher: Energy and Development Research Centre (EDRC), University of Cape Town (UCT).	
10.70.	What equity resources are spent on PBMR in relation to other resources?	19-09-00	Mr. S. Law, Director: Environmental Monitoring Group (EMG), Cape Town.	Eskom is in the process of considering evaluation of various technologies. Please refer to section 6.4.2 and 6.4.3 of the RFSR.
10.71.	Are there really markets for this technology? How many of the plants have been sold? Where are the markets? Who will buy them?	19-09-00	Mr. R. Karotti, Mr. H. Winkler, Senior Researcher: Energy and Development Research Centre (EDRC), University of Cape Town (UCT).	This aspect falls outside the scope of this project. However, indications are that the world market for new power stations is in the order of US$ 100 billion (R700 billion) per year. At present no reactors have been sold. The techno-economic demonstration needs to be completed first to assess the first full sized PBMR reactor module and its workings.
10.72.	Who is going to do the economic evaluation of plant? Will the economic evaluation be done publicly?	19-09-00	Mr. R. Karotti, Mr. H. Winkler, Senior Researcher: Energy and Development Research Centre (EDRC), University of Cape Town	These aspects will be addressed during the EIA phase. Please refer to section 7.3.2 and 7.3.3 in this regard.

10.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
			(UCT).	
10.73.	R400 Million of the taxpayer's money has already been spent on technology that has been rejected by the U.S. and Germany!	25-08-00	Ms. K. Abbott, IAP, Cape Town.	However, research on the PBMR technology is continuing in the USA, China and Japan.
10.74.	Costs associated with the exercise should rather be re-directed with hazardous free energy options; to create low and semi-skilled employment opportunities; which the PBMR cannot do.	08-02-01	Ms. A. Alba, IAP, Johannesburg.	Comment noted. This aspect falls outside the scope of the EIA. Eskom has spent R226, m in the last financial year on R&D, which as included renewables such as wave, wind, solar thermal, bio mass power and gas generation technologies
10.75.	Considering the new labour market environment, how will strikes affect the daily maintenance of the PBMR?	16-02-01	Ms. B. M. Blignaut, Secretary: Green Belt Action Group, Roodepoort.	As with any other organisation, the PBMR DPP could be affected by strikes and civil action.
10.76.	Issues that are significant but fall outside of the scope of the DSR for the PBMR DPP: It is submitted that items 1, 6 and 7 relate to the costs and economic viability of the PBMR and are therefore relevant considerations for these assessments as required in terms of NEMA. It is submitted that assessing socio- economic sustainability would include assessing the impact on the use of public funds to develop a nuclear technology given the scale of expenditure involved, and would therefore also include an assessment of the financial viability of the pebble bed as an electricity generating option.	7-3-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	No public funds are used. British Nuclear Fuels Ltd (BNFL). Eskom and its South African partner, the Industrial Development Corporation (IDC), jointly have over 50% shareholding in the project. With the exception of a 10% stake, which is reserved for an empowerment company, the available shareholding has now been taken up. Contracts between Eskom, the PBMR (Pty) Ltd and other partners are proprietary information.
10.77.	Will Eskom sell shares coming from public money sources?	02-09-00	Attendant: Pelindaba open day.	British Nuclear Fuels Ltd (BNFL). Eskom and its South African partner, the Industrial Development Corporation

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				(IDC), jointly have over 50% shareholding in the project. With the exception of a 10% stake, which is reserved for an empowerment company, the available shareholding has now been taken up. Contracts between Eskom, the PBMR (Pty) Ltd and other partners are proprietary information.
10.78.	What is the commercial relationship between Eskom and the PBMR? It appears that public funds are used to develop a commercial product for a private company? Why is Eskom paying for the EIA?	9 Nov 2005	Unknown participant	Eskom is purchasing the PBMR DPP from PBMR Limited; as such there is a contractual relationship between the parties. Under the new Shareholders Agreement PBMR Limited is SA Government majority owned. Eskom will be the owner/operator of the PBMR DPP, and as such is the EIA applicant.
10.79.	How and why is so much money spent on nuclear research?	30-01-01	Ms. G.P. Watkins, Member, Earthlife Africa, Cape Town (Durban public meeting).	Eskom has spent R35m on the PBMR R&D. Eskom aligned with Government's policy on diversification of the South African energy mix and is integrated into its investment strategy. The PBMR potentially allows Eskom to meet this requirement
10.80.	Will the electricity be sold and is the intention to sell the technology?	Undate d.	Anonymous.	Yes.
10.81.	What are the job opportunities and where would they be?	Undate d.	Anonymous.	These impacts will be assessed in the EIA phase. Please refer to chapter 7 of the RFSR:

10.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
				issue number 1.
10.82.	How do you substantiate the export potential?	Undated.	Anonymous.	This is done through market evaluation and market research.
10.83.	Is the full cost for the project R1.5 billion?	01-02-01	Mr. L. Heron: Member: Earthlife Africa, Johannesburg.	No. The project costs are currently being re-evaulated and will be tabled to government in early 2007.
10.84.	Eskom must consult with consumers on their preferences for electricity generation. The consumer will not pay for nuclear power.	01-02-01	Attendant: Pelindaba public meeting.	Suggestion and conclusion noted. Such a process falls outside the scope of the EIA.
10.85.	Would the PBMR Company lose money if the PBMR is not built?	30-01-01	Mr. M. Louwrens, IAP, Cape Town (Durban public meeting).	Yes.
10.86.	Will it make a difference in the cost of electricity?	Undated.	Anonymous.	The PBMR DPP will not have an impact on the cost of electricity.
10.87.	Who is going to carry operational costs, e.g. in case of a 6-hour emergency operation?	Undated.	Anonymous.	This aspect falls outside the scope of the EIA. Aspect should be referred to the PBMR company and Eskom.
10.88.	Are the cost estimations limited to one plant and how relevant will it be for more than one plant?	Undated.	Anonymous.	The cost for the development and construction of the PBMR DPP will probably be much more than the unit cost if the PBMR would be sold. The development cost would be recouped over a number of modules.
10.89.	Is the cost of Koeberg electricity lower than the cost of coal generated electricity in terms of capital or operating costs?	Undated.	Anonymous.	No.
10.90.	What guarantee is there that the 10% stake for	Undate	Anonymous.	This will be addressed in terms of the

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	black economic empowerment will be allocated to these groups?	d.		current BEE legislation
10.91.	How much did it cost to set up the PBMR Company and where did this money come from?	Undate d.	Anonymous.	This aspect falls outside the scope of this EIA. The DPE setup the PBMR company.
10.92.	It is recommended that the EIA include the full lifecycle costs of nuclear waste management, storage and final disposal. Any decision to proceed with the PBMR must take these costs into account, including the cost of establishing a final repository for nuclear waste.	18-05-01	Messrs K Wiseman & E Weinronk, Cape Metropolitan Council: Planning, Environment & Housing – Environmental Management.	Recommendation noted. The EIA will address the requirements of full lifecycle costing. Please refer to chapter 7 of the RFSR: issue number 24 and 25.
10.93.	The City of Cape Town requests that the costs to the City, arising out of the location of the PBMR plant at Koeberg NPS site, be borne by Eskom.	18-05-01	Messrs K Wiseman & E Weinronk, Cape Metropolitan Council: Planning, Environment & Housing – Environmental Management.	Request noted. This aspect falls outside the scope of the EIA. This request should be addressed to Eskom.
10.94.	Alternative locations have been investigated in the past and include Thyspunt and Bantamsklip. This assessment and selection of alternatives is inadequate since potentially significant impacts have not been identified or assessed in a systematic or comprehensive way.	18-05-01	Messrs K Wiseman and E Weinronk, Cape Metropolitan Council: Department of Planning, Environment and Housing.	Comment noted. Alternative locations have been assessed. This aspect is addressed in the RFSR. Please refer to section 6.4 of the RFSR in this regard.
10.95.	Despite repeated efforts, we have been unable to source sound market research for the generous predictions of job creation and foreign exchange earnings. Indeed the proponents admitted that some countries wish to buy the technology from South Africa, so that they may manufacture PBMRs abroad, thereby forgoing local jobs, and	22-05-01	Dr. L. Platzky, Deputy Director General: Department of Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town	Concern noted. The commercial expectations of the applicant are disregarded for purposes of environmental assessment of a demonstration module.

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	by implication, poverty alleviation at local level.			
10.96.	The opportunity costs of the PBMR will limit the expenditure in diverse, safe and clean energy sources.	19-10-01	Mr. M Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	Eskom has spent R226,7m in the last financial year on R&D, which as included renewables such as wave, wind, solar thermal, bio mass power and gas generation technologies Opportunity cost with regard to tourism and spatial development will be considered in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1 and 12.
10.97.	If developing PBMRs or fuel plants at 'greenfields' sites 'will escalate the price of the fuel to an unacceptable level' we question the viability of the proposal without subsidies.	19-10-01	Mr. M Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	Comment noted.
10.98.	What is the cost to the NNR regarding licensing, involvement in the EIA, ongoing monitoring and responding to various requirements with regard to the PBMR, fuel plant and transport?	19-10-01	Mr. M Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	This EIA focuses only on the proposed PBMR DPP at Koeberg. The other aspects mentioned fall outside the scope of this EIA. The NNR's involvement in the EIA process is detailed in terms of the co-operative governance agreement. Please refer to section 2.5.1 and 8.14 of the RFSR for more information on this agreement.
10.99.	In our view, it is ill-conceived and unconstitutional that the South African public subsidise Eskom and the nuclear industry to develop an industry that is	14-07-01	Messrs EA Peackock, S Peackock, JH Peacock, W Peacock and AM	Your comment is noted However it is also true that many people hold the opposite view.

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	shown to be unsafe for humans as well as the environment, uneconomic and unsustainable, while polluting this country and our planet for hundreds of thousands of generations to come.		Peacock, Affected Parties, Broederstroom.	The environmental impact assessment will consider all policy and legislative requirements to ensure that this project Is not unconstitutional and ill-conceived. Some of the implications regarding perceptions and the impact thereof will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 28.
10.100.	Is the cost of the licence included in the costing and feasibility of the proposed project?	22-10-01	Mr. M Lakhani, Anti-nuclear Coordinator: Earthlife Africa.	Yes.
10.101.	What would the costs be for a greenfields site? What would be the costs if the water system were not fed from the sea? Why a cooling tower is not always used, to minimise impacts on water?	22-10-01	Mr. M Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	Greenfields sites cost will be calculated for multiple module plants and that is the basis for the costing. Waste heat from any means of power production needs to be dissipated to the air or sea. The means chosen depend on the site and the environment.
10.102.	Earthlife Africa request information regarding the extent of public funding for the PBMR.	30-09-01	Earthlife Africa: Johannesburg Branch.	No public funding is utilised for the PBMR DPP. Funding is sourced from the various investors.
10.103.	Earthlife Africa would like clarity if there is any process with regard to prior informed consent of target export markets and what authorities and/or agencies have responsibilities in this regard.	25-09-00	Earthlife Africa: Johannesburg Branch.	This aspect falls outside the scope of the EIA.
10.104.	Issues that are significant but fall outside of the scope of the DSR for the PBMR DPP: Item 9 deals with the issue of an international market for the	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape	The commercial and market related aspects of the PBMR technology falls outside the scope of this EIA. This EIA

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	future PBMR technology. As stated in the first EIA "the purpose of the proposed plant is to assess the techno economic viability of the technology of the South African and international application for electricity generation and other commercial applications". In the previous EIR it is stated, "the stated commercial potential of the PBMR for global application although outside of the scope of the EIA will be addressed to some degree within the EIR". It is inconsistent to totally exclude this consideration in current EIA. If local markets and real economic potential are identified as issues under economic aspects then by implication international markets should not be excluded from the EIA.		Town)	focuses on the demonstration PBMR DPP. The demonstration process will determine the techno-economic and commercial/cost related information
10.105.	What is the ratio of expenditure on the various demonstration technologies?	9-11-05	Unknown participant	A copy of NIRP 2 is attached in section 8.16. Please refer to figures 7 and 8 on page 30 of NIRP 2
10.106.	What is the cost comparison between the various supply technologies?	9-11-05	Unknown participant	A copy of NIRP 2 is attached in section 8.16. Please refer to table 7 on page 28 for the cost and performance data of the new supply side options
10.107.	How much has been spent on the PBMR to date?	9-11-05	Unknown participant	Since 1993 the current investors have spent R 1.83b on research for plant and fuel up to March 2005.
10.108.	How is the cost for the various technologies calculated?	9-11-05	Unknown participant	Normal accounting and PFMA practises are used for budget calculations.
10.109.	Does Eskom export electricity?	9-11-05	Unknown participant	Yes – Eskom exports and imports electricity. In 2004 about 16 000 GWh was exported and 14 000 GWh was imported

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10.110.	Electricity must be kept affordable to ensure economic growth; will PBMR contribute to economically feasible electricity?	17-11-06	Mr. Moulton	The purpose of the demonstration programme is to assess the viability of the technology.
10.111.	The Economical Feasibility Study and Business Plan for the PBMR were not available to IAPs in the previous EIA. Will it be available in this EIA, together with other information which Earthlife Africa (ELA) wishes to study to meaningfully participate with the EIA?	9-11-05	Unknown participant	Non-commercially sensitive information relating to the PBMR DPP will be made available. Due to the fact that this is a demonstration plant the economic feasibility will be developed from the results of the demonstration.
10.112.	What foreign investors does the PBMR have?	9-11-05	Unknown participant	Westinghouse former British Nuclear Fuels Limited (BNFL)
10.113.	If the PBMR is so safe, clean and economical ELA would want to have access to the economic feasibility study	9-11-05	Unknown participant	Request noted. Non-commercially sensitive information relating to the PBMR DPP will be made available. Due to the fact that this is a demonstration plant the economic feasibility will be developed from the results of the demonstration.
10.114.	Economics is a core issue in the debate. How does Eskom track the economics of other new or emerging technologies?	9-11-05	Unknown participant	There are Eskom Committees that specifically looks at/tracks emerging technologies. NIRP 2 (attached in section 8.16) also provides information on the costing and related aspects of new or emerging technologies.
10.115.	The estimated cost of the PBMR is R 15b. This is significantly up from estimates during previous EIA. Why is Eskom still considering this in the light of the higher cost, compared to other alternatives?	17-11-05	Mr. Lakane	PBMR is not different from other innovative technologies considered and investigated by Eskom. . It must be stressed that the 400 MW(t) PBMR DPP is a demonstration of the techno-economic and commercial applicability of a specific technology, one of a suite of

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				energy generation technologies investigated by Eskom.
10.116.	Disproportional investment by Eskom in PBMR relative to other proven technologies. PBMR R 35 b, Other R 255 m, ELA statement.	17-11-05	Mr. Lakane	PBMR figure given is incorrect, the budget on record is R14.5 b budget for the PBMR Company in total and includes the design and construction of the PBMR DPP, the pilot fuel plant and US design certification costs. There will be a disproportionate spending due to the level of technology development associated with the PBMR DPP.
10.117.	If the PBMR business case is based on the export market, how many orders are there, or how many potential customers? ELA makes statement that there are none!	17-11-05	Mr. Lakane	ELA view noted. The business case is based on only 100 nuclear reactors into the world market, which represents 2% of the nuclear capacity gap over the next 25 years.
10.118.	Following on from above. Should the SA tax payer be asked to gamble?	17-11-05	Mr. Murphy	The PBMR DPP feasibility studies are conducted within the relevant policy and legislative frameworks.
10.119.	Will the enriched uranium for the fuel be imported?	01-12-05	Ms. Garbett	Yes
10.120.	A direct comparison of routine maintenance and operational fuel costs of PBMR vs. alternative energy sources should be undertaken.	07-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	This aspect does not fall in the scope of this EIA. An assessment (and comparison) of routine maintenance and operational fuel costs between the PBMR and other alternative energy sources will be undertaken as part of the demonstration process and will include various other comparisons as well.

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10.121.	Dissemination of information: the escalating costs which are difficult to accurately predict (as has been amply demonstrated by the applicant who estimated in 1998 a cost of R847 million, which had grown by 1358% to 11.5 thousand million in 2002 and currently stands at around R16 thousand million rand) a budget overrun of 1889%. Details of the consequential economic risks that are inherent in the PBMR which includes the risk that the PBMR experiment may be decommissioned and abandoned as it may not be suitable for commercial purposes. These economic risks (excluding any potential accidental damage) are currently estimated at a loss to the taxpayer of R16 thousand million rand, excluding the costs of dealing with the resultant high level waste for hundreds of thousands of years as a legacy by Eskom to future generations.	07-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	The economic factors in particular, the various financial provisions will be assessed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 12.
10.122.	The document entitled "The economic risk to electricity consumers of the Pebble Bed Modular Reactor" is relevant and pertinent issues are to be included in the Scoping Report.	07-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	This document is attached to this report, and considered as part of the EIA information base. Please refer to appendix 9.
10.123.	Dissemination of information: Explanation of how viability was assessed when the only firm order on the horizon is from Eskom itself and that is not at the cost of production of the PBMR but at the cost of the next best alternative, meaning that the	07-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust	Based on projections of a successful demonstration power plant, an exhaustive business plan as been prepared addressing prospects for domestic and international markets for

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	Eskom orders will be subsidised by the taxpayer.		Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	both power and process heat applications
10.124.	Dissemination of information: The impact on Eskom prices to consumers should the cost of using PBMR technology if it falls between failure and success i.e. that it works but not as well as PBMR hope and production costs of energy are higher than alternatives.	7-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	The NER regulates pricing.
10.125.	PBMR is a private company albeit the SA government (and the public they represent) is its majority shareholder. The applicant should justify in detail why further public funds be expended at the public expense for DME to deal with the following high level radioactive waste, NNR to assess decontamination process and finally the costs of dealing with long term waste for hundreds of thousands of years at the expense of the taxpayer and the public and not the PBMR company (while to some extent this may be academic there is one outside shareholder being subsidised at the SA public's expense).	7-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	It is the purpose of the EIA to assess the environmental impacts of this proposed development and to determine if adverse aspects can be mitigated, managed or avoided. The findings of the environmental assessment will be addressed in the EIA phase. Government's decision to fund, or not to fund for example the PBMR DPP falls outside the scope of this EIA. The required financial provisions for the PBMR DPP will be assessed during the EIA. Please refer to chapter 7 of the RFSR: issues number 9, 24 and 25.
10.126.	Details of the financial model in respect of amounts allocated for disposal, monitoring and long term storage for all nuclear waste generated and period of time that applicant will pay to dealt with such waste. The previous figure was R2.7	10-03-06 03-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust	Financial provision/guarantees for radiological waste materials generated during the life of the plant will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR:

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	billion, is this figure included n the PBMR development costs?		Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	issues number 9, 12, 24 and 25.
10.127.	The costs of the PBMR have escalated by well over a 1000% since 1998, substantially diminishing its perceived comparative competitiveness, which conclusion in any event appears even then to have been founded on dubious and speculative information, and certainly on merit was not a selection of technology of choice, rendering the continued pursuit of the PBMR ill-advised and perhaps even reckless.	10-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	Comment noted. Government's decision or motivation to fund, or not to fund, for example the PBMR DPP, falls outside the scope of this EIA.
10.128.	Details of financial guarantees that will be in place should the PBMR be the cause of catastrophic failure – directly or indirectly.	10-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	Financial provision/guarantees for radiological waste materials generated during the life of the plant will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 11.
10.129.	A clear picture of "cradle to grave" environmental impacts of the PBMR including the building and development impacts, the fuel plant impacts, the ongoing uranium mining impacts, the enrichment impacts, the transport impacts, should be undertaken with a comparison to other technologies, with a 20, 30, 40 year projected running costs versus alternatives.	10-3-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	Issues relating to fuel manufacture and transport are subjects of a separate EIA.

11. LOCATIONAL CONSIDERATIONS

11.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
11.1.	Is the EIA for the PBMR site specific to Koeberg?	14-03-02	Mr. G Clapisson, National Nuclear Regulator (NNR).	Yes.
11.2.	If the project is successful what would the concentration of PBMRs be, where would they be built?	03-04-02	Clr S Kotze, Ward Councillor – City of Johannesburg.	This question falls outside the scope of this EIA which deals only with the demonstration module.
11.3.	Would future PBMR sites be located next to the ocean?	23-08-00	Messrs. J. Minnie, G. Laskey, F. Schlaphoff, Disaster and Emergency Services: Cape Town. H. Linde, Pollution Control: Cape Metropolitan Council (CMC). Mr. H. Schrader, Municipal Health Services, Cape Metropolitan Council (CMC). Messrs. Z. Toefy, S. Granger; Ms. E. Weinronk; K. Pavers, Environmental Management Department: Cape Metropolitan Council (CMC). Mr. K. Hennessy, Spatial Planning: Cape Metropolitan Council (CMC). Mr. P. Tomalin, Cape Metropolitan Council	Not necessarily. Technology adaptable to various cooling water sources, as well as dry cooling technology.

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			(CMC).	
11.4.	Where are the construction workers going to stay?	26-08-00 26-08-00	Mr. R. van der Toorn, Mr. P.M. Jewell, Ms. W. van Schalkwyk (Member: Koeberg Policing Forum), Ms. L. Nolte, Ms. D. Moore, Ms. V.A. Jewell, Sgt. J.T. Grobbelaar (SAPS) Duynefontein Community Policing Forum (Duynefontein). Attendant: Koeberg open day.	This aspect will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1.
11.5.	How far is the PBMR from the nearest dwelling?	09-04-01	Dr. C. Miller, Long Island, United States of America. IAP.	+ 2 km from Duynefontein. Please refer to the activity description in chapter 4 of the RFSR in this regard.
11.6.	If the PBMR concept is really safe, then why not place it at Coega's industrial area? If this is not acceptable, then the PBMR is not safe on any other site.	08-01-01	The Campbell's, St. Francis Bay.	The site selection process is addressed in the RFSR. Please refer to section 6.4 and 6.5 of the RFSR report.
11.7.	Why were the Brazil and Schulpfontein-West coast sites not considered for the installation of this new technology? Wouldn't it be safer to try this potentially dangerous technology further away from Cape Town?	13-10-00	Mr. S. Thorne, Director: Energy Transformation CC, Cape Town.	The site selection process is addressed in the RFSR. Please refer to section 6.5 of the RFSR report.
11.8.	Could the reactor be built underground for safety reasons?	02-09-00	Attendant: Pelindaba open day.	Yes, this scenario is possible, however it would be area is required for a reactor substantially more costly and offer no significant safety benefits.

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11.9.	Generation of electricity should take place at site or near site that is the preferred source of energy generation	01-09-00	Ms. M. Costanza, Managing Director: International Institute for Energy Conservation, Johannesburg.	Comment noted. However, there are a number of factors that influence the siting of a nuclear reactor. Please refer to section 6.5 of the RFSR report.
11.10.	It was irresponsible to erect Koeberg to close to a metropolitan area. Having sites far away from metro areas will be a valuable enhancement. PBMR should therefore already be planned far away from Koeberg.	Undate d.	Mr. A.G. Hacker, IAP, Cape Town.	Comment noted. The site selection process is addressed in the RFSR. Please refer to section 6.5 of the RFSR report.
11.11.	Koeberg is supposed to be a nuclear-free zone.	23-01-01	Mr. W. de Pinho, Member: Tableview Residents Association, Cape Town (TVRA) (Milnerton public meeting).	It is assumed that this reference is to a nuclear weapons free zone.
11.12.	The PBMR should be relocated now to a locality far away from metropolitan areas. Although initially expensive, in the long run operational problems and disasters would safeguard the built-up environment.	Undate d.	Mr. A.G. Hacker, IAP, Cape Town.	Comment noted.
11.13.	Where would the development of the Western Cape go in terms of the PBMR?	23-01-01	Attendant: Milnerton public meeting.	The zoning and land use implications and imparts will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1 and 2.
11.14.	What is Eskom's official response to the fault line at Koeberg?	30-01-01	Mr. R. Ferguson, IAP, Durban (Durban public meeting).	Impacts will be assessed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 18.

11.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
11.15.	What would the impact of PBMR be on the long-term life of Koeberg?	23-08-00	Cape Metropolitan Council.	May extend the life of the site.
11.16.	Will you have to build beyond the Koeberg fence?	Undate d.	Anonymous.	No.
11.17.	If the PBMR study is successful, will the next PBMRs be built at Koeberg?	Undate d.	Anonymous.	There is no clarity where other PBMRs may be situated. Such a process will be the subject of its own EIA process.
11.18.	There is not enough infrastructure to support the project in Bantamsklip and Thyspunt.	Undate d.	Anonymous.	Comment noted. The site assessment also came to the same conclusion. Please refer to section 6.5 of the RFSR in this regard.
11.19.	The PBMR design allows placement very close to demand centres. Thyspunt is a remote site in this respect.	Undate d.	Anonymous.	Comment noted. The site selection process is addressed in the RFSR. Please refer to section 6.5 of the RFSR in this regard.
11.20.	The PBMR will restrict the movement of people around the coastal areas.	Undate d.	Anonymous.	Comment noted. This aspect will be assessed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1.
11.21.	Why not concentrate these stations (PBMRs) at the end of the transmission lines or at large growth nodes?	Undate d.	Anonymous.	This issue falls outside the scope of this project.
11.22.	If the demonstration plant is built at Koeberg, will Eskom come back to Thyspunt?	Undate d.	Anonymous.	This may be a possibility in the future. It is however not the case for this PBMR DPP.
11.23.	What are the site requirements?	02-09-00	Attendant: Pelindaba open	Please refer to section 6.5 of the RFSR in

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			day.	this regard.
11.24.	Concerned about development at Koeberg. Is it necessary?	11-08-00	Mr. F. Hagelberg, IAP, Cape Town.	Please refer to chapter 7 of the RFSR: section 7.3.1 as well as section 4.3.7 of the RFSR.
11.25.	Why must the PBMR be placed in Cape Town? Why not Durban?	02-10-00	Mr. B. Veldman, Chief Director: Department of Economic Affairs, Agriculture & Tourism, Western Cape, Cape Town.	Koeberg emerged as the preferred site for the PBMR DPP. The site selection process is addressed in the RFSR. Please refer to section 6.5 of the RFSR in this regard.
11.26.	The alternative site for the PBMR in South Africa must be defined.	02-10-00	Dr. L. Platzky, Deputy Director General: Department of Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town.	The site selection process is addressed in the RFSR. Please refer to section 6.5 of the RFSR in this regard.
11.27.	Is Koeberg the only site under consideration?	23-09-00	Blaauwberg Municipal Council.	Koeberg is the preferred site. The site selection process is addressed in the RFSR. Please refer to section 6.5 of the RFSR in this regard.
11.28.	How was Koeberg selected and has Pelindaba been considered as an alternative site?	19-09-00	Duynefontein Community Policing Forum (Duynefontein). Ms. D. Murry, Chairperson: Urban Planning and Environment; Blaauwberg Administration, City of Cape Town; D. Stoffberg, Mr. D.C.	Pelindaba was considered. The site selection process is addressed in the RFSR. Please refer to section 6.5 of the RFSR in this regard.

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			Bettesworth, Town planner, Blaauwberg Administration, City of Cape Town; R. Rodman; Ms. P. Titmus, Cape Town.	
11.29.	The reason for placing the PBMR at Cape Town must be investigated. Why not place the PBMR at Durban?	03-10-00	Mr. B. Veldman, Chief Director: Department of Economic Affairs, Agriculture & Tourism, Western Cape, Cape Town.	Koeberg emerged as the preferred site for the PBMR DPP. The site selection process is addressed in the RFSR. Please refer to section 6.5 of the RFSR in this regard.
11.30.	On what authority did Eskom decide not to pursue the investigations at the alternative sites?	Undated.	Anonymous.	A site selection processes was undertaken. The site selection process is addressed in the RFSR. Please refer to section 6.5 of the RFSR in this regard.
11.31.	Which sites are reserved for PBMR and PWR's?	Undated.	Anonymous.	No sites are reserves as such. However, all of the alternative sites discussed in the RFSR have been approved as nuclear sites. Please refer to section 6.5 of the RFSR in this regard.
11.32.	Why not build the PBMR at Vaalputs?	Undated.	Anonymous.	Koeberg emerged as the preferred site for the PBMR DPP. The site selection process is addressed in the RFSR. Please refer to section 6.5 of the RFSR in this regard.

11.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
11.33.	Why is Koeberg considered the preferred site for the PBMR demonstration site in spite of it being widely recognised to be a particularly controversial site with respect to nuclear operations in such close proximity to a major urban area?	06-11-00	Mr. S. Granger and Ms. E. Weinronk, Review Co-ordinator, Environmental Management Department, Cape Metropolitan Council (CMC), Cape Town.	A site selection process was undertaken. The site selection process is addressed in the RFSR. The motivation and rationale for selecting Koeberg as the preferred site is indicated in section 6.5 of the RFSR report.
11.34.	Where is the PBMR proposed to be constructed? The area is zoned a Natural Reserve.	29-09-00	Mr. J.D. Kruger, Director: Regional Planning, Department of Development Planning, Local Government and Housing, Cape Town.	Within the Koeberg security area. Please refer to section 4.7 of the RFSR in this regard.
11.35.	Where does the company hope to export the technology to in the future? Especially in the light of the international decline in the popularity of nuclear technology.	28-03-01	Ms. H. Kingwill, Journalist, Cape Town.	This aspect falls outside the scope of this project.
11.36.	Which countries were regarded as safe to export this technology to?	30-01-01	Mr. M. Louwrens, IAP, Cape Town (Durban public meeting).	This aspect falls outside the scope of this project.
11.37.	Please advise why Koeberg has been selected as the site for PBMR development (other than the financial benefits) when the potential for nuclear disaster impacts on the entire population of Cape Town which is also one of our leading tourist destinations.	02-05-02	Ms. CT Garbett, Director: Watt Props (Pty) Ltd. Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd.	Koeberg is the only commercial nuclear power station in Africa and the expertise will be invaluable in operating the new facility; infrastructure such as switching yards and cooling water outlets can be shared. The added nuclear risk of the PBMR will, firstly, be small compared to the total size of the Koeberg power station which has a total of about 2000 MW while the PBMR is about 110 MW i.e. about 5%. Secondly the inherently safe

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				design of the PBMR allows for a much smaller emergency planning zone than Koeberg. Cape Town is at no greater risk. The site selection process is addressed in the RFSR. Please refer to section 6.5 of the RFSR in this regard
11.38.	Koeberg as the PBMR site, being in close proximity to a major city, the original decision to build a NPS at Koeberg is questioned. To lengthen the life of Koeberg, through the PBMR, without a thorough review of the nuclear power industry is unacceptable.	22-05-01	Dr. L. Platzky, Deputy Director General: Department of Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town	This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1 and 2.
11.39.	Development in Cape Town is taking place towards the north, e.g. Melkbosstrand. As such, some sectors want to get rid of Koeberg, because of the valuable land. Some even want to develop the exclusion zone around Koeberg.	04-04-02	Prof. P Lloyd, Petro-chemical consultants.	The land-use aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1 and 2.
11.40.	Cognisance should be taken of the Atlantis Corridor Development.	04-04-02	Messrs D Bettesworth and T Kotze, Blaauwberg Administration.	Comment is noted. Due to the PBMR design intentions to limit the emergency-planning zone to 400 metres the proposed development does not add significance to the environmental impact assessment. However, the land-use aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1 and 2.
11.41.	The PBMR development would not encroach upon	04-04-02	Messrs D Bettesworth and T Kotze, Blaauwberg	Opinion noted.

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	the KNPS Nature Reserve.		Administration.	
11.42.	ESKOM and the NNR were busy reworking the current emergency plan at Koeberg and proposals were being awaited in this regard. The emergency zones could be reduced to allow more development to take place. The NNR, however, favoured the status quo.	04-04-02	Messrs D Bettesworth and T Kotze, Blaauwberg Administration.	Comment noted.
11.43.	Population densities around any nuclear site have to be managed. In the absence of infrastructure, people would not live next to such a facility. Cape Town is 30 km away from Koeberg and the urban centre is expanding eastwards. This is quite close and the city's expansion would be restrained if the PBMR were to be placed at Koeberg.	05-04-02	Mr. S. Thorne. Director: Energy Transformation CC, Cape Town.	The land-use aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1, 2 and 27.
11.44.	The siting of the PBMR would change the way the city would expand, which might not be desirable. It might even be that the high level of waste that was already being created at the KNPS could have the same effect.	05-04-02	Mr. S. Thorne. Director: Energy Transformation CC, Cape Town.	Opinion noted. The land-use aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1 and 2.
11.45.	Where does ELA make input into the process of alternative sites? It would appear that the NO-GO alternative is the only option given the demonstration nature of the project.	9-11-05	Ms. O Andrews	That is correct. Alternatives were considered in the previous EIA and the Koeberg NPS site was found to be best suited for the demonstration module PBMR. This conclusion has been validated during the current scoping phase. Please refer to section 6.5 of the RFSR in this regard and chapter 7: Issue number 8 in this regard.

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11.46.	Have alternative sites been properly evaluated?	15-11-05	Mr. Barker	All the potential sites have been assessed during the 302 MW(t) process. The site assessment results have been evaluated and the conclusion is that Koeberg is the preferred site. Please refer to section 6.5 of the RFSR in this regard.
11.47.	How does Pelindaba fit into this EIA process?	1-12-05	Mr. D Sayce	Pelindaba is the proposed site for the manufacturing of fuel. However, this is the topic of a separate EIA application by NECSA.
11.48.	Why can the PBMR DPP not be build at Vaalputs?	1-12-05	Ms. Garrett	Alternative sites where assessed, and Koeberg was found to be the preferred site. The plant will require cooling water and specific infrastructure, neither of which is available at Vaalputs. Please refer to section 6.5 of the RFSR in this regard.
11.49.	Location alternatives: We suggest that the location alternatives were prematurely dismissed based on unclear reasoning. It is not clear how the various alternative sites were originally selected and on what information the comparative assessment was based. Was this information up to date? How were the criteria selected? Were these weighted and if so, how? Was public input sought?	6-3-06	WESSA Western Cape Region: Samantha Ralston (Environmentalist)	Alternatives were comprehensively considered in the previous EIA and Koeberg NPS site was found to be best suited for the demonstration module PBMR. This conclusion has been validated during the current scoping phase. There was an extensive public consultation process during the site selection process. Please refer to section 6.5 of the RFSR in this regard.

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11.50.	Location alternatives: We believe that conducting a comparative assessment during Scoping is inappropriate, as Scoping should involve information gathering not assessment. The comparative assessment should therefore have been part of the Environmental Impact Report. We suggest further that alternative sites should continue to be considered and assessed as part of this EIA process, unless they are found to be completely unsuitable. The public should have an opportunity to review information on which the assessment is based and suggest additional criteria for consideration. Transparency in this regard is key.	6 -3-06	WESSA Western Cape Region: Samantha Ralston (Environmentalist)	Comment noted. However, a number of alternative sites were comprehensively considered in the previous EIA and Koeberg NPS site was found to be best suited for the demonstration module PBMR. This conclusion has been validated during the current scoping phase. Please refer to section 6.5 of the RFSR in this regard.
11.51.	Location alternatives: Two major concerns with the proposed Koeberg site are: 1) The proximity to a major urban centre and 2) The risk implications of locating the PBMR adjacent to an existing nuclear power station - should there be a major incident at either plant what would the knock-on effect be? These issues do not appear to have been adequately considered in the comparative assessment.	6-3-06	WESSA Western Cape Region: Samantha Ralston (Environmentalist)	Safety and emergency aspects will be addressed during the EIA phase for the 400 MW(t) PBMR DPP. Please refer to chapter 7 of the RFSR: issue numbers 1,2, 26, 27 and 28.
11.52.	Investigation of the potential impact, including cumulative effects of the activity and its alternatives on the environment, socio-economic conditions and cultural heritage: The DSR indicates that alternatives (site and technology) will not be assessed in the EIA. However, Eskom were requested by DEAT to scope Pelindaba as a potential site (pg 12). The DSR does not present a balanced evaluation of the two sites and instead the point of departure seems to be 'Is there a better site than Koeberg?'	6-3--06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	The issues of alternatives (technology and locations) are addressed in the RFSR. Additional socio-economic and cultural aspects will be assessed during the EIA phase. Please refer to chapter 6 of the RFSR in this regard. The use of a green field or brown field site will not change the findings on the suitability of a demonstration plant. The

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	Information contained in the DSR indicates that the Pelindaba site may be feasible, albeit at a higher direct (infrastructural) cost. However, factors such as the savings incurred by not having to transport fuel to the Cape (as it is manufactured at Pelindaba) do not appear to have been included. Table 1 (pg 24) fails to fully evaluate the costs and benefits of these two sites. For example, there is no indication of the volumes of cooling water required or the feasibility of installing a dry cooling system. In an inherently water-scarce country, dry cooling systems must be regarded as increasingly important. The Directorate: Water Services of the CCT have requested that security of water supply also be considered (are there two separate supply points?). Given the scarcity of water sources, the omission of a dry cooling system as a process alternative is questioned. The feasibility of the PBMR is proposed to be evaluated in a situation where a nuclear power plant is already located, with readily available infrastructure and expertise. No comparable site would exist for potential future PBMRs in South Africa and thus any viability studies based on the Koeberg situation would be misleading. The DSR is not required to make detailed evaluations but the forthcoming EIA should undertake a balanced and comprehensive assessment of both sites. There is no indication that the proponents have applied to DEAT for an exemption from considering alternative sites and technologies. It is not clear from the report how long Koeberg will			difference will come into the cost of developing the sites to accommodate the PBMR. The issue of wet or dry cooling, apart from licensing safety, again is largely a matter of cost that can be calculated into the final cost appreciation of the technology. Proposed siting was done at a location of optimal conditions/site to enable simulation of sub-optimal conditions. However, the inverse is not true. The two plants will operate simultaneously. Koeberg will continue to operate for about another 20 years. The cumulative impact of the two Plants will be addressed in the current EIR for the 400 MW(t) PBMR DPP. Please refer to chapter 7 of the RFSR: issues number 36.

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	continue to operate and whether the PBMR and Koeberg will be operating at the same time. If so, what are the cumulative implications in terms of safety and security and other impacts? What would be the impacts on Koeberg should there be a significant incident at the PBMR (or vice versa)?			
11.53.	Failure to consider alternatives – Geographical / Location Alternatives: An analysis of the DSR reveals that instead of describing geographical location alternatives identified during the scoping phase of the EIA in accordance with the EIA Regulations, the Applicant has improperly sought to pre-determine the issue by including a comparative assessment of alternatives in the DSR. The EIA Regulations clearly stipulate that a comparative assessment of all the alternatives should be reported in the Environmental Impact Report.	7-3-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	Comment noted. However, a number of alternative sites were comprehensively considered in the previous EIA and Koeberg NPS site was found to be best suited for the demonstration module PBMR. This conclusion has been validated during the current scoping phase. Please refer to section 6.5 of the RFSR in this regard.
11.54.	Failure to consider alternatives – Geographical / Location Alternatives: The Applicant also seeks to introduce information and assessment from a previous and legally separate and distinct EIA into the DSR, and inevitably concludes that the alternatives are less desirable than the proposed Koeberg site. It is submitted that the Independent Consultant is not legally competent to incorporate information from a previous and legally distinct EIA and adjudicate it to be 'valid' at the Scoping Phase of an EIA, as discussed in paragraph one above. At the very least such information, including any underlying reports upon which the information relies, should be made available to IAPs for critical comment. Various factors (including the lapse of	7-3-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	Comment noted. However, a number of alternative sites were comprehensively considered in the previous EIA and Koeberg NPS site was found to be best suited for the demonstration module PBMR. This conclusion has been validated during the current scoping phase. Only validated base datasets were utilised. Please refer to section 6.5 of the RFSR in this regard.

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	time between the previous comparative site assessment and the current application; the possibility that new interested and affected parties may wish to comment, changes in site conditions such as the precarious state of the Koeberg reactor and the like) could influence the results of a comparative site assessment undertaken in respect of the new proposed 400 MW(t) PBMR DPP. These results could differ significantly from the results from those of the comparative site assessment undertaken in the EIA for a 302 MW(t) demonstration model PBMR. To preclude interested and affected parties from participating in a comparative assessment or having the opportunity to provide comment on alternatives sites in respect of the proposed 400 MW(t) PBMR DPP would render the current EIA process unfair, and any decision to accept the draft Scoping Report would be subject to be set aside on review.			
11.55.	The issue regarding the lack of infrastructure capabilities at the Koeberg Site. These include the Roads, Medical and emergency services.	17-05-06	Mr. W F M de Pinho	Health and safety aspect will be assessed during the EIA. However, Koeberg has an extended emergency response plan.
11.56.	Eskom has chosen Koeberg as their best option for onsite availability of technology and personnel. Eskom should reassess the Pelindaba site, although some modifications are needed. A major point against Koeberg site is that the nuclear material required will be processed at Pelindaba with inherent dangers of multiple handling, transfer and transport, this major cost would be excluded.	17-05-06	Mr. W F M de Pinho	All the potential sites have been assessed during the 302 MW(t) process. The site assessment results have been evaluated and the conclusion is that Koeberg is the preferred site. Please refer to section 6.5 of the RFSR in this regard.

12. MANAGEMENT RELATED ISSUES

12.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
12.1.	Once Eskom is privatised what will happen to the principle of the polluter pays?	20-09-01	Mr. A Murphy, Member: eThekwini ECOPEACE	The Polluter pays principle is contained within the National Environmental Management Act, (Act 107 of 1998) and will apply to Eskom, in what ever form it be in.
12.2.	In the case of the PBMR, only design safety has been emphasised. Safety designing is not the qualifying criteria – but the safe management of the plant, is!	Feb. 01	eThekwini ECOPEACE.	Safety aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 28. Nuclear management aspects form a core part of the NNR licensing process.
12.3.	Can the effective management process of nuclear be guaranteed?	02-10-00	Afrikaanse Handelsinstituut, Bellville, Cape Town.	Yes. This has been demonstrated by excellent world practice including South Africa.
12.4.	What international linkages exist with international bodies?	26-08-00	Attendant: Koeberg open day.	The project as a whole has linkages with a host of international bodies, a few of them are: ❖ The International Atomic Energy Agency (IAEA) ❖ World Association of Nuclear Operators (WANO) ❖ Nuclear Regulatory Commission of the USA (NRC) ❖ Jürlich ❖ Kurchatoff Institute ❖ Research Labs Petten

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				❖ Massachusetts Institute of Technology (MIT) ❖ Exelon (merger between PECO Energy and Unicom Corporation) ❖ Westinghouse (ex-British Nuclear Fuel)
12.5.	South Africa should not export technology that is not implemented here.	28-09-00	Representative from the Department of Community Health, University of Cape Town (UCT).	Comment noted. This aspect does not fall within the ambit of this EIA. The techno – economic feasibility of this project needs to be demonstrated first before any commercial processes can be undertaken.
12.6.	The DSR reports that an interested and affected party noted that the current NNR CEO used to be the Manager of Licence at the PBMR and therefore could not be both referee and player. In the response to this issue, the comment is 'noted'. If this is indeed the case, the neutrality of the NNR is to be questioned and must be addressed.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	This issue was recorded but clearly falls outside of the scope of the EIA. If the proponent of the statement feels strongly about the "neutrality" of the CEO it needs to be directed to the minister of the DME for address.
12.7.	Dissemination of information: Eskom's CEO has stated that they will accept liability for any accidental and operational problems caused by the PBMR. Eskom needs to quantify this risk that has been assumed, especially as it is risk that is excluded from every standard property and aviation insurance policy. Whichever way the liability ultimately falls, South African public will bear the loss, either via state owned Eskom or PBMR government majority owned or directly by government.	7-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	The NNR Act will require Eskom to have liability insurance therefore the insurer underwrites the risk and not the South African government.
12.8.	Insurance: Standard property and aviation insurance policies exclude any claims for damage or	7-03-06	RCH Garbett CT Garbett	The NNR Act will require Eskom to have liability insurance therefore the insurer

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	destruction of property as a result of a nuclear accident. The South African public would therefore shoulder the financial burden of any accidental damage as this risk will be underwritten by the government. Insofar as the government may not be able to pay for such risk the burden will fall on the property owners that fall within the potential danger zones. In terms of the climatic conditions the areas that could be affected would be extensive and financially of such a level that could undermine the entire economy. The proximity of the World Heritage Sites to Cape Town and Pelindaba which are both at risk should be considered and weighed carefully before embarking on this experiment. The loss of either is a risk that should not be undertaken on such a dubious experiment without absolute proof that there is no safety risk. The applicant has acknowledged that safety is not yet proven which should be sufficient reason to abandon the PBMR. Eskom should also reaffirm its undertaking that it will, as it has stated, shoulder the financial risks of the PBMR. The worst case scenario cost should be calculated and factored into the risks of PBMR development.		Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	underwrites the risk and not the South African government. Eskom has an insurer and will fund the proposed PBMR DPP proportional to the share that they hold.

13. LOCAL GOVERNMENT MATTERS

13.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
13.1.	What is the present status quo with Cape Town Council and Government in terms of getting permission to build the PBMR?	24-04-01	Ms. H. Kingwill, Journalist, Cape Town.	Both are subject to the outcome a number of legislative approvals, one of which is the EIA process.
13.2.	Why didn't the government stop development in the area (if it was to be used for nuclear activities)?	26-03-02	Attendant at the Focus Group Meeting for Community Based Organisations (Madibeng).	Comment is noted. Due to the PBMR design intentions to limit the emergency-planning zone to 400 metres proposed development does not add significance to the environmental impact assessment.
13.3.				
13.4.	The PBMR process falls outside their scope of work. However, this could change if a need arises for re-zoning or if the process has an impact on the attempted registration of the area as part of the Cape West Coast Biosphere Reserve.	29-09-00	Mr. J.D. Kruger, Director: Regional Planning, Department of Development Planning, Local Government and Housing, Cape Town.	The land-use aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1 and 2.
13.5.	Growth must take place up on the West Coast, Koeberg places pressure on the way in which the city is developing naturally. Is the new structure going to put additional pressure on the growth of the city?	23-09-00	Blaauwberg Administration, City of Cape Town.	The land-use and zoning aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1 and 2.
13.6.	The hampering of spatial planning and development at Koeberg, are not included in the process of this investigation.	14-05-01	Mr. W.A.J. Nel, Director: Johannesburg City Parks, Greater Johannesburg Metropolitan Council, Johannesburg.	The land-use and zoning aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1 and 2.
13.7.	Will future urbanization in time interface with the PBMR in Koeberg? How will this interface be secured?	16-02-01	Ms. B. M. Blignaut, Secretary: Green Belt Action Group, Roodepoort.	The land-use and zoning aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR:

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				issues number 1 and 2.
13.8.	The close proximity of the PBMR to the Koeberg plant reduces the capacity of the CMC to develop the area.	Undated.	Anonymous.	Comment noted. The land-use and zoning aspects will be addressed during the EIA phase. The Cape Town Metropolitan Municipality will be consulted with in this regard during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1 and 2.
13.9.	Eskom would have to get planning permission from the Council.	23-09-00	Blaauwberg Administration, City of Cape Town.	Comment noted. The land-use and zoning aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1 and 2.
13.10.	Will the same zones / boundaries regarding Koeberg be maintained?	19-09-00	Duynefontein Community Policing Forum.	Yes.
13.11.	Can we use Eskom's billing system to include information packs and survey response forms in the electricity account envelope?	01-02-01	Dr. C.F. Marais, IAP, Cape Town.	Suggestion noted
13.12.	What would the impact of the PBMR be on local government?	Undated.	Anonymous.	Some of these aspects would be considered during the EIA phase. Please refer to chapter 7 of the RFSR.
13.13.	What would the impact of the new technology be on Local Government level?	01-02-01	Councillor V. Mkhabele, Local Municipality of Madibeng, Brits. (Pelindaba public meeting).	Some of these aspects would be considered during the EIA phase. Please refer to chapter 7 of the RFSR.
13.14.	A draft Cape Metropolitan Council (CMC) policy	23-01-01	Attendant: Milnerton public	Comment noted. The CTC has

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	document opposed any further nuclear development in the CMC's area of jurisdiction, which includes Koeberg.		meeting.	subsequently revised their position on this issue. The policy and regulatory framework is addressed in the RFSR. Please refer to chapter 7 of the RFSR: issues number 1 and 2.
13.15.	The City of Cape Town issued an Environmental Management Plan, this plan called for the decommissioning of the Koeberg site. How would this affect the PBMR?	19-03-02	Attendant at the Focus Group Meeting with Prof Lloyd and Messrs Longden-Thurgood and Walmsley.	After Koeberg ceases to operate, changes to the Koeberg exclusion zone may be possible.
13.16.	The Western Cape White Paper entitled "Preparing the Western Cape for the Knowledge Economy of the 21st Century" sets out very clearly that the Western Cape desires to promote a positive domestic and international image of the province as a thriving centre for sustainable, environmentally friendly production, as a premier location for investment, business and leisure, and as a gateway to Africa.	28-09-01	Dr. L. Platzky, Deputy Director General: Department of Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town.	This aspect will be assessed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 7
13.17.	Investigation of mitigation measures to keep adverse impacts at a minimum as well as the option not to implement the activity: The 'no go' option is necessary to assist in determining whether the PBMR should be included in the suite of options for energy supply. Even though this is a 'demonstration plant', it will run for a full life cycle with the associated costs and benefits and is therefore very similar to a commercial plant. The ISEP identifies options to be investigated – not only in terms of techno-economic feasibility, but also in terms of environmental impact and social acceptability. Therefore the no go option must remain part of the EIA.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager.	The "no-go" option will be addressed in the EIA phase for the 400 MW (t) PBMR DPP. Please refer to chapter 7 of the RFSR: issue number 8.

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13.18.	Public information….independent review and conflict resolution in all phases of the investigation and assessment of impacts: The City has previously requested that an independent 3rd party review of the EIA be undertaken prior to decision-making by DEAT. This request is repeated for the current EIA.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager.	DEAT has appointed an independent review panel.
13.19.	Focus should be Uni-city orientated.	23-09-00	Ms. D. Murry, Chairperson: Urban Planning and Environment; Blaauwberg Administration, City of Cape Town; D. Stoffberg, Mr. D.C. Bettesworth, Town planner, Blaauwberg Administration, City of Cape Town; R. Rodman; Ms. P. Titmus, Cape Town.	Comment noted. The land-use and zoning aspects will be addressed during the EIA phase. The Cape Town Metropolitan Municipality will be consulted with in this regard during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1 and 2.
13.20.	Many of the concerns and issues raised by the City were not reflected in the previous EIA and subsequent ROD and conditions of approval for the PBMR. These concerns and issues formed the basis for the City's Notice of Appeal and included - High level nuclear waste storage at Koeberg: Financial and environmental costs Current and future emergency planning measures: Costs to the CCT Health monitoring, health risk assessment and ambient radiation monitoring The City of Cape Town's role as a key stakeholder A number of important principles and requirements of the National Environmental Management Act 107	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager.	These issues were addressed in the EIR 2002. However, the degree of detail appears to be the contention of the CCT. These aspects will be addressed in the EIA phase the 400 MW(t) PBMR DPP assessment. Please refer to chapter 7 of the RFSR: issues number 2, 26 and 27.

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	of 1998 These issues have not been sufficiently addressed in the Draft Scoping Report (DSR).			
13.21.	During the first PBMR EIA process (1999 - 2003), City comment was submitted and included extensive input from relevant services including Town Planning, Economic Development, Transport and Roads, Emergency Services and City Health. Political endorsement of City comments was obtained in order to ensure that the inputs to the EIA reflected the City's interests broadly. The City's comment at that time concluded that the final EIR was an inadequate basis for a decision to proceed with the PBMR at Koeberg as key environmental risks and concerns raised by the City were not assessed. Key issues raised by the City were omitted from the EIA. The City appealed against the approval of the EIA in 2003.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	Mawatsan confirms that the CCT indeed appealed against the RoD on the EIA of 2003 However, most of the issues raised by the CCT were addressed and assessed in the Final EIA of Oct 2002.
13.22.	Eskom have now initiated a second EIA process for a PBMR to be located at Koeberg. The proposed PBMR has potentially significant spatial, health, transport, environmental and safety implications for the City over the 40 year lifespan of the nuclear plant, plus the additional time during which high level nuclear waste is stored at Koeberg. The proposal also has significant implications for the future supply of electricity and for economic development in the region.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	Mawatsan acknowledges the issues the CCT submitted and will address and/or assess them during the EIA phase. These issues relate to spatial planning and use, health, safety and transport of nuclear materials and the storage of spent fuel/high level nuclear waste for the life of the proposed PBMR DPP and thereafter. The economic and supply issues will likewise be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 2, 26 and 27.

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13.23.	Financial and environmental costs of waste: The full life cycle financial and environmental costs of storing the high level nuclear waste from the PBMR at Koeberg for the 40 year life span of the plant, and until a final depository for nuclear waste is licensed some time in the future must be addressed in the EIA.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	The financial requirements related to high level waste management will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issues number 9, 110,11 and 12.
13.24.	Costs of emergency planning: The costs of current and future emergency planning and related infrastructure are direct costs due to the activity and should thus be borne by the developer, not the City of Cape Town. There is no indication in the DSR of how current and future emergency planning measures are to be addressed.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	This aspect will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issues number 26 and 27.
13.25.	The City of Cape Town's role as a key stakeholder: The City's role in service delivery, emergency services, land use management, housing delivery and community health was emphasised in comments submitted by the City during the previous EIA process. The current 2006 EIA must include an assessment of the role of the City and its existing and future obligations in terms of relevant legislation and the effect that approval of the proposed PBMR could have on City functions and services.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	The impact of the proposed PBMR DPP on the City of Cape Town's functions and services will be assessed in the EIA phase Please refer to chapter 7 of the RFSR: issues number 2, 26 and 27.
13.26.	Principles contained in the National Environmental Management Act (NEMA): The CCT raised a number of key principles contained in NEMA that must be taken into account in the EIA.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	Comment noted. These principles are taken into account for the EIA.
13.27.	Future electricity supply and evaluation of the alternative supply options: The DSR states that SA will	6-03-06	City of Cape Town: Keith Wiseman (Manager:	

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	need additional peak generation capacity by 2007 and additional base load capacity by 2010. The PBMR DPP, if approved, would be operational by around 2012. However, the proposed DPP is also in response to the need to evaluate a number of power generation technologies not yet implemented in South Africa on a commercial basis in terms of technical, socio-economic and environmental aspects. Clarification is sought on the following aspects of the proposed evaluation of the technical, socio-economic and environmental aspects: What other supply side generation options are being investigated for the Western Cape? What criteria will be used to both evaluate the PBMR DPP and to compare it to the above alternative supply options? Will the data and information to be used for this evaluation be open to the public and other stakeholders for review? How will the price of PBMRs be determined? How will this influence the average cost of the electricity to the City? Under what circumstances would the PBMR DPP be 'decommissioned and dismantled', as stated in the DSR?		Integrated Environmental Management) for City Manager.	Supply side options being considered in the Western Cape are wind energy and gas; The NER's Advisory and Review Committee (ARC) gives guidance in determining whether an option is formally included in the base case. Only proven technologies are included in the base case. However this is a demonstration plant which can only be evaluated on their own merits. Pricing is determined by the NER. The PBMR DPP will not influence the average consumer cost of the City Decommissioning and dismantling will occur if the demonstration proves that the technology integration is not viable or if the technology reaches the end of its life.
13.28.	At several of the meetings, questions were raised	6-03-06	City of Cape Town: Keith	Clear linkages have been provided

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	which were not answered or only partially answered. An attempt has been made to address the issues in the issues trail but information provided is still very superficial. (Example, the request for the Safety Case Report – pg 133). Each issue needs to be clearly addressed in an issues trail and not just 'noted'.		Wiseman (Manager: Integrated Environmental Management) for City Manager.	between the issues and the RFSR. It is indicated whether the issues will be addressed during the EIA phase or not. Reference is also given to the section of the RFSR where it will be indicated how this aspect will be addressed during the EIA phase. Where aspects fall outside the scope of this EIA it is indicated.
13.29.	The newly formed Regional Electricity Distributor, or RED 1, does not appear to have been involved in the scoping process.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	The Regional Electricity Distributor (RED 1) will be informed of the RFSR and the EA phase to follow. They will be consulted with as and when they require. It must be indicated that the process till now had been widely advertised, and that the Regional Electricity Distributor may have known about this process.
13.30.	The web site has been dysfunctional. For example, repeated attempts to download the ISEP have been unsuccessful.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	Eskom apologises. The National Integrated Resource Plan is made available on the website. A hardcopy can be made available on request. This document is included as an attachment in the final Scoping document.
13.31.	Pg 1 Introduction of the DSR. The introductory sections of the report should indicate the regulatory framework for EIAs and also note that South Africa is a member of the International Atomic Energy Agency. It should also indicate to what extent the proposed project is a modification of a nuclear plant versus a brand new technology.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	The RFSR has been amended to direct the reader to the full chapter that deals with Legal framework. The draft and RFSRs defines the scope of the PBMR as a technology

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13.32.	Pg 11 of the DSR: Coal - South Africa has committed to a reduction of 10% use of coal from 2012 due to climate change issues. This is not reflected in the statements with regard to energy sources.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	Eskom is in the propose of undertaking various demonstration projects in order to diversify its energy mix. South Africa in terms of the Kyoto Protocol of which it is a signatory is not forced to meet the standards set by the protocol due to its status as a developing country. However, Eskom is endeavouring to respond to this commitment as reflected by the Mr. Moosa, Eskom's Chairman made a statement during the Climate Change Conference Mr. Moosa reiterated Eskom's aspiration of reducing the percentage of coal in our energy mix by 10% by 2012.
13.33.	Pg 17 of the DSR: Pelindaba: Pelindaba is located west of Pretoria and not east as stated in the DSR.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	Apologies, the adjustment has been made in the RFSR.
13.34.	Pg 28 of the DSR: Pelindaba infrastructure: Why was supporting infrastructure for the PBMR at Pelindaba 'dismantled'? Would the site be technically feasible if such infrastructure were still in place?	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	The dismantling formed part of the fuel manufacturing plant for Koeberg that was sold to China. The alternative sites described in the DSR are all technically feasible/suitable. The difference in the sites manifest in the cost of developing infrastructure and the impact thereof on the Environment (Economic, social and biophysical).

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				The Koeberg site would still be the preferred site, even if the supporting infrastructure at Pelindaba was still in place., due to the size and scope of supporting infrastructure required.
13.35.	Pg 30 of the DSR: Waste management: Clarification and further detail is needed with regard to the proposals to "accommodate all spent fuel" on site 'processing' of low and medium level waste. Would low and medium level waste also be stored on-site or would it be transported to Vaalputs for disposal?	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	The aspect of waste management will be dealt with during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 24. It is the intention that low and Intermediate level waste will be transported and disposed of at Vaalputs as indicated in the RFSR.
13.36.	Pg 31 of the DSR: Demonstration of the commercial performance: Will data on the "key commercial parameters … such as construction costs, plant availability and efficiency, operational and maintenance costs and mid – life upgrade requirements" be available to the public? How will the cost savings of locating the plant at an existing nuclear site be calculated in order to estimate the comparable costs for a green field site remote from such infrastructure?	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	The commercial parameters of the PBMR DPP will be determined. The site related cost becomes a factor of engineering calculation based on experience and estimate that is added on to the Plant cost. Based on the DPP demonstration results, the projected lifecycle costs will be used by Eskom to evaluate the competitive merits of the PBMR DPP.
13.37.				
13.38.	Pg 42 of the DSR: Faults: There is insufficient information on the stability (or otherwise) of the three faults.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	This aspect will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 18.

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13.39.	Pg 45 and 88 of the DSR: Urban growth: There is brief mention of growth northwards of Milnerton and Tableview. This issue needs to be comprehensively addressed in the EIA, making reference to all relevant planning documents (not only the West Coast Biosphere Policy as mentioned on pg 88).	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	This aspect will be addressed in the EIA phase, referencing all relevant planning documents. Please refer to chapter 7 of the RFSR: issue number 1.
	Pg 47 of the DSR: Occupational categories: What is "…the case for 26% of the population of the WC"?	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	It seems to have been a typing error. Our apologies.
13.40.	Pg 86 of the DSR: Thermal outflow: How reliable is the thermal outflow figure given? Should the worst case scenario not be considered?	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	This aspect will be assessed in the EIA phase. However, the figure is reliable and the impact of "spikes" in the outflow temperature will not significantly impact on the receiving water body and its biota. The assessment that will be conducted in the EIA phase will look at the combined impact of both Koeberg and the PBMR DPP on full load. Please refer to chapter 7 of the RFSR: issue number 13.
13.41.	Pg 111 of the DSR: Feasibility and Business Plan availability: When will these documents become available?	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	The "Feasibility Report'" or DFR as it is often referred will be commissioned by the DME. IAPs may approach DME for a copy.
13.42.	Pg 112 of the DSR: Decommissioning: What will the costs of decommissioning and dismantling be should the project prove unsuccessful and who would bear	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental	This aspect will be addressed in the EIA phase. The cost of dismantling, etc will be for

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	them?		Management) for City Manager	Eskom's account. Please refer to chapter 7 of the RFSR: issue number 9.
13.43.	The presence of this waste effectively sterilises the site for any alternative use and the location of the existing and any future new nuclear plants has an impact on the future sustainable development of the West Coast region.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	Aspects relating to the future sustainable development and land use will also be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issues number 1 and 2.
13.44.	Fuel manufacture and transportation: It must be explained how the information from the fuel manufacture and transportation EIA will be integrated into the EIA for the PBMR.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	There will not be integration of information since it is two separate EIAs, conducted by separate entities, viz a viz Eskom and NECSA. The Minister for Environment Affairs is yet to provide his ruling on the appeal against the RoD for the NECSA EIR.

14. COMMENTS IN SUPPORT OF THE PBMR

14.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
14.1.	Record my vote strongly in favour of the proposed PBMR and against coal-fired power stations. "Earthlife" and its spokesmen do not speak for me nor for the silent majority.	07-05-01	Mr. R. Jones, IAP, Hilton.	Your viewpoint is noted and will be considered in the EIA phase.
14.2.	The EWT supports the development of the PBMR because of its economical potential for South Africa and for the world-class technological expertise required by an African country to produce and operate it.	30-10-00	Dr. J.A. Ledger, Director: Endangered Wild Life Trust (EWT), Johannesburg.	Your viewpoint is noted and will be considered in the EIA phase.
14.3..	Are against the hypocrisy of the anti-nuclear lobby.	07-01-01	Ms. C. Campbell, IAP, Johannesburg.	Your viewpoint is noted and will be considered in the EIA phase.
14.4.	The Energy Research Institute has no bias for or against any form of energy.	31-01-01	Mr. M. Howells, Deputy Director: Department of Mechanical Engineering, University of Cape Town (UCT).	Your viewpoint is noted and will be considered in the EIA phase.
14.5.	PBMR is a good idea because fossil fuels will be depleted.	Undated.	Mr. A.G. Hacker, IAP, Cape Town.	Your viewpoint is noted and will be considered in the EIA phase.
14.6.	There is a feeling among members that the NECSA will act responsibly and there are no immediate concerns.	14-09-00	Mr. L. van Dalsen, Committee Member: Hartbeespoort Local Environmental Association.	Your viewpoint is noted and will be considered in the EIA phase.
14.7.	Generally in favour of the responsible use of nuclear energy. The proposed technology of PBMR seems to be good. If the project is successful, it has a	26-09-00	Mr. K.P.J. Nel, IAP, Hartbeespoort.	Your viewpoint is noted and will be considered in the EIA phase.

14.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
	tremendous potential to generate foreign exchange.			
14.8.	Record my vote strongly in favour of the Pebble-bed Reactor and against coal-fired power stations.	07-05-01	R. Jones, IAP, Hilton.	Your viewpoint is noted and will be considered in the EIA phase.
14.9.	PBMR needs a fair hearing – we do not need to burn more coal.	16-01-01	Dr. J.A. Ledger, Director: Endangered Wild Life Trust (EWT), Johannesburg.	Your viewpoint is noted and will be considered in the EIA phase.
14.10.	The planned reactor gives South Africa and NECSA, the opportunity to prove themselves. This is an opportunity to use existing infrastructure, scientists and engineers. The process is very safe and has been thought through thoroughly.	02-09-00	Attendant: Pelindaba open day.	Your viewpoint is noted and will be considered in the EIA phase.
14.11.	I leave with the knowledge that this process of generating electricity is safe. I find the explanation of the whole process in the reactor and the making of pebbles fascinating.	02-09-00	Attendant: Pelindaba open day.	Your viewpoint is noted and will be considered in the EIA phase.
14.12.	The EWT is concerned about global warming. Nuclear power has to be investigated as an option because wind and solar power is not economically viable. Nuclear will not contribute to global warming as coal and oil does.	30-01-01	Dr. R. Wedlake, Independent Consultant, Endangered Wildlife Trust (Durban public meeting).	Your viewpoint is noted and will be considered in the EIA phase.
14.13.	Overall, I find the technical development of the PBMR to very well along, particularly the sophisticated and innovative arrangement of the direct-cycle turbo machinery and the effective way that the total helium inventory has been minimized. The state of technical development for the PBMR is clearly sufficient to enter into licensing and construction	04-10-01	Prof. PF Peterson	Your viewpoint is noted and will be considered in the EIA phase.

14.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
14.14.	The project proposed seems well argued and will generate valuable foreign income.	26-09-00	Mr. K.J.P. Nel, IAP, Hartbeespoort.	Your viewpoint is noted and will be considered in the EIA phase.
14.15.	The Vilieria Community Association and the Ward committee of ward 53 has no problems with the PBMR PROJECT and hopes that it will go ahead and be on line as soon as possible	3-03-06	Vilieria Community Association and the Ward committee of ward 53	Your viewpoint is noted and will be considered in the EIA phase.

15. COMMENTS IN OPPOSITION TO THE PBMR

15.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
15.1.	PBMR is not sustainable, is not renewable, can never become a zero waste technology, is not clean, may be of relatively safer design than other nuclear technology, but this remains to be proven in practise, is not well developed lacking vital components, is not readily available, is not labour intensive, is not economically viable, and is of dubious political heritage.	20-09-01	Mr. A Murphy, Member: eThekwini ECOPEACE.	Your viewpoint is noted and will be considered in the EIA phase.
15.2.	This entire project is contrary to the commitment by SA to the OAU policy of a Nuclear Free Africa. The proposed sale to other African countries is irresponsible in the extreme. Nuclear is a technology that requires a high degree of efficiency and a non-negotiable commitment to funding. In the face of such overwhelming poverty on this continent, promotion of this technology is reckless.	27-09-01	Messrs RCH & TAHH Garbett, Ms. CT Garbett, Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd., The Karee Trust, Wat Props (Pty) Ltd.	This issue was raised with DME. The DME is in the process of compilation of policy and assessment criteria for receiving countries, to ensure sufficient maturity to receive this technology.
15.3.	This is just another chance for scientists to act in the place of God and to "mess up" the natural ways of nature.	30-03-01	Ms. L. de Villiers, Director: Wildlife and Environmental Society of South Africa (WESSA).	Your viewpoint is noted and will be considered in the EIA phase.
15.4.	For the sake of our children, please take care of our environment and stop this nuclear demo exercise.	30-04-01	Ms. A. Morkel, National Marketing Manager, Spectramed, Johannesburg.	Your viewpoint is noted and will be considered in the EIA phase.
15.5.	Formally notes his opposition to the PBMR at Koeberg, based on the content of the National Environmental Management Act, 107 of 1988 (NEMA) – that the	29-03-01	Mr. S. Davey.	Your viewpoint is noted and will be considered in the EIA phase.

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	Koeberg location within the Cape Town Metropolitan region, is clearly not a "cautious approach".			
15.6.	You will get my vote against the use of nuclear energy.	29-01-01	Dr. L.T. Dube, Lecturer, University of Zululand, KwaDlangezwa	Your viewpoint is noted and will be considered in the EIA phase.
15.7.	Strong objection to the building of the PBMR near Koeberg.	01-05-01	Mrs. K. Cleminshaw, IAP, Cape Town.	Your viewpoint is noted and will be considered in the EIA phase.
15.8.	Outrage and concern about the proposed PBMR!	29-03-01	Mr. P. and Ms. E. Kruger.	Your viewpoint is noted and will be considered in the EIA phase.
15.9.	Strongly objects against the Koeberg PBMR. Money should be better spent on alternative renewable resources. Disposal of nuclear waste has, as yet, not satisfactorily been dealt with.	07-05-01	Ms. L. Claase, IAP, Cape Town.	Your viewpoint is noted and will be considered in the EIA phase.
15.10.	This is an attempt by Eskom, through its front company PBMR (Pty) Ltd, to force the redundant PBMR programme on the people of South Africa.	29-01-01	Prof. D. Holm, Chairperson: Hartbeespoort Water Forum.	Your viewpoint is noted and will be considered in the EIA phase.
15.11.	Eskom and their PBMR should cease all planning and expansion of nuclear facilities at Koeberg. Supports a nuclear-free zone in the Indian Ocean.	29-01-01 17-05-01	Prof. D. Holm, Chairperson: Hartbeespoort Water Forum. Mr. G. Mpufane, Environmental Officer, National Union of Mineworkers (NUM), Johannesburg.	Your viewpoint is noted and will be considered in the EIA phase.
15.12.	Does not support the construction of another nuclear power station.	07-05-01	Mr. F. Krummacher, IAP, Johannesburg.	Your viewpoint is noted and will be considered in the EIA phase.
15.13.	Does Eskom think for one moment that the South African population cannot mobilise and halt such an	29-03-01	Mr. P. and Mrs. E. Kruger.	Your viewpoint is noted and will be considered in the EIA phase.

15.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
	outrageous practice?			
15.14.	Strongly objects to the building of a nuclear power station, as this destroys the environment and takes years for the waste to reduce to poisonous radiation.	30-04-01	Ms. A. Morkel, National Marketing Manager, Spectramed, Johannesburg.	Your viewpoint is noted and will be considered in the EIA phase.
15.15.	Strongly objects against PBMR at Koeberg. If anything goes wrong, the side effects will be catastrophic.	01-05-01	Mrs. K. Cleminshaw, IAP, Cape Town.	Your viewpoint is noted and will be considered in the EIA phase.
15.16.	Strongly opposed to the PBMR project. It truly is both an ignorant and pretentious endeavour.	30-04-01	Ms. C. Roos, IAP, Pretoria.	Your viewpoint is noted and will be considered in the EIA phase.
15.17.	Wants to register a concern regarding the development of a PBMR.	31-08-00	Ms. K. Abbott. IAP, Cape Town.	Your viewpoint is noted and will be considered in the EIA phase.
15.18.	IIEC Africa is concerned over the proposed development of PBMR.	01-09-00	Ms. M. Costanza, Managing Director: International Institute for Energy Conservation, Johannesburg.	Your viewpoint is noted and will be considered in the EIA phase.
15.19.	Finds ‘sentimentalist’ incorrect word for those that oppose nuclear technology.	16-02-01	Ms. B. M. Blignaut, Secretary: Green Belt Action Group, Roodepoort.	Your viewpoint is noted and will be considered in the EIA phase.
15.20.	The use of nuclear energy for destructive purposes is unacceptable.	16-02-01	Ms. B. M. Blignaut, Secretary: Green Belt Action Group, Roodepoort.	Your viewpoint is noted and will be considered in the EIA phase.
15.21.	He supports all renewable energy projects, energy conservation and efficiency, while reducing attribute pollution to coal fired stations, and supporting the development of natural gas.	22-01-01	Mr. M. Kantey, Chairperson: Koeberg Alert, Cape Town.	Your viewpoint is noted and will be considered in the EIA phase.

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15.22.	PBMRs have not been successfully pursued anywhere in the world. PBMRs are the most expensive option to pursue.	26-08-01 22-01-01	Attendant: Pelindaba Open Day. Mr. M. Kantey, Chairperson: Koeberg Alert, Cape Town.	Your viewpoint is noted and will be considered in the EIA phase.
15.23.	Opposed to Eskom's proposed construction and other nuclear power stations.	10-09-00	Dr. J. Naude, IAP, Cape Town.	Your viewpoint is noted and will be considered in the EIA phase.
15.24.	Opposed to nuclear development of any kind because of hazards, risks and costs associated with nuclear energy.	08-02-01	Ms. A. Alba, IAP, Johannesburg.	Your viewpoint is noted and will be considered in the EIA phase.
15.25.	We are fully convinced that nuclear reactors pose a serious threat to people and environment alike and support any effort to ensure a nuclear-free South Africa and other countries in Southern Africa.	19-10-00	Ms. A. Zellman, Sister-in-Charge, Dominican Sisters.	Your viewpoint is noted and will be considered in the EIA phase.
15.26.	Having watched the TV programme 50/50 on 29 April 2001, I hereby wish to lodge my total objection to the construction of the proposed nuclear reactor near Koeberg. My two daughters and their partners join me in this objection. Please consider this e-mail as representing five objections.	30-04-01	Mrs. Y. Taylor, IAP.	Your viewpoint is noted and will be considered in the EIA phase.
15.27.	I watched 50/50 and saw the program on nuclear energy and I feel that nuclear testing is NOT safe.	30-04-01	Ms. L. de Villiers, Director: Wildlife and Environmental Society of South Africa (WESSA)	Your viewpoint is noted and will be considered in the EIA phase.
15.28.	Strongly disapproves of the project!	11-08-00	Mr. J. Burnham, IAP, Cape Town.	Your viewpoint is noted and will be considered in the EIA phase.
15.29.	Cease the effort!! Remains vehemently opposed to any further development in the nuclear industry, but they welcome the opportunity to put their views	22-01-01	Mr. M. Kantey, Chairperson: Koeberg Alert, Cape Town.	Your viewpoint is noted and will be considered in the EIA phase.

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	across to both the community and the stakeholders. Calling a halt to all further nuclear developments until the Integrated Energy Planning Process has been completed and passed into law.			
15.30.	Objection to pebble power plants starting up, – ever!	02-05-01	"Il Captain", Anonymous e-mail.	Your viewpoint is noted and will be considered in the EIA phase.
15.31.	The decision should be a resounding NO against the construction of another nuclear power station. Reasons for this are diverse.	07-05-01	Mr. F. Krummacher, IAP, Johannesburg.	Your viewpoint is noted and will be considered in the EIA phase.
15.32.	Strongly objects to the building of a pebble-bed nuclear power station near Koeberg.	01-05-01	Mrs. K. Cleminshaw, IAP, Cape Town.	Your viewpoint is noted and will be considered in the EIA phase.
15.33.	The PBMR type of reactor is posing a serious problem.	25-08-00	Ms. K. Abbott, IAP, Cape Town.	Your viewpoint is noted and will be considered in the EIA phase.
15.34.	Strong objection against proposed plans. Strongly urges Eskom to use fossil fuels as an alternative in existing power plants.	17-10-00	Ms. R. Adatia, IAP, Johannesburg.	Your viewpoint is noted and will be considered in the EIA phase.
15.35.	Voicing strong disappointment for the PBMR.	11-08-00	Mr. J. Burnham, IAP, Cape Town.	Your viewpoint is noted and will be considered in the EIA phase.
15.36.	Various comments in opposition to the proposed PBMR.	30-04-01	Mr. M.P. Grosskopf, IAP, Pretoria.	Your viewpoint is noted and will be considered in the EIA phase.
15.37.	Please stop this project and look at other options.	02-09-00	Attendant: Pelindaba open day.	Your viewpoint is noted and will be considered in the EIA phase.
15.38.	The development of the PBMR is a move away from sustainability.	01-02-01	Mr. M. Louwrens IAP, Cape Town (Pelindaba public meeting).	Your viewpoint is noted and will be considered in the EIA phase.
15.39.	There is a downward trend in the commissioning of	01-02-01	Mr. M. Louwrens IAP, Cape	Your viewpoint is noted and will be

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	nuclear reactors and it is unnecessary for South Africa to be the exception to the rule by commissioning a nuclear plant.		Town (Pelindaba public meeting).	considered in the EIA phase.
15.40.	We don't need the extra power.	Undated.	Anonymous.	Your viewpoint is noted and will be considered in the EIA phase.
15.41.	ELA publicly rejects the PBMR	17-11-05	Mr. Lakane	Your viewpoint is noted and will be considered in the EIA phase.
15.42.	We hereby support the submission made by Earthlife Africa on the DRAFT SCOPING REPORT for the 400 MW Pebble Bed Modular Reactor	10-03-06	Christine T Garbett / Robert C H Garbett	Your viewpoint is noted and will be considered in the EIA phase.
15.43.	We hereby support the submission made by Earthlife Africa on the DRAFT SCOPING REPORT for the 400 MW Pebble Bed Modular Reactor	10-03-06	Christine T Garbett, and on behalf of: Professional Aviation Services (Pty) Ltd The Karee Trust Wat Props Pty Ltd Itumaleng Farm cc	Your viewpoint is noted and will be considered in the EIA phase.
15.44.	We reject the pebble bed on economic, environmental and social grounds. We believe energy should be renewable, non-toxic and in the hands of the people. We support the submission made by Earth Life Africa.	11-03-06	Sally Andrew, Bowen Boshier.	Your viewpoint is noted and will be considered in the EIA phase.

16. BACKGROUND TO THE PBMR AND QUESTIONS RELATED TO THE EXISTING KOEBERG REACTORS

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16.1.	Why was nuclear brought to the area in the first place?	26-03-02	Attendant at the Focus Group Meeting for Community Based Organisations (Madibeng).	Pelindaba was under investigation due to the fact that it was an existing facility. The facility was specifically designed to manufacture nuclear fuel. Safeguards were designed into the buildings to protect the environment. The non-proliferation treaty act only refers to the development of nuclear weapons.
16.2.	Isn't the Koeberg reactor out of service?	23-10-00	Mr. G.H. Stemmer, Acting Head: Safety, Local Municipality of Madibeng, Brits.	No.
16.3.	Which seven nuclear power stations commenced construction in 1999?	27-09-00	Mr. R. Worthington, Branch Co-ordinator, Earthlife Africa, Johannesburg.	At the end of 1999 there were 433 nuclear power plants in operation with a total installed capacity of 349 GW (e) and 37 nuclear power plants under construction. Four new nuclear power plants were connected to the electricity grid in 1999: • Civaux 2, a 1450 MW(e) PWR in France • Kaiga 2,a 212 MW(e) PHWR in India • Wolsong 4, a 650 MW(e) PHWR in Republic of Korea • Mochovce 2, a 388 MW(e) WWER in Slovak Republic Construction started on seven nuclear power plants in 1999: • Shika 2, a 1325 MW(e) ABWR in Japan

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				• Hamaoka 5, a 1087 MW(e) ABWR in Japan • Ulchin 5, a 960 MW(e) PWR in Republic of Korea • Ulchin 6, a 960 MW(e) PWR in Republic of Korea • Tianwan 1, a 1000 MW(e) PWR in China • Lung-Mei 1, a 1300 MW(e) ABWR in Taiwan, China • Lung-Mei 2, a 1300 MW(e) ABWR in Taiwan, China Two nuclear power plants were shutdown in 1999. Source: IAEA Power Reactor Information System (PRIS) database http://www.iaea.org/programmes/a2/index.html.
16.4.	Since when is Koeberg operational? What is the estimated life span of Koeberg?	02-10-00 24-04-01	Afrikaanse Handelsinstituut, Bellville, Cape Town. Ms. H. Kingwill, Journalist, Cape Town.	Approximately 20 years ago. Lifespan approximately 20 more years.
16.5.	Approximately how much waste is being stored on the site at Koeberg at the moment?	30-01-01 28-03-01	Mr. M. Louwrens, IAP, Cape Town (Durban public meeting). Ms. H. Kingwill, Journalist, Cape Town.	The Koeberg facility has the capacity to accommodate 40 years worth of spent fuel in its spent fuel pools. At present the plant is operational for XX years of which it has accommodated fuel generated.
	What capacity has the existing Koeberg site to store	29-09-00	Mr M Botha, Conservation	The PBMR will be designed in a manner

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	more high-level waste?		Officer: Botanical Society of South Africa (Kirstenbosch), Cape Town.	that will allow it to store its own high level waste with the PBMR facility generated over the lifetime of the DPP.
16.6.	Why did the Germans not change from concrete to steel for the pressure housing?	26-08-00	Attendant: Pelindaba Open Day.	The Germans considered steel for the HTR Module (80 MWe), but for larger units the use of a steel vessel is not practical because of the size of the pressure vessel.
16.7.	Is indigenous material being used at Koeberg?	26-08-01	Attendant: Pelindaba Open Day.	Civil work and some of the mechanical work at Koeberg were locally sourced, while local manufactured fuel elements were used for a limited time.
16.8.	When will Koeberg be decommissioned?	30-01-01	Mr. M. Louwrens, IAP Cape Town. (Durban public meeting).	The design life is 40 years.
16.9.	There is no proof that the proposed alterations to the PBMR design will rectify the problems experienced with the German model	12-11-01	Dr. TA Fasheun, Director – Pollution and Waste Management: KwaZulu-Natal Department of Agriculture and Environmental Affairs.	High-Temperature Reactor technology was successfully applied and demonstrated in the mid-1980s in Germany with the building and operation of the 15 MW Arbeitsgemeinschaft Versuchsreaktor (AVR) (German for the Jointly-operated Prototype Reactor) research reactor and the 300 MW Thorium High-temperature Reactor (THTR). The AVR was a research reactor built to illustrate the characteristics of high-temperature reactors using pebble bed fuel and successfully demonstrated extended and stable reactor operation, and validated the use of Triple-coated

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				Isotropic (TRISO) fuel particles over a period of 21 years. The 300 MW THTR was built as a first-of-a-kind production plant and was aimed at demonstrating subsystem designs with specific emphasis on plant availability and maintainability. It was to be the forerunner of a commercial machine, namely the HTR-500 and aimed to have an operating life of 40 years and an availability of 80% to 90%. The plant achieved 100% power in 1986. During a manually executed process of loading new fuel in the German 300 MW THTR, a valve was inadvertently opened. This caused the fuel to be spilled and reactor coolant gas was released to the environment. The fuel was collected by hand as it was not radioactive. The dose rate due to the incident was well below the regulatory limits and swamped by the Chernobyl event. There was no effect on the near or distant environment. It played absolutely no role in closing the reactor. A commission of enquiry appointed by the German government subsequently confirmed this. In 1987, the 200 MWth/75 MWe Siemens HTR_Modul design received a concept licence from the German safety authorities, demonstrating that the key technologies incorporated in this design

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				were licensable. Although the foregoing plants did suffered technical problems in one way or another, each served to confirm the suitability of one or more key elements that now constitute part of the overall PBMR conceptual design. The previous research h programmes and operational experience have therefore provided confidence in the technical basis of the PBMR design, especially in instances where the coated particle pebble bed fuel had been adopted as the primary energy source.
16.10.	Are nuclear standards, practises and procedures sufficiently demonstrated and maintained at Koeberg NPS?	10-11-05	Unknown participant	Yes, Koeberg operates within the NNR requirements.

17. WASTE

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17.1.	The amount of "high-level waste by weight" from the PBMR is higher than other types of nuclear reactors. This means that there will be a much higher impact in terms of numbers of vehicles on the roads with the inherent risks of accidents and sabotage	28-03-02	Ms. CT Garbett, Director: Watt Props (Pty) Ltd. Itumaleng Farm CC, Crossroads Valley Properties (Pty) Ltd.	This activity is likely to take place only after about 40 years after the PBMR demonstration module has operated for an expected 40 years. The transportation of the spent fuel will take place in terms of the requirements set out by the National Nuclear Regulator as based on international standards.
17.2.	Was the recycling of waste considered?	26-03-02	Attendant at Focus Group Meeting with Community Based Organisations (Madibeng).	There are two types of spent fuel, namely radioactive waste and non-radioactive waste. The non-radioactive waste would be recycled at the Pelindaba facility. High-level radioactive waste would be stored on site at Koeberg, whilst medium to low level radioactive waste would be transported to Vaalputs for storage.
17.3.	Were there any guarantees that South Africa would not become the international disposal site for nuclear waste?	26-03-02	Attendant at Focus Group Meeting with Community Based Organisations (Madibeng).	Absolute guarantees are seldom possible. However, such a shipment would have to be registered with the NNR who is part of the International Atomic Energy Agency (IAEA). The IAEA is aware of all such shipments worldwide
17.4.	The public must be assured that the issue of high-level waste will be addressed in the long-term.	27-03-02	Dr. Z Butnik-Lees, Executive Director: Business council for Sustainable Development – South Africa.	Comment noted. The aspect of nuclear related reporting and communication will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24 and 25.
17.5.	Concern regarding the storage and management of	29-11-05	Mr. J de Villiers	The legal framework for this issue is in

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	spent fuel.			place, i.e. National Radioactive Waste Management Policy and Strategy. This aspect will also be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24 and 25.
17.6.	How will the nuclear waste generated by the PBMR affect future generations?	27-03-02	Dr. Z Butnik-Lees, Executive Director: Business council for Sustainable Development – South Africa.	One of the requirements for licensing of new technologies using radioactive materials is that allowance shall be made for the possible demands by society for greater standards of safety over the operational life of the facility. The intent is that there should be no health effects burdened on future generations and that any means chosen for either handling or storage of radioactive waste will embrace levels of protection suitable to ensure that.
17.7.	How long does it take for spent fuel to cool down enough to allow handling?	03-04-02	Clr S Kotze, Ward Councillor –City of Johannesburg.	Spent fuel can be handled at any time by remote means even though it may be highly radioactive and very hot. The radioactivity level in the fuel would mean that there would always have to be precautions in the physical handling of fuel - even in the event that it were to be cool enough to be handled with bare hands.
17.8.	How long will the spent fuel be contained in the PBMR Building?	1-12-05	Mr. Garbett	The PBMR DPP is designed to store the full complement of spent fuel of its full life cycle inside the plant building. Low level radioactive waste will be managed via

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				the Koeberg radioactive waste management facility.
17.9.	At what depth will spent fuel be stored at the PBMR?	03-04-02	Clr S Kotze, Ward Councillor –City of Johannesburg.	Fuel will be stored in the fuel storage tanks located at the - 17.5 level in the PBMR Module.
17.10.	How long will spent fuel remain dangerously active?	14-03-02	Adv. D Barnard, Director: Duard Barnard and Associates.	The spent fuel can always be regarded as highly active in a given situation. The situation of spent fuel handling and storage that will be designed into the PBMR will ensure sufficient containment, cooling and shielding that the fuel will not be dangerous.
17.11.	Is there an organisation that would control the handling of nuclear waste?	25-03-02	Mr. J Serfontein, Brits Industrial Association, Northwest Chamber of Industry and Mines and Brits Industrial Society.	Yes, the National Nuclear Regulator (NNR). The NNR is a government organisation and falls under the Department of Minerals and Energy.
17.12.	Very few members (of SACOB) were concerned about potential environmental impacts. Environmental concerns raised, were mostly regarding the safe handling and disposal of radioactive waste.	15-03-02	Ms. P Drodskie, Director: South African Chamber of Business (SACOB)	Comment noted.
17.13.	Government/Eskom may not ignore the issue of high level waste disposal.	20-09-01	Mr. A Murphy, Member: eThekwini ECOPEACE	High level waste management aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24 and 25.
17.14.	Without a program for final High Level Radioactive Waste disposal and management the production of that Waste amounts to an unconstitutional	20-09-01 09-10-01	Mr. A Murphy, Member: eThekwini ECOPEACE Ms. L McDaid, Earthlife	Comment noted. High level waste management aspects will be addressed during the EIA phase.

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	infringement of environmental rights.	01-10-01	Africa, Western Cape. Mr. M Lakhani, Anti-nuclear Coordinator: Earthlife Africa.	Please refer to chapter 7 of the RFSR: issues number 24 and 25.
17.15.	The stated design life of 40 years for the operation of the PBMR and an additional 40 years for the interim storage of spent fuel is to be confirmed through analysis, previous experience and a programme of laboratory tests. How, where and when are these laboratory tests to be carried out? What previous experience is relevant to this case? What analysis will be done?	20-09-01	Mr. A Murphy, Member: eThekwini ECOPEACE	The storage tanks for the high level waste is to be tested to ensure that it lasts 80 years. This will be carried out during the demonstration period.
17.16.	What is the half-life of a pebble (spent fuel)?	03-04-02	Clr S Kotze, Ward Councillor – City of Johannesburg.	This aspect will be described in the EIR.
17.17.	Is there enough space to store all the spent fuel?	03-04-02	Clr S Kotze, Ward Councillor – City of Johannesburg.	Nuclear waste at Koeberg is handled according to nuclear licence requirements that meet international standards. There are several different grades of such waste each with different technical specifications for treatment, encapsulation, packaging and storage and then final disposal off-site at a licensed facility such as the Vaalputs repository in the Northern Cape Province. Low and intermediate level nuclear waste is currently transported to Vaalputs. Spent PBMR fuel will be stored on the reactor site for up to 40 years after the reactor closes down. The spent fuel is intended to remain in the spent fuel tanks for approximately 40

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				years following the shut down of the PBMR. After the plant has been shut down, the spent fuel can be safely stored on site for another 40 years before being sent to a final repository. No decision has yet been made on the location of such a site.
17.18.	What happens to spent fuel after the PBMR is decommissioned?	03-03-02	Clr S Kotze, Ward Councillor – City of Johannesburg.	The spent fuel is intended to remain in the spent fuel tanks for approximately 40 years following the shut down of the PBMR. After the plant has been shut down, the spent fuel can be safely stored on site for another 40 years before being sent to a final repository. No decision has yet been made on the location of such a site.
17.19.	The cumulative effect of nuclear waste (from the PBMR and other industries) has to be investigated.	03-04-02	Clr S Kotze, Ward Councillor – City of Johannesburg.	The cumulate impact of waste will be assessed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24, 25 and 36.
17.20.	Plutonium 239 is a problem, and will be so for the next 250,00 years. This issue should be driven by international procedures and be addressed as a local issue.	10-03-02	Attendant at Focus Group Meeting.	The cumulate impact of waste will be assessed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24, 25 and 36.
17.21.	The management of high-level nuclear waste can only effectively be managed by an international policy dealing with the issue.	19-03-02	Attendant at the Focus Group Meeting with Prof. Lloyd and Messrs Longden-Thurgood and Walmsley.	The cumulate impact of waste will be assessed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24, 25 and 36.
17.22.	The assumption that the working life is of the order of	20-09-01	Mr. A Murphy, Member:	The cumulate impact of waste will be

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	several decades (part of the fundamental safety requirements for NNR licensing) pre-empts any public process concerning a safe geological depository. If this is not successful then the highly dangerous PBMR waste must be stored on site indefinitely.		eThekwini ECOPEACE	assessed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24, 25 and 36.
17.23.	There is no solution, worldwide, to the nuclear waste problem and it is not known if a solution will ever be found. It is unacceptable that the proponents are proposing to produce large quantities of high-level radioactive waste on the basis that one day a solution might be found.	25-09-01	Mr. J & Ms. L Stevens, Member: Pelindaba Working Group.	The cumulate impact of waste will be assessed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24, 25 and 36
17.24.	Environmental aspects with no radiological dimension: A second section on waste management is included on page 77 and relates to "continued management of radioactive waste". However no assessment of the impacts of waste management is in fact recommended, rather it is suggested that the issue of continued management of radioactive waste is merely to be considered by the Department of Mineral & Energy Affairs. This is an abdication of responsibility to continue the impact of generation of large quantities of radioactive waste.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The issue will be assessed in the EIA phase and mitigation included in the EMP for consideration by the public, the applicant and the authorities. Please refer to chapter 7 of the RFSR: issues number 13 and 24.
17.25.	Environmental aspects with no radiological dimension: Table 7 of the DSR contains a summary of the screening assessment under waste management generation of radioactive waste is included; It is not clear why this is included under a section dealing with environmental aspects with no radiological dimension.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	This issue has been corrected in the RFSR.
17.26.	It is important to note that the PBMR has safety and waste minimization features that represent large	04-10-01	Prof. P Petersen, Department of Nuclear	Comment noted.

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	improvements over current water-cooled reactor (LWR) technology. The PBMR converts 44% of the nuclear energy to useful electricity, compared to 32% in typical water-cooled reactors. Furthermore, the approach used in fuelling the PBMR makes much more effective use of neutrons generated from fission reactions, so that fewer long-lived heavy elements are produced per unit of fission energy generated. The combined effect is approximately a factor of 2 reductions in high-level waste.		Engineering, University of California.	
17.27.	The graphite fuel form is extremely inert, and tentative data suggests that corrosion rates in repositories may be as low as 1 millimetre per billion years, so that following placement in corrosion-resistant canisters in a deep geologic repository essentially no releases could occur through the 10-millimetre thick graphite layer that covers each pebble.	04-10-01	Prof. P Petersen, Department of Nuclear Engineering, University of California.	Comment noted.
17.28.	What is being done in different countries regarding waste management? Are there any authorised long-term storage facilities anywhere in the world?	23-08-00	Messrs. J. Minnie, G. Laskey, F. Schlaphoff, Disaster and Emergency Services: Cape Town. H. Linde, Pollution Control: Cape Metropolitan Council (CMC). Mr. H. Schrader, Municipal Health Services, Cape Metropolitan Council (CMC). Messrs. Z. Toefy, S. Granger; Ms. E. Weinronk; K. Pavers,	There is a long term deep waste repositories in Finland, France and the USA. More information available on website: www.iaea.org

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			Environmental Management Department: Cape Metropolitan Council (CMC). Mr. K. Hennessy, Spatial Planning: Cape Metropolitan Council (CMC). Mr. P. Tomalin, Cape Metropolitan Council (CMC).	
17.29.	There were serious leaks and threats of closure at Vaalputs, the waste disposal site near Springbok in 1997. What is being done about the waste now? How is the waste transported to Vaalputs? What waste can be disposed of at Vaalputs?	29-09-00	Mr. M. Botha, Conservation Officer: Botanical Society of South Africa (Kirstenbosch), Cape Town.	Please refer to chapter 7 of the RFSR: issue number 37.
17.30.	Where will the high-level waste go and for how long?	26-08-00 30-01-01	Mr. M. Botha, Conservational Officer: Botanical Society of South Africa, [Kirstenbosch) Cape Town. Attendant: Pelindaba open day.	The high level radioactive waste will be contained within a disposal facility designed to accommodate and store such waste for 40+40 years The low level and inter-mediate radioactive waste will be disposed at Vaalputs. Please refer to chapter 7 of the RFSR: issues number 24, 25 and 37.
17.31.	Radioactive waste is hazardous and requires global solutions.	16-02-01	Ms. B. M. Blignaut, Secretary: Green Belt Action Group, Roodepoort.	Comment noted. Yes. This is why it is stored on a nuclear-licensed site under very strict monitoring conditions. Any waste from any facility that is incorrectly handled, transported, stored or disposed of can present a

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				danger. Strict rules and procedures reduce dangers.
17.32.	Public insecurity and fear is real. Nuclear waste presents the worst fear in the absence of international treaties on accepted waste disposal, beyond the obligation to return the waste to the country of origin.	17-05-01	Mr. G. Mpufane, Environmental Officer: National Union of Mineworkers (NUM), Johannesburg.	Comment noted. The aspects of fear and risk (real and perceived) are assessed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1.
17.33.	Is the storage of radioactive waste a practical problem or a political / economical one?	30-03-01	Mr. J. van der Velden, Vice Chairperson: Greater Hermanus Association for Commerce and Tourism, Hermanus.	It contains aspects of all mentioned.
17.34.	Disposal of nuclear waste, as a last resort, could be fired into space with the aid of fossil fuels before they become economically unaffordable.	Undate d.	Mr. A.G. Hacker, IAP, Cape Town.	Comment noted.
17.35.	Where and how does Eskom plan to store its radioactive spent fuel?	01-02-01 29-03-01 18-09-00 30-01-01	Mr. A. Holm, Member: Hartbeespoort Erfenis en Omgewingsvereniging, Hartbeespoort. (Pelindaba public meeting). Mr. P. and Mrs. E. Kruger Mr. M. A. Ranoszek, General Manager: Pioneer Natural Resources of South Africa, Cape Town. Mr. R. Makroti, Member: Goodlife Initiative Africa, Durban.	The high level radioactive waste will be contained within a disposal facility designed to accommodate and store such waste for 40+40 years The low level and inter-mediate radioactive waste will be disposed at Vaalputs. Please refer to chapter 7 of the RFSR: issues number 25.
17.36.	The EWT believes that qualified, competent, present	30-10-00	Dr. J.A. Ledger, Director:	Comment noted.

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	or future generations of South Africa can meet the challenge of responsible storage of spent nuclear fuel.		Endangered Wild Life Trust (EWT), Johannesburg.	
17.37.	How was the waste strategy of storage chosen and by what criteria? Reference is made to "international endorsed standards". What are these and by what bodies are they endorsed?	03-10-00	Mr. R. Worthington, Branch Co-ordinator, Earthlife Africa, Johannesburg.	The aspects relating to waste management will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 33.
17.38.	How many tons of high level and intermediate waste will be generated by the demonstration module in its 40-year life?	20-02-00	Mr. J. Acton, Director: New Eden Foundation; Chairperson: PERMACOAE: Permaculture Foundation of the Western Cape; National Secretary: Green Party of South Africa, Cape Town.	This asoect will be assessed duing the EIR phase. Please refer to the RFSR, Chapte7 issues 24, 25 and 28.
17.39.	What are the characteristics of the waste produced by the PBMR?	27-09-00	Mr. F. Bekker, Director: Safrich, Johannesburg.	This aspect is addressed in the RFSR. Please refer to chapter 7 of the RFSR: issue number 24.
17.40.	Was the issue of wastes included in the process?	13-10-00	Messrs. W. Fourie, C. Agenbach, D. Smit, M. Oosthuizen, Department of Environmental Affairs and Tourism (DEAT). Mr. L. Eichstadt, Dr. L. Platzky, and Deputy Director General: Department of Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town. Ms. C. le Roux,	This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24 and 25.

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			Environmental Officer: Department of Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town. Mr. J. P. Louw, Director: Department of Environmental Affairs and Tourism (DEAT). Ms. I. Coetzee, Director: Department of Environmental and Cultural Affairs and Sport, Western Cape, Cape Town. Ms. E. Weinronk, Review Co-ordinator: Cape Metropolitan Council (CMC), Cape Town.	
17.41.	What are the qualities and extent of nuclear waste?	02-10-00	Afrikaanse Handelsinstituut, Bellville, Cape Town.	All nuclear waste is dangerous. This is why it is stored on a nuclear-licensed site under very strict monitoring conditions. Any waste from any facility that is incorrectly handled, transported, stored or disposed off, can present a danger. Strict rules and procedures reduce dangers. At the fuel plant no high-level radioactive waste is generated and quantities of intermediate-level waste will be low (few drums per year).
17.42.	What is the long-term plan for nuclear waste?	28-09-00	Representative of the Department of Community Health, University of Cape Town (UCT).	The National Policy on radioactive waste management was recently published. A strategy to implement this policy is still in process.

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17.43.	The Department would need a detailed plan regarding the PBMR project and its impact on the management of waste and water use, as this could impact on the granting of future Licences.	26-01-01	Messrs. S. Enele and M. Mathegana, Department of Water Affairs and Forestry (DWAF).	This aspect will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 22 and 24.
17.44.	Spent nuclear fuel is hazardous for thousands of years. What is the current general waste policy in terms of nuclear spent fuel? It is simply impossible to fill the planet with nuclear waste, which remains radioactive for thousands of years.	16-02-01	Ms. B. M. Blignaut, Secretary: Green Belt Action Group, Roodepoort.	The National Policy on radioactive waste management was recently published. A strategy to implement this policy is still in process.
17.45.	The issue of "spent fuel storage" was raised at various meetings, without identifying where such storage facility should be or without addressing the lack of such facilities globally.	26-05-01	Ms. L McDaid, Member: Koeberg Alert, Earthlife Africa, Western Cape.	The design is such that spent fuel may be stored in dry storage tanks at the PBMR plant for its life span. During this time it is not foreseen that spent fuel will leave the site. After shut-down the spent fuel may be stored on site for a further period before being sent to a final repository or being disposed of according to government policy, which is currently being formulated.
17.46.	That waste is avoided …and otherwise disposed of in a responsible manner: Insufficient information is provided in the DSR on the volumes and radioactivity of waste likely to be generated. No long-term repository for high level waste exists and the DSR therefore indicates that waste will be stored on the site for the lifetime of the plant (pg 30 of DSR). This issue continues to be of concern to the City Of Cape Town (as indicated in the appeal submitted to the Minister of Environmental Affairs and Tourism in August 2003). The DSR indicates that waste impacts will be addressed in the forthcoming EIA (pg 88) but	6 March 2006	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	The issue will be addressed in the EIR phase Please refer to chapter 7 of the RFSR: issues number 24 and 25.

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	the precise scope of these studies is not clear. The radioactivity and volumes of the spent fuel and other waste components is not indicated in the DSR and no clarity is given with regard to how radioactive waste will be stored or managed.			
17.47.	The full details of total waste by weight and volume over 40 year design life to be generated should be detailed in the EIA.	7-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	This information would be required for assessment and will therefore be included in the EIR.
17.48.	Will Eskom build a waste repository?	30-01-01	Mr. M. Louwrens, IAP, Cape Town (Durban public meeting).	No.
17.49.	Will high-level waste be stored on site?	Undated	Anonymous.	Yes. The design is such that spent fuel may be stored in dry storage tanks at the PBMR plant for its life span. During this time it is not foreseen that spent fuel will leave the site. After shut-down the spent fuel may be stored on site for a further period before being sent to a final repository or being disposed of according to government policy, which is currently being formulated.
17.50.	Are you going to burn the waste?	Undated	Anonymous.	No waste will be burned.
17.51.	What happens when the waste and water are	Undate	Anonymous.	In the fuel plant uranium will be separated from the water, resulting in

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	separated?	d		concentrated slurry of uranium waste. The uranium will be recovered from this slurry. The residual water will have a concentration of uranium that is less than the drinking water limit and can be discharged together with other industrial wastewater under permit.
17.52.	There is a need for both qualitative and quantitative information on the waste emanating from spent fuel.	Undated	Anonymous.	This information is provided in the RFSR. Please refer to chapter 7 of the RFSR: issues number 24 and 25.
17.53.	What happens after the 40 plus 40 years of waste storage on the PBMR site?	Undated	Anonymous.	The issue of waste will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24 and 25.
17.54.	How will the waste be managed?	1-12-05	Mr. Garbett	The PBMR DPP is designed to store the full complement of spent fuel of its full life cycle inside the plant building. Low level radioactive waste will be managed via the Koeberg radioactive waste management facility
17.55.	What is the expected lifespan of the Vaalputs site?	Undated	Anonymous.	This issue will be best addressed during the licensing process of the NNR.
17.56.	Get scientists from all over the world to run a 24-hour research programme to develop an inert fuel from the radioactive "waste". It is by no means "waste" and in the future will actually become valuable, once the required scientific information is re-discovered. This, however, is like the paper pulp industry – it remains cheaper to continue felling and	21-05-01	Mr. M. Louwrens, IAP, Cape Town.	Comment noted.

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	planting up grasslands than it is to recycle.			
17.57.	There is sufficient time to develop the best possible site and technology for waste disposal.	23-01-01	Mr. J. Walmsley, Consultant, J Walmsley Consultants (Milnerton public meeting).	Comment noted.
17.58.	There is no solution for high level radioactive waste anywhere in the world. At present there is no indication that a satisfactory solution will be found. To produce many tons of waste on the basis that a solution will be found is a gamble and a risk. This simply repeats what the nuclear industry has been saying for the last 50 years, that a solution will be found "later" deferring costs and environmental, health and safety impacts is unconstitutional.	01-10-01 18-05-01 25/09-01	Mr. M Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa. Messrs K Wisemand & E Weinronk, Cape Metropolitan Council: Planning, Environment & Housing – Environmental Management. Mr. J & Ms. L Stevens, Member: Pelindaba Working Group	All countries that are nuclear enabled have national policies and high level waste storage procedures.
17.59.	The exclusion of the long-term resolution and management of nuclear wastes makes it extremely difficult to consider the merits of both the environmental and economic aspects of nuclear generated electricity.	Aug 01	Messrs P Hardcastle & C le Roux, Provincial Department of Environment and Cultural Affairs and Sport, Western Cape Province.	The issue of waste will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24 and 25.
17.60.	Radioactive waste must be safely managed for the protection of human health and the environment. The safe management of all radioactive waste must be dealt with according to the comprehensive set of internationally agreed principles as established by the International Atomic Energy Agency (IAEA).	17-10-01	Mr. D Louw, Director, Department of Health – Western Cape.	The issue of waste will be addressed during the EIA phase. The internationally agreed principles as established by the International Atomic Energy Agency (IAEA) will inform this issue. Please refer to chapter 7 of the RFSR: issues number 24 and 25.

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17.61.	All sources of waste must be identified and characterised and the design must provide for collecting and treating of the waste, for control over effluent discharge and for safe storage of waste at the facility.	17-10-01	Mr. D Louw, Director, Department of Health – Western Cape.	The issue of waste will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24 and 25.
17.62.	We confirm that it is expensive to dispose of radiologically contaminated waste. We specifically request that these costs be included covering all stages of the process, including decommissioning and 'final' disposal. The 'losses to waste' are unacceptable, as no information is made available regarding the impact of these materials. It must also be noted that these 'losses' – emissions – are for a single PBMR and must be calculated also for the proposed 10 PBMRs as well for the full production run of 216 PBMRs that are envisaged	19-10-01	Mr. M Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	High level waste will be managed on site for the duration of the plant life, i.e. 40 years. Please refer to chapter 7 of the RFSR: issues number 24 and 25.
17.63.	Nuclear waste creates secondary pollution.	05-04-02	Mr. S. Thorne. Director: Energy Transformation CC, Cape Town.	Comment noted.
17.64.	Where will the solid waste be stored in the long term? What volumes will be generated annually, and at what levels of radioactivity?	22-10-01	Mr. M Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	Low-level waste will be transported to Vaalputs. Approximately 90 x 200 l drums of solid waste will be generated per annum. Radioactivity is low-level. Please refer to chapter 7 of the RFSR: issues number 37.
17.65.	How can the radioactivity be removed (from liquid waste)? How will this treatment be done? Where will this effluent be released to? Have the authorities to whom the waste will be discharged been informed	22-10-01	Mr. M Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	An evaporator and centrifuge system will be employed for liquid waste processing. This will separate active from non-active substances. Fine solids will then be

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	that this will happen What level of radioactivity are workers exposed to, particularly with regard to gaseous waste? What will be the total volume going through the HEPA filters per day / per week / per month / per annum? At what level of efficiency is it expected that the HEPA filters will operate?			separated from liquids. Discharge of resulting liquid to the environment is subject to authorisation from regulatory authority The liquid waste will not be very active and can be released to the sea without treatment. Exposure of workers to all forms of radioactivity including airborne activity is controlled according a radiation protection programme. A radiation protection organisation will be established in order to identify responsibilities for the implementation of the various programmes embraced under the radiation protection programme. The radiation protection organisation will comprise an adequate number of suitably qualified and experienced personnel to ensure the effectiveness of the individual programmes such that the objectives of the radiological protection programme are attained. The PBMR site operational management will ensure that the radiation protection organisation is equipped with sufficient resources in order to be able to achieve this.
17.66.	There is no clear indication of how Nuclear Waste/Fuels will be stored.	18-05-01	Messrs K Wiseman and E Weinronk, Cape Metropolitan Council: Department of Planning,	Aspects relating to radioactive waste will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24 and 25.

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			Environment and Housing.	
17.67.	Whereas it was formerly believed that Plutonium (IV) was insoluble in water and would therefore not be very mobile in the underground geological environment because of its insolubility. New research demonstrated that water can oxide PuO_2 into PuO+x in which more than 25% of the plutonium ions exist as Pu (VI), an ion that is far more water soluble.	22-05-01	Mr. R Worthington, Branch co-ordinator, Earthlife Africa – Johannesburg.	Any plutonium IV will be retained within the fuel pebble and spent pebbles will not come into contact with water.
17.68.	Custody of long term waste, how is this ensured?	17-11-05	Mr. Lakane	Management of long term waste is addressed by the National Radioactive Waste Management Policy and Strategy. The waste management aspects will be addressed n the EIA phase. Please refer to chapter 7 of the RFSR: issue number 25.
17.69.	Should PBMR Company export the technology, will South Africa be responsible for the disposal of all the spent fuel?	1-12-05	Ms. Garbett	As per international conventions, and accepted international contractual principles spent fuel has to be maintained and managed by the country that operates the facility.
17.70.	WESSA believes that the ability to manage radioactive waste in the long term must be addressed. We are therefore concerned that issues surrounding the storage, management and disposal of the high level waste in the long term will also not be explored in this EIA process - the DSR states that these issues will be considered by the Department of Minerals and Energy (DME). We suggest that it is inappropriate to place this responsibility on solely the DME and that issues concerned with the operation	6-3-06	WESSA Western Cape Region: Samantha Ralston (Environmentalist)	Radio active waste management aspects will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24 and 25. In addition, the National Radioactive Waste Management Policy and Strategy provides the framework to manage radio active waste in the long term. Internationally there are advanced

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	and entire lifecycle of the PBMR DPP are key to the EIA process. We urge that a holistic view of the proposed development and its potential impacts be taken.			technologies and practises for the safe keeping and management of HLW. However, no sites for the long term disposal of HLW have been established. RSA law obligates the DME with the function of radioactive waste disposal, which ito NEMA must be discharged in cooperation with other government bodies and agencies. However, the presence of specific policy or repository facilities is not a prerequisite for the establishment of a PBMR or other nuclear facility.
17.71.	Environmental aspects with no radiological dimension - the impact of waste management during the decommissioning of the plant: Storage/management of long-term high-level waste. It is recommended that issues are considered by the Department of Mineral & Energy and included in the National Waste Policy. This constitutes an abdication of responsibility to consider the impacts of storage and management of long-term high-level waste.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	This aspect will be assessed in the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24 and 25.
17.72.	Environmental aspects with no radiological dimension - the impact of waste management during the decommissioning of the plant: Decontamination of irradiated materials. Here the issues are to be assessed by the NNR process and to inform the EIA process. It is submitted that any input provided by the NNR should take place before completion of decision making in terms of the EIA process, and be subject to procedural rights to comment by IAP's and critical decisional scrutiny by	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	This aspect will be assessed in the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24 and 25.

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	the DEAT.			
17.73.	Environmental aspects with no radiological dimension - the impact of waste management during the decommissioning of the plant: Long-term disposal at the Vaalputs facility. Here the issues are to be considered by the DME and included in the National Waste Policy. Once again there is an abdication of responsibility to consider the assessment of impacts of long-term disposal of the Vaalputs facility (e.g. increased traffic, effects on adjacent communities of increased risk of accidents in the transportation of nuclear hazardous waste etc).	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	This aspect will be assessed in the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24 and 37
17.74.	Environmental aspects with no radiological dimension - the impact of waste management during the decommissioning of the plant: Dismantling of the plant, disposal of plant material and high-level waste storage plant. Under this item waste management also includes the issue of radiological waste. Issues are to be assessed by the NNR process and to inform the EIA process. The NNR process should precede the final ROD for the EIA.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	This aspect will be assessed in the EIA phase. Please refer to chapter 7 of the RFSR: issues number 9, 24 and 25.
17.75.	General: On page 80 of the DSR under the issues designated "economic impacts" the issue "expenditure and support for the dismantling and rehabilitation" is indicated. The "recommendations" column states that "that the potential impacts (before and after mitigation) should be assessed during the EIA phase. Recommendations should be made regarding appropriate mitigation measures required to minimize impacts." This recommendation	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The issue of adequate financial provision for decontamination, rehabilitation is included for assessment during the EIA phase. P Please refer to chapter 7 of the RFSR: issues number 9, 24 and 25. This report has been amended to prevent an interpretation of the contradiction indicated in the comment.

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	does not appear to make sense and also appears to contradict the recommendation contained in item 6 of table 6 on page 70 which suggests that the use of public funds to develop a nuclear technology is not an issue that falls within the EIA.			
17.76.	Environmental aspects with no radiological dimension: the management of waste, its storage and transportation, and the issue of decontamination of the site are issues that are not novel in the sphere of nuclear management. The environmental impacts of the generation of a known or easily estimable amount of nuclear waste can readily be ascertained from the available knowledge on the matter within the nuclear industry. There is no justification for deferring the consideration of the impacts hereof to other departments as is suggested in the DSR. The legislative provisions in terms of which for example the DME is to consider storage and management of waste are not spelled out. This precludes an evaluation of whether there will be substantial compliance with the assessment requirements of the ECA if this is indeed a lawful approach. The same applies to the Issue of decontamination of the site. Why does the DEAT need the NNR to deal with this issue? The consultants can draw up expert reports so that the DEAT can discharge its responsibilities of assessing the impacts hereof before giving a record of decision. If not, the approach adopted by the consultants needs to be properly justified in the DSR.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	Comment noted. The NNR is the Department with the jurisdiction in this case.

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17.77.	Will the government give a grant in respect of nuclear waste generation – if so, what amount?	10-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	This issue is to be resolved via government policy. Comment to be directed to the DME.
17.78.	After 40 years use as envisaged, the demonstration PBMR DPP highly radioactive waste will have to be made secure requiring security at this site for ever. There is no method as yet to remove this material to a safe place. The Department and the Government that makes the decision to proceed must clearly inform all the people of the consequences for them to be able to vote in a referendum to be held. No license should be issued until the vote/referendum has taken place.	17-05-06	Mr. W F M de Pinho	Suggestion noted. The NNR does have a public process as part of the licensing process.
17.79.	How has the waste disposal facility been sited & designed to contain the radiation hazard?	27-03-06	Wilhelm Alheit	The high level radioactive waste will be contained within a disposal facility designed to accommodate and store such waste for 40+40 years The low level and inter-mediate radioactive waste will be disposed at Vaalputs. Please refer to chapter 7 of the RFSR: issues number 24, 25 and 37.

18. PUBLIC PARTICIPATION, TRANSPARENCY, CREDIBILITY AND PROCESS ISSUES

18.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
18.1.	Participation in the process. Integrated Energy Planning process did not include facilitation of stakeholder participation and the process was dominated by big business. Also, the process was 'voluntary' i.e. parties had to provide their own funds to attend meetings, etc.	22-05-01	Mr. R Worthington, Branch co-ordinator, Earthlife Africa – Johannesburg.	Comment noted. This aspect falls outside this EIA process.
18.2.	Public participation is a farce, waste of time and money. Continuation of this project and its changes has cost this country and its taxpayers millions of Rand. Information that should have been in the public domain has not been released.	17095-06	Mr. W F M de Pinho	Comment noted. However, a legally proscribed process is followed. The DEAT oversees the process.
18.3.	Scoping documents cannot be reviewed during holiday periods and needs to be available in public libraries other than Tableview.	9-11-05	Unknown participant	Holiday time does not count for review time although the draft Scoping Report may be out before year end. The documents will be placed in various public libraries around Cape Town and Koeberg residential areas.
18.4.	The notes of the meetings held do not include an attendance list which makes it difficult to gauge level of participation.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager.	The RFSR contains copies of the attendance registers for the public meetings that were conducted as part of the Scoping Phase.
18.5.	ELA requests focus group meeting to discuss and debate specialist issues and reports.	9-11-05	Mrs. L McDaid	A number of focus group meetings were being arranged. None of these realised.
18.6.	How will non-English speaking persons be accommodated in the EIA process?	9-11-05	Unknown participant	The EIA is mostly conducted in English. Translation was available at all public events. Documents or summaries of

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				documents will be translated on request.
18.7.	The DEAT commissioned an international review of the EIR which was not offered for sight by the IAPs. In absence of any guidance in the ECA, who should be responsible for commissioning the international review? There is nothing to prevent DEAT from establishing its own international review commission.	10-11-05	Mr. Longden-Thurgood	DEAT has appointed a review panel which consists of member from across the global. This panel was convened in order to assist DEAT with the review of the EIA process.
18.8.	The independence of the specialists contracted to carry out specific tasks is critical.	10-11-05	Mr. Longden-Thurgood	The EIA consultants have to demonstrate their independence by means of a formal declaration of independence, which requires compliance to a number of factors.
18.9.	Doubt the independence of the Consultants.	1-12-05	Ms. Garbett	The EIA consultants have to demonstrate their independence by means of a formal declaration of independence, which requires compliance to a number of factors
18.10.	Concern regarding the integrity of the Public Participation Process and in fact the entire EIA Process in respect of the “proposed” PBMR nuclear experiment	2-08-06	C T Garbett R C H Garbett	Comment noted. However, a legally proscribed process is followed. The DEAT oversees the process.
18.11.	The EIA process has restarted but I have not been informed of this. Meetings have been held at Vaalputs which is too far away and not advertised.	2-06-06	A W Pienaar M Goedeman A Darlington F Kordom J Kriel F Vries	Notification was widely advertised in the newspapers. Subsequent to the receipt of this comment, a series of information workshops were held on the Northern Cape. Please refer to section 3.1.7 for the newspaper notifications.

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18.12.	Vast sums of money have been utilized in awarding contracts by the PBMR Company at the tax payer's expense since 2005. The only reasonable conclusion to be drawn is that the entire EIA Process is based on an outcome that has been pre-determined.	2-08-06	C T Garbett R C H Garbett	Comment noted. However, a legally proscribed process is followed. The DEAT oversees the process.
18.13.	The venue for the Milnerton meeting was unsuitable – lost to much in understanding.	14-12-05	Mr. W de Pinho	We apologise. The acoustics in the venue was bad. We will not use that venue again
18.14.	The review period of 30 days for the Scoping Report is too short and 45 calendar days are more appropriate, given the mass of information that the IAPs need to work through.	9-11-05	Ms. O Andrews	Comment noted. The POS for Scoping approved by DEAT indicates 30 calendar days public review period for the draft Scoping Report, and 45 calendar days for the Draft EIR.
18.15.	Period allowed for comment is insufficient to make any meaningful and thorough assessment of the technical scoping report.	2-08-06	C T Garbett R C H Garbett	Comment noted. The POS for Scoping approved by DEAT indicates 30 calendar days public review period for the draft Scoping Report, and 45 calendar days for the Draft EIR.
18.16.	Review times should only start once all information is disseminated, and should be at least 60 days.	17-11-05	Mr. Lakane	Comment noted. The POS for Scoping approved by DEAT, indicates 30 calendar days review period for the draft Scoping Report, and 45 calendar days for the Draft EIR.
18.17.	In view of the lack of participation of the majority of the SA citizens we reject the claim in the DSR that no	7-03-06	RCH Garbett CT Garbett	The intention of the draft scoping report is not to ignore these issues, but to indicate that sufficient baseline data

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	further study is required.		Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	exists for these issues to be assessed. Please refer to chapter 3 of the RFSR in this regard.
18.18.	On what basis is it deemed that the level of information and assessment that will be consulted in the final EIR should be determined y the agreement between DEAT and the NNR. We do not accept the proposed lack of public participation in the aforementioned agreement and call for transparency.	7-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	The co-operative agreement is a process indicated by DEAT and the NNR and followed by the consultants. Comments on the agreement should be addressed to DEAT and the NNR.
18.19.	Plan of study for scoping: By failing to afford interested and affected parties an opportunity to participate in the Plan of Study for Scoping procedure, the EIA applicant has failed to comply with the requirements of Regulation 3(1)(f). The applicant has also failed to comply with the requirements of administrative justice as set out in sections 3 and 4 of the PAJA. It has prejudiced interested and affected parties who have been denied an opportunity to participate in important procedures such as that determining how environmental issues and alternatives will be identified. It has also prevented Earthlife and other interested and affected parties from making representations on the proposed POS to the decision for consideration. As a consequence, the EIA process is fatally flawed.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The consultants respect this viewpoint, but do not agree. IAPs have had an opportunity to consider the draft scoping report and there has been a comprehensive public participation process. One of the core purposes of the scoping process is to identify aspects and issues to be considered during the EIA. The IAPs have participated substantively in this process. Please refer to chapter 3 of the RFSR in this regard.

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18.20.	Plan of study for scoping: It is noted that the Plan of Study for Scoping (POS) purports to limit the discussion of alternatives. We object to the legality of decision-making process flowing from the POS in the light of the fact that no right was afforded to the public to comment on the Plan of Study. Regulation 3(1)(f) of the EIA Regulations stipulates that the applicant is responsible for the public participation process to ensure that all I&APs, including government departments that may have jurisdiction over any aspect of the activity, are given the opportunity to participate in all the relevant procedures contemplated in these regulations. No opportunity appears to have been afforded to Earthlife or any other I&APs to participate in the POS procedure.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The consultants respect this viewpoint, but do not agree. IAPs have had an opportunity to consider the draft scoping report and there has been a comprehensive public participation process. One of the core purposes of the scoping process is to identify aspects and issues to be considered during the EIA. The IAPs have participated substantively in this process. Please refer to chapter 3 of the RFSR in this regard.

19. PROCESS ISSUES

19.	DESCRIPTION OF ISSUE	DATE	RAISED BY	CROSS-REFERENCE/COMMENT
19.1.	A copy of the proposed timeline for the National Nuclear Regulator process should be available and on record.	27-09-00	Mr. R. Worthington, Branch Co-ordinator: Earthlife Africa, Johannesburg.	This information is available from the NNR.
19.2.	In order to get a complete picture of the risks involved and limiting alternatives, a complete and holistic process needs to be considered.	19-01-01 12-02-01	Greater Brits Investment Group. Ms. S.N. Andrew, IAP, Cape Town.	Safety and risk aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 13 and 36.
19.3.	Issues raised in the previous EIA have apparently been 'included (where appropriate) into this process' (pg 59). It is not clear on what basis issues have been incorporated or dropped. It is recommended that a full list of issues be included in the RFSR together with an indication of which ones will not be considered any further.	6-03-06	City of Cape Town: Keith Wiseman (Manager: Integrated Environmental Management) for City Manager	These issues that will be addressed during the EIA phase is clearly indicated in the issues and comments register (section 8.7 of the RFSR), with a reference chapter 7, indicating how it will be addressed in the EIA phase. This will be reflected in the recommended plan of study for the EIA phase .The DEAT remains at liberty to revise the content of the plan of study.
19.4.	The public needs to have a place in the final decision-making process. As much research as is necessary, needs to be done. All relevant information may not be available at the given time, but as information becomes available, it should be forwarded to IAP's to enable them to make informed decisions. New information must be added and conclusions refined.	4-12-00	Adv. D. Barnard, Director: Duard Barnard and Associates.	The importance of public opinion in the process is embodied in the regulations (R1183) in terms of the Environment Conservation Act (Act No 73 of 1989, ECA) in that: Public participation must be part of the process. The RFSR must include an appendix containing: ❖ details of the public participation process;

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				❖ a list of IAPs; ❖ their comments. The RFSR and environmental impact report will be reviewed by the relevant authority. A public participation process for this EIA has been implemented and will ensure that interested and affected parties will be consulted throughout the EIA process through various means, such as interviews, focus group meetings, open days and public meetings. In addition, the public have the opportunity to launch and appeal if they do not agree with the environmental decision made b y DEAT.
19.5.	Will the EIA application be reviewed by a public / expert panel?	Undate d.	Anonymous.	Yes, an expert review panel appointed by DEAT. Provision was also made for review by the general public.
19.6.	Is there an independent authority to monitor the process?	26-08-00	Attendant: Pelindaba Open Day.	Yes, DEAT monitors the EIA process and guides the implementation thereof.
19.7.	The proposed time line for the whole process should always be on record and be available.	03-10-00	Mr. R. Worthington, Branch Co-ordinator, Earthlife Africa, Johannesburg.	Comment noted.
19.8.	Has the EIA been completed, and is the licence being granted?	24-04-01	Ms. H. Kingwill, Journalist, Cape Town.	No. The EIA process has not been completed. The granting of the nuclear license is a separate NNR process, which has also not being completed.
19.9.	What assurances can be given that alternative	19-02-01	Dr. D. Fig, Representative:	The issue of alternatives is addressed in

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	proposals will be considered by the EIA?		Leadership for Environment and Development Southern Africa (LEAD), Johannesburg.	the RFSR. Please refer to chapter 6 of the RFSR in this regard.
19.10.	What is the level of detail at which the EIA will go into? What will the impact of our concerns regarding the de-linking of the EIA processes be?	19-01-01	Messrs. L. Serobatsi, D. Fisher, L. Bothma and H. Crous, Department of Agriculture, Conservation and Environment (GDACE), Gauteng Province, Johannesburg. S. Enele and M. Mathegana, Department of Water Affairs and Forestry (DWAF).	The level of detail will be sufficient to enable a realistic assessment of the anticipated environmental impacts and allow DEAT to make an informed decision.
19.11.	Was the scope of the EIA site specific?	19-09-00	Mr. S. Law, Director: Environmental Monitoring Group (EMG), Cape Town.	No. Please refer to the section 6.5 on site alternatives in the RFSR.
19.12.	Preparations are already going ahead at the Koeberg power station to facilitate the building of PBMR, this suggests that whatever the outcome of the meetings and however strong the objection, the project will go ahead?	01-02-01	Mr. L. Griffiths, IAP, Cape Town.	No construction or related activities may commence until DEAT has published the record of decision regarding this EIA.
19.13.	Will the EIA process focus on the PBMR at Koeberg or will it be used to justify the construction of more PBMRs?	23-08-00	Representative from the Cape Metropolitan Council (CMC), Cape Town.	The PBMR DPP EIA process only focuses on Koeberg. Any further PBMRs will be the subject of new EIA processes.
19.14.	There are concerns that there are no individuals with a neutral perspective that can meaningfully interact in the technology review.	23-08-00	Messrs. J. Minnie, G. Laskey, F. Schlaphoff, Disaster and Emergency Services: Cape Town. H. Linde, Pollution Control:	Comment noted. A review panel was appointed by DEAT. Provision was also made for review by the general public.

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			Cape Metropolitan Council (CMC). Mr. H. Schrader, Municipal Health Services, Cape Metropolitan Council (CMC). Messrs. Z. Toefy, S. Granger and Ms. E. Weinronk; K. Pavers, Environmental Management Department: Cape Metropolitan Council (CMC). Mr. K. Hennessy, Spatial Planning: Cape Metropolitan Council (CMC). Mr. P. Tomalin, Cape Metropolitan Council (CMC).	
19.15.	Public perception will (should) determine the exclusion zone.	23-09-00	Messrs. D. Murry, Chairperson: Urban Planning and Environment; Blaauwberg Administration, City of Cape Town. D. Stoffberg, D.C. Bettesworth, Town planner, Blaauwberg Administration, City of Cape Town; R. Rodman; Ms. P. Titmus, Cape Town.	No, this is part of the NNR licensing process.
19.16.	Demands a multi stakeholder review panel.	17-11-05	Mr. Lakane	DEAT will establish a review panel, and the composition of the panel is the

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				prerogative of DEAT.
19.17.	A joint specialist review forum should be set up to review the process.	13-10-00	Messrs. W. Fourie, C. Agenbach, D. Smit, M. Oosthuizen, Department of Environmental Affairs and Tourism (DEAT); Mr. L. Eichstadt, Dr. L. Platzky, Deputy Director General: Department of Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town. Ms. C. le Roux, Environmental Officer: Department of Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town; Mr. J. P. Louw, Director: Department of Environmental Affairs and Tourism (DEAT); Ms. I. Coetzee, Director: Department of Environmental and Cultural Affairs and Sport, Western Cape, Cape Town; Ms. E. Weinronk, Review Co-ordinator: Cape Metropolitan Council (CMC), Cape Town.	An expert review panel was appointed by DEAT. Provision was also made for review by the general public.
19.18.	Was a terms of reference drawn up before the study commenced?	23-01-01	Attendant at Milnerton public meeting.	The EIA process was planned but the extent of specialist studies will be determined during the scoping phase.

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19.19.	What are the project schedule and time frames?	26-08-00 02-09-00	Attendant: Koeberg open day. Attendant: Pelindaba open day.	A construction licence is expected to be granted (by the NNR) in 2008 which would result in plant operation
19.20.	Does British Nuclear Fuel (BNF) own the process?	26-08-00	Attendant: Pelindaba Open Day.	No, the South African government is the major shareholder in the PBMR Company
19.21.	Does this EIA only cover the PBMR demonstration model?	01-02-01	Mr. A. Tregenna, IAP, Cape Town (Pelindaba public meeting).	Yes. This is indicated in the application and the RFSR – please refer to section 2.2, 2.3 and 2.4 of the RFSR.
19.22.	What is the relationship between the EIA process and the NNR's licensing process?	19-03-02	Attendant at the Focus Group Meeting with Prof. Lloyd and Messrs Longden-Thurgood and Walmsley.	The two processes are not connected at all. It is recommended that licensing by the NNR be made a precondition for undertaking the proposed activity.
19.23.	Concerns relating to the NNR process.	17-11-05	Mr. Lakane	In terms of the NNR Act public hearings will be conducted to allow for input.
19.24.	The NNR should consider the need for public hearings.	01-02-01	Councillor V. Mkhabele, Local Municipality of Madibeng, Brits. (Pelindaba public meeting).	Comment noted. The NNR does allow for public hearings in their processes.
19.25.	Clarity should be provided of any processes regarding prior informed consent of target export markets and what authorities and / or agencies have responsibilities in this regard.	03-10-00	Mr. R. Worthington, Branch Co-ordinator, Earthlife Africa, Johannesburg.	Comment noted. This aspect falls outside the scope of the EIA.
19.26.	Concerned that the NNR and EIA processes are separated. The EIA should be taking the opinions of the NNR into consideration.	19-01-01	Representative of the Department of Environmental Affairs and Tourism (DEAT).	NNR will be consulted in terms of the DEAT-NNR co-operative agreement. Please refer to sections 1.3.2 and 2.5.1 of the RFSR in this regard.

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19.27.	It is customary that for controversial EIAs, a review panel be appointed. What is the assurance that such a review panel will be appointed and that it will conduct public hearings?	16-02-01	Dr. D. Fig, Representative: Leadership for Environment and Development Southern Africa (LEAD), Johannesburg.	A review panel was appointed by DEAT. In terms of the NNR process, Public meetings may be held .
19.28.	We are calling a halt to all further developments on the nuclear front until the Integrated Energy Planning Process has been completed and passed into law.	27-01-01	Mr. M. Kantey, Chairperson: Koeberg Alert, Cape Town.	Comment noted.
19.29.	It is clear that the EIA processes for the PBMR and the licensing from NNR, are uncoordinated.	14-05-01	Mr. W.A.J. Nel, Acting Director: City Parks, Greater Johannesburg Metropolitan Council, Johannesburg.	NNR will be consulted in terms of the DEAT-NNR co-operative agreement. Please refer to sections 1.3.2 and 2.5.1 of the RFSR in this regard.
19.30.	An independent consultant must conduct the EIA. It is important for the independent consultants to ensure that their instructions are correct from a legal technical point of view. With this in mind, it is suggested that the independent consultants advise Eskom to investigate all possible alternatives, amongst others, including de-mothballing coal-generating plants.	23-04-99	Adv. D. Barnard, Director: Duard Barnard and Associates.	The EIA is conducted by a team of independent consultants.
19.31.	Who makes sure that the impacts are managed in the way proposed by the EIA?	26-01-01	Anonymous.	The statutory and regulatory framework, which provides the framework for the EIA process is indicated in sections 2.3, 2.4 and 2.5 of the RFSR.
19.32.	How does the appointment of the independent technology review committee link to our time frame? Is there an independent technical review? Is it independent? Where is it? Can we see it?	23-08-00	Messrs. J. Minnie, G. Laskey, F. Schlaphoff, Disaster and Emergency Services: Cape Town.	A review panel was appointed by DEAT. This committee reports to DEAT. Activities of the committee to be performed in the overall time frame of this project.

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			H. Linde, Pollution Control: Cape Metropolitan Council (CMC). Mr. H. Schrader, Municipal Health Services, Cape Metropolitan Council (CMC). Messrs. Z. Toefy, S. Granger and Ms. E. Weinronk; K. Pavers, Environmental Management Department: Cape Metropolitan Council (CMC). Mr. K. Hennessy, Spatial Planning: Cape Metropolitan Council (CMC). Mr. P. Tomalin, Cape Metropolitan Council (CMC).	
•	Our concern is that Government can release that holding point, without receiving the independent technology review. What assurance can we have that this does not happen?	23-08-00	Messrs. J. Minnie, G. Laskey, F. Schlaphoff, Disaster and Emergency Services: Cape Town. H. Linde, Pollution Control: Cape Metropolitan Council (CMC). Mr. H. Schrader, Municipal Health Services, Cape Metropolitan Council (CMC).	The result of the review committee is a requirement of a number of Departments such as DPE, Treasury and DME , all of which have input into the PBMR process.

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			Messrs. Z. Toefy, S. Granger and Ms. E. Weinronk; K. Pavers, Environmental Management Department: Cape Metropolitan Council (CMC). Mr. K. Hennessy, Spatial Planning: Cape Metropolitan Council (CMC). Mr. P. Tomalin, Cape Metropolitan Council (CMC).	
19.33.	How will the effective management of the nuclear process be guaranteed?	27-09-00	Mr. F. Bekker, Director: Safrich, Johannesburg.	The National Nuclear Regulator has received a license application from Eskom for a high-temperature gas-cooled modular reactor making use of the so-called Pebble Bed Reactor type design coupled with a direct-cycle gas-turbine generator. Licensing requirements for such a power reactor, referred to as the fundamental safety standards, must be adhered to, to demonstrate compliance with these requirements (quantitative criteria and qualitative requirements). The licensing process requires the licensee to present a safety case to the National Nuclear Regulator, i.e. a structured and documented presentation of information, analyses and intellectual argument to demonstrate

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				that the proposed design can and will comply with the safety standards. Please refer to chapter 7 of the RFSR: issue number 34.
19.34.	Would like to see some peer international review.	23-09-00	Messrs. D. Murry, Chairperson: Urban Planning and Environment; Blaauwberg Administration, City of Cape Town. D. Stoffberg, D.C. Bettesworth, Town planner, Blaauwberg Administration, City of Cape Town; R. Rodman; Ms. P. Titmus, Cape Town.	A review panel was appointed by DEAT.
19.35.	Do we have the assurance that after this prototype, each following model will go through a separate licensing process?	23-09-01	Messrs. D. Murry, Chairperson: Urban Planning and Environment; Blaauwberg Administration, City of Cape Town. D. Stoffberg, D.C. Bettesworth, Town planner, Blaauwberg Administration, City of Cape Town; R. Rodman; Ms. P. Titmus, Cape Town.	Yes. Each new application will require its own EIA.
19.36.	Concerned that the licensing and EIA procedures are followed in the correct manner.	26-09-00	Mr. K. J.P. Nel, IAP, Hartbeespoort,	Comment noted. Please refer to sections 1.3.2 and 2.5.1 of the RFSR in this regard.
19.37.	An EIA is inappropriate to investigate energy alternatives – a strategic environmental assessment is needed. The EIA for the PBMR should be stopped -	19-09-00	Mr. R. Karotti, H. Winkler: Energy and Development Research Centre (EDRC).	The requirement for a strategic environmental assessment falls outside the scope of this project.

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	Why was a Strategic Environmental Assessment not done?	23-01-01	Mr. T. Barbair (Milnerton public meeting).	
19.38.	The EIA process is totally flawed – legislation requires that all possible alternatives must be investigated and presented to the public.	23-01-01	Mr. W. de Pinho, Member: Tableview Residents Association (TVRA), Cape Town (Milnerton public meeting).	The issue of alternatives is addressed in the RFSR. Please refer to chapter 6 of the RFSR in this regard.
19.39.	Does licensing include construction, operation and job creation?	26-08-00	Attendant: Pelindaba Open Day.	Yes, excluding job creation.
19.40.	Will the NNR consider the outcome of the EIA before granting a license?	02-09-00	Attendant: Pelindaba open day.	These are separate processes with separate jurisdictions.
19.41.	The rules, process and responsible organisations for the waste process must be clearly defined.	02-09-00	Attendant: Pelindaba open day..	The broad responsibilities for nuclear waste storage, management and disposal are clearly defined in the new Nuclear Energy Act and the Nuclear Regulator Act. There are currently well defined rules and procedures for the disposal of low and intermediate level nuclear waste at the National Radioactive Waste Repository at Vaalputs in the Northern Cape. However further details and regulations concerning all radioactive waste streams await the completion of the National Waste Strategy process. Please refer to chapter 7: Issues no 24, 25, 36 and 37 of the RFSR in this regard.
19.42.	Does licensing have to be renewed for additional activities or additional production?	02-09-00	Attendant: Pelindaba open day.	An activity is licensed once, but the process covers siting, design,

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				commissioning, operation and decommissioning. The licensee must request approval for modification of the plant or procedures, which may be proposed at any time. The NNR can approve or reject these modifications..
19.43.	What are the processes involved in an EIA?	Undated	Anonymous.	Please refer to chapter 2 of the RFSR in this regard.
19.44.	How does the overall approval process work for this process?	Undated	Anonymous.	Please refer to chapter 2 f the RFSR in this regard.
19.45.	The NNR is at fault for allowing only a 30-day period for comment on the licence application.	01-02-01	Attendant: Pelindaba public meeting.	Comment noted. Comment falls outside the ambit of this EIA and should be directed at the NNR..
19.46.	An independent Review Panel for the PBMR will be appointed by the PBMR Inter-Departmental Coordinating Committee to "review the PBMR project on behalf of the government of South Africa". It is recommended that the PBMR Interdepartmental Committee be requested to provide the City of Cape Town with the opportunity to nominate a representative to the Review panel.	18-05-01	Messrs K Wisemand & E Weinronk, Cape Metropolitan Council: Planning, Environment & Housing – Environmental Management.	This request should be directed to the department of Minerals and Energy.
19.47.	We believe that the application for a nuclear license is premature and that the EIA should run its course before the proponents applies for a licence.	22-05-01	Dr. L. Platzky, Deputy Director General: Department of Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town	Comment noted.
19.48.	The separation of transport from manufacture and use is unacceptable. The cumulative impacts must	19-10-01	Mr. M Lakhani, Anti-nuclear Co-ordinator: Earthlife	The fuel manufacture and fuel transport is the subject of a separate EIA. Please also

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	be included in the EIR.		Africa.	refer to chapter 7: Issue number 38 in this regard.
19.49.	No application was lodged with the Department.	12-11-01	Dr. TA Fasheun, Director – Pollution and Waste Management: KwaZulu-Natal Department of Agriculture and Environmental Affairs.	Due to the fact that this EIA crosses provincial boundaries, the application was lodged with the National DEAT.
19.50.	EIA has the purpose of bringing all relevant facts to the table to be considered, to enable government to make an informed decision on any project. In this case, maybe because of the complexity and scope of the project, certain long-term issues cannot be answered. It is either strategic or will be addressed in the EIR. This makes decision making difficult as all relevant information is not available, e.g. long term waste disposal, ecological footprint, cumulative affect of low level radiation, cost of decommissioning, biological magnification, etc. These uncertainties invoke the precautionary principal. Based on this, the consultant is urged to clarify as much as possible of the uncertainties at least to a degree that is sufficient for government to be able to make an informed decision, which is currently definitely not the case. Strategic issues that need to be clarified by somebody else (DME?), (whilst the process go on without these much needed answers/policy) must be fed back into the EIR reports in the same way NNR answers/findings will be fed back into this process. This applies for the testing of the Module as well as the long term operating of the Module	11-10-01	Mr. T Gxaba, Head of Department, DEAT: Free State.	Please refer to chapter 7 of the RFSR, where the aspects to be considered during the EIA are indicated. It is the purpose of the EIA phase to do the various assessments and develop sufficient information on these for informed decision-making.

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19.51.	This should be a strategic environmental assessment and not only EIA.	18-05-01	Messrs K Wiseman and E Weinronk, Cape Metropolitan Council: Department of Planning, Environment and Housing.	Comment noted. It is believed that a strategic environmental assessment would fall in the ambit of the feasibility process, and not the EIA.
19.52.	Will the NNR have the opportunity to update the council on technical planning and safety issues?	18-05-01	Messrs K Wiseman and E Weinronk, Cape Metropolitan Council: Department of Planning, Environment and Housing.	It is recommended that this be directed to the NNR. The NNR would be required to consult with IAPs.
19.53.	WESSA is further concerned that other important issues directly relevant to the proposed development will not, according to the DSR, be considered in this EIA process. For example, transportation of nuclear fuel will apparently not be dealt with, as this will be considered in another EIA. WESSA does not support the piece-meal consideration and authorization of activities directly related to a proposed development. How will these separate EIA processes inform each other?	6 March 2006	WESSA Western Cape Region: Samantha Ralston (Environmentalist)	The issue of fuel manufacture and transport (FM&T) is under consideration by the Minister for Environmental Affairs and was dealt with in the previous EIAs for the PBMR (Eskom) and FM&T (NECSA).

20. POLICY ISSUES AND THE NUCLEAR DEBATE

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20.1.	Nuclear power must be placed within the context of the Integrated Resource Planning Policy (IRPP). "In developing policy on research, development and demonstration, government needs to address the following policy challenges; correcting the skewed allocation of funds towards nuclear energy providing clarity on national energy research strategies, including a focus on priority issues and the involvement of stakeholders clarifying the roles of government, energy suppliers and the private sector in funding research and development.""…energy sources will not become scarce in the short or medium term." "Decisions on the role of nuclear power need to be taken within the context of an integrated resource planning process." "The integrated resource planning approach includes the evaluation of all candidate energy supply and demand resources in an unbiased manner.", "The compulsory use of integrated resource planning methodologies will ensure that utilities avoid or delay electricity supply investments when it is economical to do so, by optimising the utilisation of existing capacity and increasing the efficiency of energy supply and consumption." "…more energy is used per unit of economic output than in many other countries." "Energy policy has not adequately addressed energy conservation." "There is great potential to stimulate energy demand management…..Energy savings would free resources and delay the need for further	20-09-01	Mr. A Murphy, Member: eThekwini ECOPEACE	The policy and regulatory framework is addressed in the RFSR. Please refer to chapter 2 and 4 of the RFSR report.

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	investment.", "It is estimated that greater energy efficiency could save between 10% and 20% of current consumption. Eskom calls energy savings negawatts from a household virtual energy supplier. However households can invest in energy devices such as solar power and if given encouragement such as rates rebates, can become real net energy suppliers. Those households carry the capital costs until their investments repay themselves, with no disadvantage to consumers and an even greater savings in energy consumption. "Although more than 484 000 m2 of solar water heater panels have been installed, this constitutes less than 1% of the potential market." "Follow a no-regrets approach on energy-environment decisions." "The integrated resource planning approach includes the systematic consideration of a full range of economic, environmental, social and technological factors and the consideration of risks and uncertainties posed by different resource portfolios and external factors. "Government policy is to remove distortions and encourage energy prices to be as cost-reflective as possible. To this end prices will increasingly include quantifiable externalities." However the PBMR Scoping Reports state that final disposal of High Level Radioactive Waste is beyond the scope of the EIA. Compare this to a hypothetical case of a non-nuclear industry that produces a hazardous waste for which there is no method for its disposal anywhere in the world yet they expect to operate since they bottle this waste, keep it on site for the plant's 40 year			

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	life time plus another 40 years after that, with no guarantees of whether the company will still exist at that time, no way of knowing who will eventually be responsible for that waste and no way of knowing if there will ever be an acceptable way of disposing of the waste. It is ludicrous to think that this would be allowed; yet this is what the PBMR project entails. "The complete nuclear fuel, nuclear fuel procurement and radioactive waste management will be investigated by the Department." ". . . develop a nuclear waste management policy and programme", "The Department of Minerals and Energy will investigate all aspects of the management of radioactive waste in South Africa and will make recommendations in regard to the safe management and disposal of such waste." This has not yet been done and until it is completed the PBMR EIA is premature, and it is an attempt to circumvent the results of this process. "Improve the governance of the nuclear sector and ensure its integration into broader energy planning." "Whether new nuclear capacity will be an option will depend on the environmental and economic merits of various alternative energy sources relative to nuclear and its political and public acceptability." However the PBMR Scoping Reports state that comparisons with alternate energy sources are beyond the scope of the EIA. "In the light of the decisions that have to be taken with respect to future electricity demand, the debate about moth-balled power stations, existing power stations, Koeberg, non-utility generation and import			

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	of electricity will have to be formulised and completed." Again this is still outstanding. "Research has indicated that a technical potential of as much as 6 000 MW of non-utility generation could be exploited." "There is currently a national lack of renewable energy data, and information on renewable energy system applications, system specifications, system standards, installation and performance guides, technical and economic characteristics and many other related issues." "Government will provide support for the development, demonstration and implementation of renewable energy sources for both small and large-scale applications." "Government policy on renewable energy is concerned with meeting the following challenges; ensuring that economically feasible technologies and applications are implemented, ensuring that an equitable level of national resources is invested in renewable technologies given their potential and compared to investments in other energy supply options, and addressing constraints on the development of renewable industry." "Facilitate the monitoring, evaluation and demonstration of clean energy technologies." "Establish suitable renewable energy information, statistic and data base systems." "1997 - 179 450GWh electricity used (96% from Eskom)" - i.e. less than 20,00 MW on average "1997 - max demand 28 330 MW			

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	Where are the preliminary results of research and development studies that show that the assumptions and modelling of some of these options should be validated through a demonstration or pilot plant ? This is intended to assess their long-term technical, operational, environmental and socio-economic aspects. However the long-term technical, operational, environmental and socio-economic aspect of the High Level Radioactive Waste generated by a PBMR is ignored. Technologies are selected for evaluation within the framework of the White Paper on Energy. However the White Paper says there is a skewed bias towards Nuclear energy away from renewable sources and that Nuclear energy needs to be reviewed within a framework that includes full life-cycle costing of fuels and waste, and that this economic framework must be compared to renewable sources. Eskom and the Government are therefore legitimate to evaluate the PBMR technology as a future source of electricity for the country. However, it is not legitimate to ignore the emphasis and virtual subsidisation of the Nuclear industry, nor to ignore High Level Radioactive Waste disposal, nor ignore the economies of renewable sources. In light of the above the `no-go' option was not considered during this Scoping process. However, in light of what has been ignored in the White Paper, if High Level Radioactive Waste disposal is included and unbiased economies compared with renewable sources then the Nuclear option will be a no-go. Decisions on the role of Nuclear power need to be			

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	taken within the context of an integrated resource planning process. What is the present status of this integrated resource planning process? What is the present status of the National Integrated Energy Policy? The further investigation of technological alternative was therefore excluded from this Scoping. However the integrated resource planning approach requires a great deal of data and analysis to implement and the systematic consideration of a full range of economic, environmental, social and technological factors. Why should the public tolerate these contradictions? Why is the Energy White Paper being manipulated and used selectively to further entrench the skewed support of Nuclear Power? Medium term policy priorities utilise integrated resource planning methodologies to evaluate future energy supply options and also support the introduction of other primary energy carriers as appropriate. However, the Nuclear option is clearly not appropriate at this time. National policy on disposal of Radioactive Waste is presently being established by the Department of Mineral and Energy Affairs. What is the present status of this process? When is it expected to be completed? How can the public participate in this policy development? Once this policy is available and implemented it will inform the frame within which the final disposal and management of High Level Waste(s) from the PBMR are performed. So until this policy is available it is not possible to have full costing of the proposed full-scale			

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	Nuclear Reactor, and so a full EIA is not possible. Until this policy is available it is not possible to know if there will ever be a frame for the final disposal and management of High Level Waste(s). Until then, it is unconstitutional to produce those High Level Radioactive Wastes, since that uncertainty forms a violation of our environmental rights. If the Nuclear industry is sincere in showing its capabilities in dealing with procedures of High Level Radioactive Waste disposal they will decommission the existing Koeberg and Safari Reactors to develop the information necessary concerning these untested methodologies. <u>The reasonable conclusions that may be drawn from the information above are that:</u> Eskom appears to apply conscious effort to fulfil the imperatives of the Energy Policy. This is blatantly untrue. From the Energy Policy it is clearly imperative that the skew towards Nuclear Power be addressed, that High Level Radioactive Waste disposal be addressed, and that equitable comparisons be made with renewable energy sources. Eskom appears to apply conscious effort to avoid these imperatives of the Energy Policy. The application of energy technologies which are new to South Africa need to be taken through a demonstration phase, to provide the figures for analysis within the context of IRPP and Eskom's ISEP. However Eskom's ISEP options will not form part of the EIA study. Again the Scoping Reports attempt to remove the proposed full-scale Nuclear Reactor from its context of an integrated resource planning			

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	program, even though they claim the opposite.			
20.2.	There is a need to find the central themes in the nuclear debate.	19-03-02	Attendant at the Focus Group Meeting with Prof. Lloyd and Messrs Longden-Thurgood and Walmsley.	Suggestion noted. The pro or anti nuclear debate does not fall with the ambit of this EIA.
20.3.	How can a "policy" decide after 40 years whether spent nuclear fuel is not hazardous any more?	16-02-01	Ms. B. M. Blignaut, Secretary: Green Belt Action Group, Roodepoort.	The policy and regulatory aspects are addressed in the RFSR. Please refer to chapter 2 of the RFSR in this regard.
20.4.	COSATU is backing the Organisation for African Unity in a decision that Africa should be nuclear-free. How would this impact the project?	30-01-01	Mr. A. Murphy, Member: e eThekwini ECOPEACE, Durban. (Durban public meeting).	This resolution of the OAU only refers to nuclear weapons.
20.5.	How would the decommissioning phase in 40 years be regulated and to whom is the National Nuclear Regulator accountable?	26-08-00 23-01-01	Attendant: Pelindaba Open Day. Representative of the Habitat Council and the Environmental Ethics Forum (Milnerton public meeting.	After shutdown, the spent fuel from perhaps 40 years of operation could remain in the building for several decades before ultimate disposal. Potentially, the 26 metre high building, with its non-radioactive components removed, will remain for that period. Thereafter, any radioactive components will be handled in terms of government policy, which is currently being formulated. The NNR is accountable to DME. The NNR will play a key role in determining and overseeing the decommissioning process.
20.6.	What is the general radioactive waste management plan?	28-09-00	Representative of the Department of Community	Radioactive waste management aspects will be addressed during the EIA phase.

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			Health, University of Cape Town (UCT).	Please refer to chapter 7 of the RFSR: issues number 24 and 25.
20.7.	What will happen to the nuclear waste and will the nuclear waste be returned to South Africa if PBMRs were sold to other countries?	06-02-01	Ms. B. M. Blignaut, Secretary: Green Belt Action Group, Roodepoort.	Radioactive waste management aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 24.
20.8.	What methods could be used to prevent Government from going back on their word and changing policy regarding radioactive waste?	14-03-02	Ms. M Wentzel, Chairperson: Sustainable Energy Society of Southern Africa (SESSA).	Government is bound by the provisions of the National Environmental Management Act, 1998.
20.9.	The question of energy alternatives/technologies may best be addressed within a Strategic Environmental Assessment (SEA) within the context of the IRPP. A SEA should be conducted prior to construction.	20-09-01 01-10-01	Mr. A Murphy, Member: eThekwini ECOPEACE. Mr. M Lakhani, Anti-nuclear Co-ordinator: Earthlife Africa.	Suggestion noted.
20.10.	It is disputed that the final deposition and management of high-level radioactive waste is beyond the scope of the EIA. IAPs need to be informed as to exactly what progress has been made with regard to identifying a site for the repository for the final safe storage of high-level radioactive waste and guarantees need to be given in terms of when such a facility will be operational. It is crucial to identify a repository PRIOR to establishing the PBMR at Koeberg.	1910-01	Clr B Watkyns, Executive Councillor: Planning and Environment, Cape Metropolitan Council.	Radioactive waste management aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issue number 24 and 25.
20.11.	Because the existing Koeberg reactors were developed in the 1970's, during a period of restricted political debate, a broad-based thorough public participation process is essential.	22-05-01	Dr. L. Platzky, Deputy Director General: Department of Economic Affairs, Agriculture and	Concern noted. However, the pro or anti nuclear debate does not fall with the ambit of this EIA.

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	While the industrialised nations have intensely debated the pros and cons of nuclear power over the last three decades, south Africa has only recently entered the democratic era, which allows, even encourages, such vigorous interaction between technical experts, environmentalists, planners, economists and the public at large. To state the point clearly, there has been no real "anti-nuclear" lobby in this country, but there is a strong nuclear capacity inherited from former state-supported entities, such as Denel and Eskom. The Koeberg Nuclear Power Station (NPS) was built in an age of secrecy, very close to a major SA city and it is now proposed to develop a demonstration PBMR, which would extend the life of Koeberg, without a full policy reassessment on the desirability or otherwise of generating nuclear power in South Africa. (I.e. there is a need for a policy reassessment on the desirability of nuclear.)		Tourism, Western Cape, Cape Town	
20.12.	A policy void on alternatives exists, particularly with respect to renewable energy sources. While it must be said that the Department of Minerals and Energy is responsible for providing a more rigorous policy document on this subject – an "Integrated energy Plan" is required.	22-05-01	Dr. L. Platzky, Deputy Director General: Department of Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town	Suggestion noted.
20.13.	Koeberg as the PBMR site, being in close proximity to a major city, the original decision to build a NPS at Koeberg is questioned. To lengthen the life of Koeberg, through the PBMR, without a thorough review of the nuclear power industry is unacceptable.	22-05-01	Dr. L. Platzky, Deputy Director General: Department of Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town	Concern noted. Impacts on spatial planning will be assessed in the EIA phase.
20.14.	The objective of sustainable development should be	17-10-01	Mr. D Louw, Director,	Sustainable development is one of the

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	used as a policy directive during these processes.		Department of Health – Western Cape.	NEMA cornerstones.
20.15.	WESSA calls for social and environmental costs and benefits to be foremost in decisions taken about South Africa's energy strategy.	Feb 01-01	Mr. K Cooper, Director: Conservation. Wildlife and Environment Society of South Africa.	Viewpoint noted. Decisions regarding South Africa's energy strategy fall outside the ambit of this EIA.
20.16.	Why is Eskom moving against the global trend to phase out nuclear power?	29-03-01	Mr. P. and Mrs. E. Kruger.	The nuclear debate falls outside the scope of this EIA.
20.17.	Does South Africa really need a nuclear energy source given the global political environment vis-à-vis renewable energy options? And closer to home: – how to meet the current and future energy demands?	17-05-01	Mr. G. Mpufane, Environmental Officer, National Union of Mineworkers (NUM), Johannesburg.	The nuclear debate falls outside the scope of this EIA. The aspect of where nuclear fits into the suite of generation options is addressed in the RFSR. Please refer to sections 4.2 and 4.3 of the RFSR report.
20.18.	Nuclear Power generation has a host of hidden costs that are not included on the operators' balance sheets. The costs should include the cost of environmental damage and human health effects from routine emissions, the effect on human and society following an accident and also long-term problems associated with nuclear waste and decommissioning of the nuclear facility.	March 01	Messrs R Sherman and R Worthington, Earthlife Africa.	Comment noted. The pro or anti nuclear debate falls outside the scope of this EIA.
20.19.	Does the performance and cost of Koeberg power suggest that South Africa should even consider another nuclear plant and especially one of pioneering design?	12-02-01	Mr. A. Sztab, Managing Director: Foundation of Freedom, Johannesburg.	This aspect falls outside the scope of the EIA. However, the PBMR is not a new technology, but an innovative combination of existing technologies to demonstrate the techno-economic and commercial applicability of the PBMR

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				DPP
20.20.	There is a need to find the central themes in the nuclear debate.	19-03-02	Attendant at the Focus Group Meeting with Prof. Lloyd and Messrs Longden-Thurgood and Walmsley.	Suggestion noted. The pro or anti nuclear debate does not fall with the ambit of this EIA.
20.21.	How can a "policy" decide after 40 years whether spent nuclear fuel is not hazardous any more?	16-02-01	Ms. B. M. Blignaut, Secretary: Green Belt Action Group, Hoodsport.	Policy describes guidelines on management of waste and does not define the hazard.
20.22.	COSATU is backing the Organisation for African Unity in a decision that Africa should be nuclear-free. How would this impact the project?	30-01-01	Mr. A. Murphy, Member: e eThekwini ECOPEACE, Durban. (Durban public meeting).	This resolution of the OAU only refers to nuclear weapons.
20.23.	The EIA must address the urgent need for radioactive waste policies.	28-09-00	Prof. B. de Villiers, University of Stellenbosch.	Outside the scope of this project.
20.24.	What is the general radioactive waste management plan?	28-09-00	Representative of the Department of Community Health, University of Cape Town (UCT).	Radioactive waste management aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24 and 25.
20.25.	What will happen to the nuclear waste and will the nuclear waste be returned to South Africa if PBMRs were sold to other countries?	06-02-01	Ms. B. M. Blignaut, Secretary: Green Belt Action Group, Roodepoort.	Radioactive waste management aspects will be addressed during the EIA phase. Please refer to chapter 7 of the RFSR: issues number 24 and 25.

21. GENERAL

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21.1.	How soon will the construction of the PBMR start?	19-09-00	Mr. R. van der Toorn, Mr. P.M. Jewell, Ms. W. van Schalkwyk (Member: Koeberg Policing Forum), Ms. L. Nolte, Ms. D. Moore, Ms. V.A. Jewell, Sgt. J.T. Grobbelaar (SAPS) Duynefontein Community Policing Forum (Duynefontein).	A construction licence is expected to be granted (by the NNR) in 2008 which would result in plant operation
21.2.	Not many people are complaining about the PBMR, as they are more concerned about having electricity than where it comes from.	19-09-00	Mr. S. Law, Director: Environmental Monitoring Group (EMG), Cape Town.	Comment noted
21.3.	What happens to the PBMR module once the demonstration need is fulfilled?	29-09-00	Mr. M. Botha, Conservational Officer: Botanical Society of South Africa, [Kirstenbosch) Cape Town.	Based on the results from the demonstration module, the PBMR DPP will either be commercialised or decommissioned.
21.4.	Is the public, who harbours genuine fear, expected to take a giant leap of faith on the efficacy of nuclear power? Historical experience of nuclear energy mitigates against that's.	17-05-01 02-10-00	Mr. G. Mpufane, Environmental Officer: National Union of Mineworkers (NUM), Johannesburg. Afrikaanse Handelsinstituut, Bellville, Cape Town.	The aspect of risk and risk perception will be addressed in the EIA phase. Please refer to chapter 7 of the RFSR: issue number 1.
21.5.	What happened at Chernobyl?	02-09-00	Attendant: Pelindaba open day.	In 1986, about half of the USSR's power reactors were of the type referred to as RBMK. Chernobyl Unit 4 was to be shut

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				down for refuelling at the end of its first year of operation. The operators were instructed to perform an experiment to test new equipment designed, ironically, to improve the safety of the plant. The experiment was to be performed with the reactor power at about one third of full power. The operators made a mistake and allowed the power to drop to almost zero. Then, in urgent efforts to raise the power level back to one third, they deliberately disobeyed basic safety rules. Unfortunately, the RBMK system was unstable and difficult to control at low power levels. The control rod design was also unsatisfactory. These facts were known to the designers and to the Soviet nuclear hierarchy, but improvements had not yet been implemented at Chernobyl. In the final seconds of the accident, the reactor power suddenly and uncontrollably rose, tubes containing the fuel and coolant water burst, and water poured onto the red-hot graphite moderator, causing a steam explosion which destroyed the reactor. The reactor core was exposed to the atmosphere and burned for ten days, releasing most of the gaseous and volatile fission products. Two operators died in the accident; 28 others (mainly firemen) received fatal

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				doses of radiation. A third individual suffered a heart attack. The local population, of whom about 135 000 were somewhat tardily evacuated, were exposed to varying degrees of radiation. Several children have since died of thyroid cancer due to inhaling or ingesting radioactive iodine. Despite claims to the contrary, the most authoritative investigations indicate that no further cancer or leukaemia deaths will be statistically observable. By far the greatest health problem is psychosomatic. Tens of thousands of people now believe themselves to be sick or likely to become sick and are therefore incapacitated in varying degrees. An area in a radius of roughly 30 km around the station remains unfit for habitation or cultivation. The accident was ascribed at the post-mortem conference four months after the accident, to a breakdown of safety culture throughout the Soviet nuclear industry.
21.6.	Can what happened at Chernobyl, happen here?	02-09-00	Attendant: Pelindaba open day.	Chernobyl was the worst conceivable nuclear accident. It was due to reckless operation compounded by unacceptably bad design and ill-directed management, a situation considered inconceivable with the design and controls implemented in the

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				West - and physically impossible with the PBMR.
21.7.	Is the aim of the PBMR to stabilise the current grid?	10-08-00	Mr. M. A. Ranoszek, General Manager: Pioneer Natural Resources of South Africa, Cape Town.	No. The Aim of the PBMR is to demonstrate the techno-economic viability and commercial applicability of the PBMR DPP technology.
21.8.	Quality control is very important.	28-09-00	Prof. B. de Villiers, University of Stellenbosch.	Comment noted. This aspect forms a core component of the NNR licensing process.
21.9.	Requests current status of the EIA for PBMR sites in South Africa.	24-05-01	Mr. J. Sole.	There are no other PBMR EIA process currently being undertaken, apart from the PBMR DPP
21.10.	Long-term research needs to be done on the demand and supply side of electricity use.	Undated	Anonymous.	Comment noted. This research requirement falls outside the scope of this EIA.
21.11.	How is South Africa going to control this technology if it is exported to countries that would abuse it?	30-01-01	Mr. A. Tregenna, IAP (Durban public meeting).	This comment does not fall within the scope of this EIA.
21.12.	Do we really want the PBMR technology in South Africa?	27-09-00	Dr. L. Platzky, Deputy Director-General, Department of Economic Affairs, Agriculture and Tourism, Western Cape, Cape Town.	Please refer to section 4.3 and 4.3.7 of the RFSR.
21.13.	Are more PBMR sites to be built?	26-08-00	Attendant: Pelindaba Open Day.	If the demonstration plant is successful and government approves commercialisation, then further sites could be identified. With the maximum demand in South Africa forecast to

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				increase at a rate of approximately 1 000 MW per annum, more capacity will be needed. This could be from nuclear or other options.
21.14.	The electricity capacity is decreasing due to Eskom not installing new coal fire power stations. This problem, could be solved if Eskom commissioned new coal fire powered stations.	01-02-01	Mr. A. Holm, Member: Hartbeespoort Erfenis en Omgewingsvereniging, Hartbeespoort. (Pelindaba public meeting).	Comment noted. Eskom is currently in a process of decommissioning moth balled coal fired power stations and commissioning new coal fired power stations.
21.15.	What is the relationship between the current Koeberg reactor and the PBMR?	23-08-00	Cape Metropolitan Council (CMC), Cape Town.	Pressurised water reactor where water absorbs heat in the reactor using steam to drive the power turbine. The PBMR uses helium to absorb heat in the reactor, produced by nuclear fission, to drive a helium power turbine. At the Koeberg reactors, the fuel has a metallic cladding, while in the PBMR the fuel cladding is ceramic. Koeberg has a core power density of about 130 MW per cubic metre, while PBMR has a power density of 4 MW per cubic metre. Koeberg employs engineered safety systems to protect the fuel from degrading under accident conditions. The PBMR's safety characteristics are in the physical design. This obviates the need for supplementary systems, thus reducing the cost per MW.
21.16.	The current nuclear waste from Koeberg should not	17-05-01	Mr. G. Mpufane, Environmental Officer:	Comment Noted.

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	be sold to other poorer countries in the continent.		National Union of Mineworkers (NUM), Johannesburg.	
21.17.	Social, environmental and economic benefits of fossil fuels outweigh that of nuclear power.	17-10-00	Ms. R. Adatia, IAP, Johannesburg.	Comment noted. It is not the purpose of this EIA to do a comparison between the environmental and economic benefits of coal vs. nuclear.
21.18.	How long will it take before the feasibility of the project has been determined?	23-08-00	Messrs. J. Minnie, G. Laskey, F. Schlaphoff, Disaster and Emergency Services: Cape Town. H. Linde, Pollution Control: Cape Metropolitan Council (CMC). Mr. H. Schrader, Municipal Health Services, Cape Metropolitan Council (CMC). Messrs. Z. Toefy, S. Granger and Ms. E. Weinronk; K. Pavers, Environmental Management Department: Cape Metropolitan Council (CMC). Mr. K. Hennessy, Spatial Planning: Cape Metropolitan Council (CMC). Mr. P. Tomalin, Cape Metropolitan Council	This aspect will be addressed duing the EIR. Please refer to secion 7.3.8.

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			(CMC).	
21.19.	WESSA calls for social and environmental costs and benefits to be foremost in decisions taken about South Africa's energy strategy.	Feb 01	Mr. K Cooper, Director: Conservation. Wildlife and Environment Society of South Africa.	Comment noted.
21.20.	EA (Ms. D Fisher) requested that all technical information which goes into making overview assumptions be made available to stake holders.	30-09-00	Ms. D Fisher, Earthlife Africa: Johannesburg Branch.	This could be done, except in the case of information relating to commercial and related issues that is considered as commercially confidential. It was agreed that Government would decide in terms of legislation what can be considered as financially confidential, and what can be released for public use.
21.21.	Proposed timeline for the whole process should be available and on the record.	25-09-00	Earthlife Africa: Johannesburg Branch.	The proposed timelines are indicated in the RFSR. Please refer to chapter 2of the RFSR in this regard.
21.22.	Developed countries is moving away from the use of nuclear power and are generally not supportive of the view that nuclear energy is the way to curb climatic change.	March 01	Messrs R Sherman and R Worthington, Earthlife Africa.	Comment noted.
21.23.	The International Atomic Energy Association (IAEA) has an exclusionary definition of what qualifies as radiation-caused illness.	22-05-01	Mr. R Worthington, Branch co-ordinator, Earthlife Africa – Johannesburg.	Comment noted. This exclusionary definition of what qualifies as radiation-caused illness will be considered during the assessment process.
21.24.	Should Eskom not consider the supply of electricity to rural communities on a direct basis rather than off the grid?	9-11-05	Unknown participant	Eskom are considering this option via various renewable technologies as well as the affordability of these technologies.

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21.25.	Is the proposed Uranium mining in Beaufort-West linked to the proposed PBMR project?	17-11-05	Unknown participant	There is no link.
21.26.	Why did Eskom increase the output of the PBMR from 110 MW (e) to 165 MW (e)?	17-11-05		A design change was initiated by PBMR Limited, and resulted from market studies and plant economics in order to fit with broad user categories.
21.27.	How does the current design compare with the previous design, why the changes?	17-11-05	Mr. Moulton	A design change was initiated by PBMR Limited, and resulted from market studies and plant economics in order to fit with broad user categories. Please refer to section 2.6 and 4.7 of the RFSR in this regard.
21.28.	What technology changes took place during the design evolution and what impact will that have on fuel usage?	17-11-05	Mashiule Phalane - ELA	The increase in capacity would lead to a slight increase in fuel usage (see above). Please refer to section 4.7 of the RFSR in this regard.
21.29.	Has any construction of the PBMR been started at Koeberg yet?	9-11-05		No construction activities for the PBMR have been started at Koeberg. Such activity will only start when all of the required authorisations have been obtained
21.30.	How will the PBMR project contribute to science and technology training in the long term, especially regarding support to schools on these subjects?	19-11-05	Unknown participant	Eskom already supports several schools maths and science programmes, including one in Atlantis. The DTI runs a program, PBMR Human Research and Innovation Frontier Program (PHRIFP). The aim of this program is to form 8 university departments in nuclear science, and to

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				provide bursaries.
21.31.	The world history of commercial Light Water Reactors (LWRS) for electricity generation, recorded no deaths, directly or indirectly related to such Plants, over the past 40 years. The worst accident was at Three Mile Island plant and the consequence on human life was zero.	10-11-05	Prof Longden-Thurgood	Comment noted.
21.32.	Understands the need for energy, but energy with least environmental impacts should be used.	15-11-05	Dr. van As	Viewpoint noted.
21.33.	What percentage of the electricity growth shown by T Stott represents large users and what percentage represents residential users?	17-11-05	Mr. Lakane	The split between industrial and domestic is about 80%:20%
21.34.	Were Eskom's mothballed stations subject to EIAs before they were decommissioned?	9-11-05	Unknown participant	Yes. RODs were obtained for Grootvlei and Camden. The Komati ROD was received on 13 December 2005.
21.35.	Are the emissions of the coal stations satisfactorily and conforming to legislation?	9-11-05	Unknown participant	The emissions conform to current legislation.
21.36.	It is possible that if the process is too protracted in SA, that Eskom will place this technology in another country.	17-11-05	Mr. Moulton	In the case of a too protracted process, the danger exists that other players in the field may take over the lead. That could have a marked impact on the potential PBMR market.
21.37.	Such a large sum of money for a test hit – it could be better spend on providing housing, water new roads and a better country to live in, protecting the environment.	14-12-05	Mr. W de Pinho	Comment noted. The social impacts of the proposed PBMR DPP will be assessed in the EIA phase.
21.38.	How long will the RSA coal reserves last?	17-11-05	Mr. Moulton	Base on current consumption the estimate coal reserve is 100 years.

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21.39.	The relationship between this EIA decision making process and the National Nuclear Regulator (NNR) is confusing. WESSA is concerned that project-specific radiological issues are relegated to the NNR. We believe that the public must have an opportunity to review and comment on all relevant information that informs the decision made by DEAT. Naturally radiological issues should be considered in such a decision. Issues considered by the NNR should therefore inform the EIA process.	3-03-06	WESSA Western Cape Region: Samantha Ralston (Environmentalist)	Project specific radiological issues will be evaluated by the NNR to inform the DEAT.
21.40.	Reliance placed in the report on the co-operative agreement between DEAT and the NNR (the co-operative agreement): The reliance placed upon the co-operative agreement between the NNR and DEAT undermines the scoping process and has resulted in an improper DSR. The co-operative agreement and the DSR draw an unjustified and indefensible distinction between "radiological/radiation issues of a generic nature not directly related to the project" (category 1) and "radiological/radiation issues of a generic nature directly related to the project" (category 2), and then provide that the latter category will generally be addressed in the formal "Safety Case" to be submitted by the applicant to the NNR. But the site specific issues lie at the heart of the environmental assessment process which has to be undertaken by DEAT.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The co-operative agreement is a process indicated by DEAT and the NNR and followed by the consultants. Comments on the agreement should be addressed to DEAT and the NNR.
21.41.	Reliance placed in the report on the co-operative agreement between DEAT and the NNR (the co-operative agreement): It is totally unclear what is meant by the assertion that issues in category 2 "will	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape	The co-operative agreement is a process indicated by DEAT and the NNR and followed by the consultants.

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	be 'tracked' within the EIA process"; and that the environmental practitioner will provide "responses to issues" and "answers to issues".		Town)	Comments on the agreement should be addressed to DEAT and the NNR.
21.42.	Reliance placed in the report on the co-operative agreement between DEAT and the NNR (the co-operative agreement): DEAT cannot delegate its decision-making functions to the NNR or, alternatively and in any event, has not purported to do so, so it cannot let the NNR set conditions as part of the EIA process, as the DSR proposes.	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The co-operative agreement is a process indicated by DEAT and the NNR and followed by the consultants. Comments on the agreement should be addressed to DEAT and the NNR.
21.43.	Reliance placed in the report on the co-operative agreement between DEAT and the NNR (the co-operative agreement): The EIA process also cannot be left open-ended yet the DSR and the co-operative agreement envisage precisely this, by saying that if input from the NNR is not available for processing as part of the EIA process, the DEAT will "refer these issues to the NNR process and make all (DEAT) decisions conditional on this process".	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The co-operative agreement is a process indicated by DEAT and the NNR and followed by the consultants. Comments on the agreement should be addressed to DEAT and the NNR.
21.44.	The applicants claim that the PBMR forms a part of a so called "strategic energy mix". However this does not detract from the grave shortcoming of the PBMR, the enormous waste of public funds being poured into a technology that may well be obsolete before it can be proven to be either safe or commercially viable, funded at the expense of our impoverished communities who stand to loose about 15 billion rand on this experiment.	10-03-06	RCH Garbett CT Garbett Wat Props Pty Karee Trust Itumaleng Farm cc Professional Aviation Services (Pty) Ltd	Comment noted. This viewpoint will be considered on the EIA phase.
21.45.	WESSA is concerned with the exclusion of issues as described in Table 6 (page 70) which lists significant issues that, according to the DSR fall outside the	6-03-06	WESSA Western Cape Region: Samantha Ralston (Environmentalist)	<u>Financial viability:</u> One of the purposes of the PBMR DPP is specifically to confirm the financial

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	scope of the EIA for the PBMR DPP. Is the proposed PBMR financially viable as an electricity generating option? What is the environmental impact of uranium mining? What are the implications of the absence of approved procedures/regulations to deal with spent nuclear fuel and how does this relate to the precautionary principle? Should public funds be used to test this technology? Is there a market for future PBMRs? These are all highly pertinent questions, directly related to the need and desirability of the proposed development. We believe that these issues should be explored in this EIA process and that to dismiss them is unjustified.			aspects of the technology as postulated by the PBMR (Pty) Ltd Uranium mining: The PBMR is not linked to any uranium mining locally. The enriched uranium will be imported from international suppliers. Procedures for Spent Fuel: The NNR has specific safety and security standards for the management of spent fuel. Spent fuel at Koeberg is managed in accordance with these standards. Use of public funds: This is a matter for government to decide and falls outside of the ambit of this EIA Market(s) for future PBMRs: On a global scale there is a large market need to replace existing plant that has reached the end of their life as well as to cater for new demand due to growth in economies Should the PBMR confirm all of the postulated characteristics (some of which were mentioned above as criteria for the need of the Plant), then there will definitely be a potential significant market for PBMR technology, both for electricity generation and other commercial applications General: These issues will be addressed in the EIR for the 400 MW (t) PBMR DPP. Please refer

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				to chapter 7 of the RFSR.
21.46.	Products can be developed that will have far greater job creation and export potential, are wholly sustainable and will relieve our planet from unnecessary greenhouse emissions, which as the dirtiest power producer in Africa, we have a duty to mitigate.	2-08-06	C T Garbett R C H Garbett	The socio-economic aspects will be considered in the EIA phase Please refer to chapter 7.3.2
21.47.	Has there been a full assessment of the financial, economic, environment, social and structural amortizing for the stated 40 year period.	17-05-06	Mr. W F M de Pinho	No, not for all those aspects. The businesses case did consider some of the financial implications.
21.48.	Technology and the wasteful use of resources, that could be better spent on our people's needs e.g. a better life, hospitals, homes etc.	17-05-06	Mr. W F M de Pinho	Viewpoint noted.
21.49.	Reliance placed in the report on the co-operative agreement between DEAT and the NNR (the co-operative agreement): IAP's could be denied procedural fairness and a proper opportunity to comment on any input provided by the NNR or any purported decision made by the NNR under guise of the EIA process 7.1 and 7.2	7-03-06	Legal Resources Centre (Cape Town) on behalf of Earthlife Africa (Cape Town)	The co-operative agreement is a process indicated by DEAT and the NNR and followed by the consultants. Comments on the agreement should be addressed to DEAT and the NNR.
21.50.	I know that a study was done by Toens & associates on the water supply in Namaqualand and I would like to see the study.	6-02-06	A W Pienaar M Goedeman A Darlington F Kordom J Kriel F Vries G Beukes I Saloma	We believe this request should be directed to NECSA.

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			C Boyce	
21.51.	Just because the area is sparsely populated does not mean we have less rights thank the rest of South Africa.	6-02-06	A W Pienaar M Goedeman A Darlington F Kordom J Kriel F Vries G Beukes I Saloma C Boyce	Comment noted. The constitution makes the point of equity of rights quite clear
21.52.	I would like an economic impact study of such nuclear on Namaqualand compared to alternatives such as renewable energy.	6-02-06	A W Pienaar M Goedeman A Darlington F Kordom J Kriel F Vries G Beukes I Saloma C Boyce	We assume this refers to the nuclear waste depository at Vaalputs. This aspect falls within the NECSA mandate.
21.53.	I hear that the Government is planning to expand its nuclear programme and know that I have not been asked if I agree or not.	6-02-06	A W Pienaar M Goedeman A Darlington F Kordom J Kriel F Vries G Beukes	There will be separate EIA processes for any new nuclear infrastructure.

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8.8 APPENDIX 8: DOCUMENTATION FROM LRC

8.8.1 LRC SUBMISSION ON THE DSR

LRC
LEGAL RESOURCES CENTRE
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LEGAL COMPLIANCE ANALYSIS

OF THE

DRAFT ENVIRONMENTAL SCOPING REPORT (DSR)

FOR A

PROPOSED 400 MW(T) PEBBLE BED MODULAR REACTOR DEMONSTRATION POWER PLANT (PBMR DPP)

(Rev 1 Jan 2006)
AT THE

KOEBERG POWER STATION SITE

Submitted by:

THE LEGAL RESOURCES CENTRE

(CAPE TOWN) On behalf of:

EARTHLIFE AFRICA (CAPE TOWN)

7 March 2006

1. INTRODUCTION

This submission is made on behalf of Earthlife Africa (Cape Town) (Earthlife).

The draft scoping report (the DSR) for the proposed 400MW(t) Pebble Bed Modular Reactor Demonstration Power Plant (PBMR DPP) is fundamentally flawed in a number of respects, as set out further below.

Unless the report and the processes it envisages are materially reconsidered and restructured, any resultant RFSR (and environmental impact assessment (EIA) which may follow) will be defective in terms of the applicable legislation. We note in this regard that the report is often vague and uncertain in meaning[1], and that the timing of important decisions is left open. This renders the report and the processes set out therein procedurally unfair to Earthlife and other interested and affected parties (IAPs).

In Limine

The current relevance of the court orders made in Earthlife Africa (Cape Town) v Director-General: Department of Environmental Affairs & Tourism & another, 26 January 2005 (the earlier case)

It is noted with concern that the applicant seems to take the approach that certain issues that were considered during the EIA for the 302MW(t) PBMR do not need not be considered in the current scoping process for the proposed 400 MW(t) PBMR DPP because these issues had been considered during the earlier EIA, or alternatively that some issues assessed under the previous EIA do not need to be reassessed in the current EIA.

For example, the applicant states at p7 of the DSR that:

'The change in output of the PBMR DPP from 302MW(t) to 400MW(t) required a new EIA application. This includes both a scoping phase and an EIA phase (including public participation). <u>This has taken con gnisance of appropriate</u> <u>assessments and results generated during the previous EIA and recoded in the</u> <u>environmental impact report (EIR) that are still valid in the contect of the</u> <u>proposed 400MW(t) DPP. Therefore, not all the required assessments/studies</u> <u>will be repeated.'</u>[2] (emphasis added)

Furthmore, the applicant states at p68 of the DSR that:

> *'A number of issues for consideration were identified through the EIA processes for both the 302MW(t) PBMR DPP (undertaken in 2001 and 2002) and the 400MW(t) PBMR DPP (current process). From the evaluation of these issues, recommendations are made regarding further detailed studies that are required to be undertaken in the environmental impact assessment phase."*

The applicant sets out issues identified as potentially having a detrimental impact on the environment on pages 70 to 88 of the DSR. For some of these issues, the applicant refers to studies or assessments that were conducted during the EIA for the 302MW(t) PBMR DPP, and reaches the following conclusion in respect of a number of these issues:

> *'No further assessment required.'*[3]

In addition, the applicant points out in respect of social aspects that 'the conclusions of the 302MW(t) PBMR DPP are regarded as valid for the 400MW(t) PBMR DPP and no further

1 See for example para 8. 2 below

2 Page 7 DSR.

3 For examples, see pages 86 and 87 of the DSR.

assessment will be required.'[4] A similar approach is taken in respect of economic aspects, in respect of which it is stated that 'Vecon Economic and Development Consultants assessed the validity of the conclusions for the 302MW(t) PBMR DPP and conclude that the findings remain valid'.[5]

We submit that the applicant's approach is erroneous and bad in law. It is an established principle of administrative law that, where a fresh application is made to a decision-maker, the decision-maker cannot rely on decisions it made in some earlier application dealing with the same or a related subject-matter. This principle also has an important procedural dimension because interested and affected parties ('I & APs') must be given a proper opportunity to participate in the fresh application. Even if it could be argued that some matter in issue in the fresh application was the same as one assessed or decided as part of the earlier application, then fresh evidence or fresh perspectives may be adduced on that issue in the course of the fresh application. The scoping report should provide for this but fails to do so.

The court set aside the decision of the Director-General (DG) of the Department of Environmental Affairs and Tourism (DEAT) to grant the application for authorisation to construct the 302 MW(t) PMBR DPP. That court order provided and envisaged that Earthlife (and other IAPs) would be afforded an opportunity to make representations on the final Environmental Impact Report ('EIR') before the DG would decide anew on whether to authorise or refuse the application to construct the 302 MW(t) PBMR DPP. To this end the court envisaged that Earthlife and other IAPs could be afforded an opportunity to make representations on the final EIR without the entire EIA for the 302 MW(t) PBMR DPP having to commence *de novo.*

The DG, however, did not call for representations to be made, and the applicant has subsequently abandoned the application to construct a 302MW(t) DPP.

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4 Page 88 of the DSR.

5 Ibid.

Furthermore, the applicant has pursued a new and different application for authorisation, namely for approval to construct a 400 MW(t) PBMR DPP. This is clear from the DSR, wherein it is stated that:

> *'The legal opinion submitted to the parties indicated that the applicant, Eskom, should submit a new application for an environmental impact assessment for the evolved design.'*[6] (emphasis added)
>
> and
>
> *'The change in output of the PBMR DPP from 302MW(t) to 400MW(t) required a new EIA application. This includes both a scoping phase and an EIA phase (including public participation).* '[7](emphasis added)

In our view, the applicant had no choice but to make a new application given the change in the subject matter of two applications.

The extract from the judgment quoted at page 2 of the DSR (namely that the DG's decision was to be set aside as flawed but should not result in the whole process having to commence afresh) applies only to the EIA for the 302 MW(t) PBMR DPP.

We submit that the applicant cannot lawfully rely on any reports or assessments conducted during the EIA for the 302MW(t) PBMR DPP in support of its new and legally distinct application for authorization to construct a 400 MW(t) PBMR DPP. Any and all such reports must be updated and included in the EIR for the 400 MW(t) PBMR DPP, and IAPs must have a full opportunity to comment and make representations on these reports. Failure to do so will render the current EIA irregular and procedurally unfair, and any decision on scoping or on authorization would fall to be set aside on review.

[6] Page 2 of the DSR.

2. IDENTITY OF THE APPLICANT

The current Applicant, Eskom Holdings Limited (Eskom), is not the proper or correct applicant. We say so because, on the information available, it is PBMR (Pty) Limited that owns the technology and intends to construct the PBMR DPP. According to the Detailed Feasibility Report (DFR) made available during the previous EIA, Eskom's purchasing of the PBMR DPP from PBMR (Pty) Limited is <u>conditional</u> upon it being <u>successfully</u> commissioned (p32 of the DFR). In our view, until such time as Eskom decides to purchase the PBMR DPP, it is PBMR (Pty) Limited that will be the owner of the PBMR DPP and would be the correct applicant for authorisation.

If PBMR (Pty) Limited is not the applicant, the following difficult questions arise:

- How can any conditions of an authorisation granted to Eskom be enforced against PBMR (Pty) Limited in the period prior to successful commissioning i.e. before Eskom purchases the PBMR DPP from PBMR (Pty) Limited?
- If Eskom is authorised to build the PBMR subject to conditions, who will be responsible for complying with these conditions in the event that commissioning of the PBMR DPP is not successful and if Eskom declines to purchase it? For example, who will be responsible for decommissioning the unsuccessful plant?

We submit that the correct identity of the applicant and its capacities are material issues. The applicant has to fulfil any conditions set as part of the environmental assessment process. The responsibilities of a particular applicant are recognised in the White Paper on Energy Policy (the White Paper) which states (at p 68) that in respect of nuclear installations:

[7] Page 7 DSR.

"the potential exists for acute exposures and catastrophic accidents and therefore require a *special liability regime with compulsory financial security* (and) sophisticated safety assessment to ensure that the risk is engineered to acceptably low levels…" *(emphasis added)*

We point out that the Environment Conservation Act[8] (ECA) makes no provision for the transfer of EIA authorisations from one proponent of an activity to another. In addition, in terms of section 25 of the National Nuclear Regulator Act, nuclear authorisations are not transferable. It is therefore not possible for Eskom to transfer its authorisation to PBMR (Pty) Limited pending its conditional purchasing of the PBMR DPP.

3. FAILURE TO PROPERLY CONSIDER THE "NO-GO" OPTION

No application has been made under Section 28A of the ECA for exemption from the requirement to consider the 'no-go' option.[9]

Notwithstanding this, the applicant states in the DSR that:

> *'…the no-go option was not considered during the scoping process, as the no-go option would imply that the technology will be lost from the suite of actions included in the White Paper on Energy'*

We submit that this approach is wrong. The White Paper on Energy ('the White Paper') is a policy document and it cannot lawfully change the scope of legislation or obviate enquiries to be made or decisions that have to be taken in terms of legislation. Moreover, and importantly, the White Paper in any event does not seek or purport to do that in respect of

[8] 73 of 1989.

[9] The application for authorisation does refer to an application for exemption under s 28A of the ECA in respect of energy/technology alternatives and site alternatives. However, Earthlife has been informed that this application has been withdrawn. We comment in detail on these isues in paragraph 7 below.

the "no-go" option. In short, the White Paper offers no support for excluding consideration of the "no-go" option in respect of PBMR DPP, as the DSR does.

In amplification of our contention that the the applicant's approach is wrong, we point out the following:

- The exclusion of the "no-go" option seeks to improperly limited the range of relevant matters to be considered and to in effect fetter the discretion expressly afforded to the decision maker to refuse to authorise the proposed activity under section 21(3) of the ECA.
- Section 24(4)(c) of the NEMA requires that procedures for the investigation, assessment and communication of the potential impact of activities must ensure, as a minimum, with respect to every application for an environmental authorization, the investigation of mitigation measures to keep adverse impacts to a minimum, as well as the option of not implementing the activity.
- The White Paper on Energy states that it would not be prudent to exclude nuclear energy as a supply option. The policy suggests the evaluation of all candidate energy supply and demand resources in an unbiased fashion but, importantly, does not seek to prescribe the construction of demonstration plants for specific options, let alone the specific technology of the PBMR.
- The White Paper instead refers to the need to utilize *integrated resources planning (IRP) methodologies*[10] to evaluate future energy supply options, and these are described as methodologies for decision making which are concerned with the acquisition of least cost energy resources[11], taking into account the need to maintain adequate, reliable, safe and environmentally sound energy services for all customers. The IRP approach includes:

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10 Paragraph 7.1.5.6 of the White Paper. This paragraph also refers to the fact that government will establish guidelines for the IRP approach through new energy legislation and regulations will require the National Electricity Regulator to oversee implementation

11 id

(1) *the evaluation of all candidate energy supply and demand resources in an unbiased manner;*

(2) *the systemic consideration of a full range of economic environmental social and technological factors;*

(3) *the consideration of risks and uncertainties posed by different resource portfolios and external factors, and external factors such as the fluctuations in fuel prices in economic conditions; and*

(4) *the facilitation of public consultation in the utility planning process.*

It is clear therefore that while there is some merit in the assertion that all candidate energy supply and demand resources will be evaluated, the the nature of that evaluation is not spelt out. Construction of a demonstration PBMR DPP is not mandated. Since the decision making process is concerned with the acquisition of least cost energy resources this suggests that prior to actually testing technology the least cost approach would need to be applied. It is submitted that this approach would curtail the future development of the PBMR in light of its high costs relative to other technologies[12].

- The fact that the proposed activity is for a demonstration PBMR is not a valid reason for excluding the ‘no go’ option. Neither the ECA nor the EIA regulations contemplate excluding the ‘no-go option’ from consideration. To do so would defeat the entire object of having to apply for authorisation to undertake an activity identified under GN R1182.
- The Applicant’s suggestion that comparisons will be made with other technologies should the PBMR DPP prove viable does not satisfy legal requirements. The EIA regulations require that all identified alternatives be described in the Scoping Report. Feasible alternatives must then be described in the Plan of Study for impact

12 See *The Economic Impact of the Proposed Demonstration Plant for the PBMR* by Steve Thomas – Annexure A hereto para 1.2.3

assessment phase.[13] The EIR must then include a description of each alternative and a comparative assessment of each alternative.[14]

In the circumstances, it is submitted that the relevant authority must exercise the powers granted to it in regulation 6(2) of the EIA Regulations[15] and request the applicant to amend the Draft Scoping Report by listing all alternatives identified, including the 'no-go' option. Should the relevant authority fail to do so, any decision under regulation 6(3)(a) or (b) will fall to be set-aside on judicial review.

4. FAILURE TO ESTABLISH NEED

The DSR fails to require that the EIA establish that there is indeed a legitimate need for the construction of a the PBMR DPP.

We note that the applicant contends that the PBMR DPP is required in order to validate the assumptions and modeling of some of the supply side power generation technology options, and to assess technical, operational and socio-economic aspects (see page 5 of the DSR).

We submit that the applicant has failed to specify what technical aspects need to be demonstrated, and that as a consequence the legitimacy of establishing the PBMR DPP for research purposes is not apparent.

The applicant's claim that there is a need for a demonstration module PBMR is disputed. There are alternative energy sources available to meet the country's energy needs (the National Electricity Regulator states that electricity needs for the next 25 years can be met

13 Setion 7(b) of GN R1183.

14 Section 8(a) and (b) of GN R1183.

without new nuclear power)[16]. It is also pointed out that the applicant's rationale is contradictory: it claims that the PBMR design is inherently safe and is based on technology proven elsewhere in the world, but then claims that the demonstration module is required to test its technical feasibility. Nuclear specialists have cast doubt on the economic feasibility of the plant. One critic is Steve Thomas, whose initial report on the PBMR in South Africa is in the public domain but finds no mention in the DSR. Thomas is one of the experts on the Department of Minerals and Energy's International Panel of Experts, who have reviewed the technical and economic feasibility of the proposed PBMR. This review has never been made available to the public, despite a formal application made under the Promotion of Access to Information Act 2 of 2000.

The DME White Paper on Energy Policy defines the timing and constraints for the consideration of future nuclear energy projects in South Africa. In terms of this policy:

- alternatives must be considered before new nuclear power plants are built;
- public acceptance of the technology and potential environmental and socio-economic impacts must be evaluated; and
- any government decision must take place within the context of an integrated energy planning process that includes an investigation of the existing Koeberg Nuclear power plant's economic and technical performance, its long term costs, implications for safety, emergency planning, decommissioning and waste disposal.

However, no alternatives to the PBMR are to be assessed in terms of the DSR. To date public acceptance for the PBMR technology has not been properly evaluated and crucial information has been withheld from the public. Integrated resource planning has to take place. The process required in the Energy Policy is not being followed. In addition, the applicant has failed to adequately specify a legitimate purpose and need for a demonstration module PBMR.

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16 An Integrated Energy Outlook For SA Published by the National Electricity Regulator para 6-8

Chapter 3 of the submission made by Earthlife Africa in respect of the draft EIA for the 302 MW(t) PBMR pointed out that the construction of a demonstration model PBMR will require the expenditure of a considerable amount of public funds, and may also expose taxpayers to future decommissioning and clean-up costs. In addition, the hazardous nature of a nuclear installation means that the building of such a plant will increase the risk of a nuclear accident, while there will be unavoidable adverse impacts on the environment resulting from increased discharges of radioactive material and radioactive waste, and the production of high level radioactive waste. In the case of the current EIA we likewise argue that as a result of the cost, risk and increased environmental impact associated with the establishment of a new nuclear power plant, the scoping report for the EIA should set out a legitimate purpose and need for a new plant. This is required in order to ensure that the decision-maker can properly assess whether the possible benefits of the proposed development outweigh its potential environmental and socio-economic impacts.

5. PLAN OF STUDY FOR SCOPING

It is noted that the Plan of Study for Scoping (POS) purports to limit the discussion of alternatives. We object to the legality of decision-making process flowing from the POS in the light of the fact that no right was afforded to the public to comment on the Plan of Study. Regulation 3(1)(f) of the EIA Regulations[17] stipulates that the applicant is responsible for the public participation process to ensure that all IAPs, including government departments that may have jurisdiction over any aspect of the activity, are given the opportunity to participate in all the relevant procedures contemplated in these regulations.

No opportunity appears to have been afforded to Earthlife or any other IAPs to participate in the POS procedure. This procedure is critical to the EIA given that it has the effect of determining how the subsequent Scoping procedure will be undertaken. For example, the POS includes a description of the proposed method of identifying the environmental issues and alternatives. The environmental issues and all alternatives identified must then be

described in the Scoping Report[18], the precursor to the Plan of Study for EIA and the assessment stage itself.

By failing to afford interested an affected parties an opportunity to participate in the Plan of Study for Scoping procedure, the EIA applicant has failed to comply with the requirements of Regulation 3(1)(f). The applicant has also failed to comply with the requirements of administrative justice as set out in sections 3 and 4 of the PAJA. It has prejudiced interested and affected parties who have been denied an opportunity to participate in important procedures such as that determining how environmental issues and alternatives will be identified. It has also prevented Earthlife and other interested and affected parties from making representations on the proposed POS to the decision for consideration. As a consequence, the EIA process is fatally flawed.

6. FAILURE TO IDENTIFY KEY ISSUES

Regulations 6(b) and (c) of GNR 1183 provide that a Scoping Report must include a brief description of how the environment may be affected and a brief description of environmental issues identified. In addition, under the PAJA, a decision-maker is required (amongst other things) to take relevant considerations into account.

We point out that the DSR does not provide a description of how the environment may be affected by the construction and operation of the proposed PBMR DPP, and the on-site storage of spent nuclear fuels, under abnormal or emergency conditions (as opposed to normal operating conditions).

We submit that key issues that should be described in the DSR include:

[18] Regulation 6(c) and (d) of GN R1183.

- the potential impact of the PBMR DPP on the operation and management of the existing Koeberg Nuclear Power Station in the event of an abnormal or emergency event at the PBMR DPP, and visa versa;
- the potential impact of the PBMR DPP on the environment in the event of a catastrophic incident.

7. FAILURE TO CONSIDER ALTERNATIVES

The EIA regulations[19] require that a Scoping Report must include, amongst other things, a description of all alternatives identified.[20]

The proper identification and assessment of alternatives in an EIA process is a central feature of EIA as it affords the decision-maker with the opportunity to determine whether to authorise the proposed activity, or whether to authorise an alternative (technology and/or site alternative) to the proposed activity, or alternatively to refuse the application altogether (the 'no go' option). This scenario is expressly contemplated in section 21(3) of the ECA, which stipulates that:

> *'The Minister or competent authority… may at his or her discretion refuse or grant the authorisation for the proposed activity or an alternative proposed activity…'*

The Draft Scoping Report appears to identify three categories of alternatives to the proposed PBMR DPP. It then attempts to preclude the further investigation of two of these alternatives (the energy / technology option and the 'no-go' option), and also presents an assessment of the third alternative (site alternatives) as a *fait accompli.*

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19 GN R1183 of 5 September 1997 (as amended).

20 Regulation 6(d) of GN R1183 of 5 September 1997 (as amended).

On the grounds set out below, it is submitted that the relevant authority must exercise the powers granted to it in regulation 6(2) of the EIA Regulations and request the applicant to amend the Draft Scoping Report by listing all alternatives identified, including energy / technology options, the 'no-go' option (dealt with in paragraph 3 above) and site alternatives. The applicant should also be requested by the relevant authority to remove the comparative assessment of site alternatives from the Draft Scoping Report.[21] Should the relevant authority fail to do so, any decision under regulation 6(3)(a) or (b) will fall to be set-aside on judicial review.

(i) Energy and Technology Alternatives

The DSR fails to describe energy and technology alternatives identified during the Scoping phase of the EIA.

Instead, the applicant presents information regarding the energy policy, the DME's integrated energy plan, the NER's national integrated resource plant, and the applicant's own strategic electricity planning process. It is submitted that none of this information is relevant to the DSR, nor does this information justify the applicant's disregard of Regulation 6(d) of the EIA Regulations.

It is noted further that the applicant has made the assumption that other energy and technology alternatives are not relevant to the scope of the entire EIA process for the proposed PBMR DPP. It is stated at page 55 of the DSR under the heading 'Assumptions of the Study' that:

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21 This comparative assessment and the underlying data must be made available to Earthlife and other IAPs for comment during the EIA phase, whereafter the relevant authority will need to consider whether it is satisfied that information from a previous and legally distinct EIA can lawfully be incorporated into a new EIA. We submit that the previous EIA was abandoned, and that the DG became *fun ctus oficio* as a consequence. The current application for authorisation is for a 400 MW(t) PBMR DPP, and the EIA should have commenced *de novo*.

'This report and its investigations are project-specific for a demonstration plant, and consequently the environmental team did not evaluate any other energy or technology alternatives'.

It is submitted that this assumption is ill founded. There is no provision in the ECA or the EIA regulations that empowers an applicant to ignore alternatives because of the 'project specific' nature of an EIA application. In fact, it is submitted that most EIA applications are project specific. For example, if an applicant were to apply for authorisation to construct a medical waste incinerator, does the 'project specific' nature of the application preclude a description of identified technology alternatives (such as autoclaving or sterilisation) in the DSR? The answer is clearly that it does not. The term "project specific" is also improperly manipulated in the DSR, which seeks to hive off "project specific" radiological matters to the NNR.

A brief perusal of Appendix 4 to the DSR (Focus Group Minutes) reveals that energy and technology alternatives were raised during the Scoping process. For example, the following alternatives are identified:

- wind electricity generation;
- solar electricity generation;
- pumped storage generation;
- non-PBMR nuclear technology options.[22]

We submit that other alternatives that should also be described in the Scoping Report include solar thermal chimneys and tidal current (as these have the potential to provide 24-hour energy).

By failing to describe all the alternatives identified, the Applicant has not complied with the mandatory legal requirements of the EIA Regulations.

In the circumstances, it is submitted that the relevant authority must exercise the powers granted to it in regulation 6(2) of the EIA Regulations and request the applicant to amend the Draft Scoping Report by listing all alternatives identified, including energy and technology options. Should the relevant authority fail to do so, any decision under regulation 6(3)(a) or (b) will fall to be set-aside on judicial review.

(ii) Geographical / Location Alternatives

An analysis of the DSR reveals that instead of describing geographical / location alternatives identified during the Scoping phase of the EIA in accordance with the EIA Regulations, the Applicant has improperly sought to pre-determine the issue by including a comparative assessment of alternatives in the DSR. The EIA Regulations clearly stipulate that a comparative assessment of all the alternatives should be reported in the Environmental Impact Report.[23]

To compound the severity of this error, the Applicant also seeks to introduce information and assessment from a previous and legally separate and distinct EIA into the DSR, and inevitably concludes that the alternatives are less desirable than the proposed Koeberg site. It is submitted that the Independent Consultant is not legally competent to incorporate information from a previous and legally distinct EIA and adjudicate it to be 'valid' at the Scoping Phase of an EIA, as discussed in paragraph one above. At the very least such information, including any underlying reports upon which the information relies, should be made available to IAPs for critical comment. Various factors (including the lapse of time between the previous comparative site assessment and the current application; the possibility that new interested and affected parties may wish to comment, changes in site conditions such as the precarious state of the Koeberg reactor and the like) could influence

[22] See page 131 of Draft Scoping Report.

the results of a comparative site assessment undertaken in respect of the new proposed 400 MW(t) PBMR DPP. These results could differ significantly from the results from those of the comparative site assessment undertaken in the EIA for a 302 MW(t) demonstration model PBMR. To preclude interested and affected parties from participating in a comparative assessment or having the opportunity to provide comment on alternatives sites in respect of the proposed 400 MW(t) PBMR DPP would render the current EIA process unfair, and any decision to accept the draft Scoping Report would be subject to be set aside on review.

8. RE PARAGRAPH 5.4

The assertion that all potential environmental impacts have been identified through studies and public participation is misleading wrong and without any foundation. It is possible that further issues will be identified int the process of comment on the DSR which this submission is a part of. There is still a public comment period to follow, and the scoping report should provide for this in respect of potential environmental impacts.

The DSR refers in paragraph 5.4 to a screening process to consider which issues are significant. However a scientific set of criteria and a proper ranking procedure has not been set out in this document. For example there is no justification why the proximity of a nuclear reactor (Koeberg), and an ailing one to boot[24], to the proposed PBMR reactor is not considered a site criterion whereas history and archeology e.g. the existence of significant fish traps is treated as a relevant consideration[25]. The relative importance of the various criteria applied to the assessment of alternatives is not ranked.

23 Regulation 8(b) of GN R1183.

24 There is oblique reference to Koeberg's problems at p 82-3 of the report but it is wholly unclear how or by whom the issues set out at p 82 to 84 of the report are going to be assessed (if at all) during the scoping or assessment process.

25 Table Once results of assessment of alternative sites DSR p24 onward

The DSR states that it is assumed that where relevant and appropriate studies undertaken during the 302MW PBMR EIA are acceptable for use in the current EIA process.

It is disputed that any study and in particular the economics and safety studies of the first EIR are acceptable for use the current EIA process. We attach the critical analyses of Dr. Steve Thomas (economics – Annexure “B) and Dr. Gordon Thompson (safety- Annexure “C) in this regard, which raise serious questions about the quality of the reports in first EIA. The current report is defective in that it does not identify these issues and does not provide for the proper assessment, nor does it disclose for comment and debate foundational documents. Here we specifically refer to the following documents, which should be disclosed:

1. the Safety Report
2. the Detailed feasibility Report
3. the report of the International Panel of Experts Technical and Economic Feasibility Report.
4. General Operating Rules
5. Operating Technical Standards
6. Probabilistic Risk Assessment

In the context of safety, a major deficiency in the DSR is its failure to provide for an assessment of the probabilities and consequences of a catastrophic event affecting the PBMR and/or the adjacent Koeberg. This is a mandatory relevant consideration in the assessment process under the legislation and also has been identified as a major concern in the White Paper. See that document at p 68 (quoted above) and also at p 71. Pursuant to s 197(1) of the Constitution, all decision-makers have a duty to loyally execute the lawful policies of the government of the day.

We also dispute that all information provided by Eskom was correct and valid even at the time that it was provided. In this regard we refer to and incorporate by reference herein the LRC's submissions in respect of the 302MW(t) PBMR DPP as well the two expert reports referred to above.

10. RELIANCE PLACED IN THE REPORT ON THE CO-OPERATIVE AGREEMENT BETWEEN DEAT AND THE NNR (THE CO-OPERATIVE AGREEMENT)

The reliance placed upon the co-operative agreement between the NNR and DEAT undermines the scoping process and has resulted in an improper DSR. We say so for the followiong reasons:

1. The co-operative agreement and the DSR draw an unjustified and indefensible distinction between "radiological/radiation issues of a generic nature not directly related to the project" (category 1) and "radiological/radiation issues of a generic nature directly related to the project" (category 2), and then provide that the latter category will generally be addressed in the formal "Safety Case" to be submitted by the applicant to the NNR. But the site specific issues lie at the heart of the environmental assessment process which has to be undertaken by DEAT;
2. It is totally unclear what is meant by the assertion that issues in category 2 "will be 'tracked' within the EIA process"; and that the environmental practitioner will provide "responses to issues" and "answers to issues"[26].
3. DEAT cannot delegate its decision-making functions to the NNR or, alternatively and in any event, has not purported to do so, so it cannot let the NNR set conditions as part of the EIA process, as the DSR proposes;
4. The EIA process also cannot be left open-ended yet the DSR and the co-operative agreement envisage precisely this, by saying that if input from the NNR is not available for processing as part of the EIA process, the DEAT will "refer these issues to the NNR process and make all (DEAT) decisions conditional on this process".

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26 DEAT NNR memorandum "Annexure A" para 3.4

The processes criticized in points 3 and 4 above suffer from the further defect that I & AP's could be denied procedural fairness and a proper opportunity to comment on any input provided by the NNR or any purported decision made by the NNR under guise of the EIA process.

It is denied that the co operative agreement creates a " definitive check and balance to the public that diligent governance will be applied at all times" as is claimed in paragraph 4 thereof.

11. RE CHAPTER 7: SUMMARY OF ISSUES IDENTIFIED

Paragraph 7.1.1 of the DSR incorrectly reflects the economic issues identified in the scoping report for the 302MW(t) PBMR DPP. In terms of this report para 7.4.4 economic aspects were limited to:

(a) the economic potential of a local based nuclear industry

(b) impact on eco tourism in the region around Koeberg

(c) impact on supply site management based on the assumption that the plant proves viable.

The issue of life cycle costing was added later at the request of the Department of Environment Affairs & Tourism. The plan of study for the first EIA reflected the following issues under the title "Economic Aspects" and included those issues mentioned above as well as life cycle costing and markets for PBMR. It thus denied that the items:

(1) impacts on spatial planning and land use; and

(2) economics of the technology

were raised as an issue under the heading "Economic Aspects" in the first EIA. Impacts on spatial planning were mentioned without reference to land use under "social impacts". The plan of study for the first EIA did not simply include as an issue "safety and security impacts"[1].

This issue was stated in a restricted form, namely "conventional safety and security impacts (i.e. excluding radiological aspects for which the NNR findings will inform the EIR)".

12. ISSUES THAT ARE SIGNIFICANT BUT FALL OUTSIDE OF THE SCOPE OF THE DSR FOR THE PBMR DPP[27].

The DSR states that certain issues of a strategic nature cannot be addressed in the EIA due to the site and activity's specific nature of the process. These so-called strategic issues are not specified. It is therefore not clear whether these issues are limited to those contained in table 6, DSR page 70.

Items 1, 6 and 9 of table 6 pertain to the issue of economic impacts. The NEMA principle in section 2(3) requires development to be socially, environmentally and economically sustainable. NEMA principles must be taken into account in the preparation of environmental impact reports required for the granting of permission of certain prescribed activities[28]. Furthermore NEMA section 23(2)(b) refers to the general objective of integrated environmental management which is to identify potential impacts on the environment socio economic conditions and cultural heritage with a view to minimizing negative impacts and promoting compliance with the principles of environmental management set out in section 2.

It is submitted that items 1, 6 and 7 relate to the costs and economic viability of the PBMR and are therefore relevant considerations for these assessments as required in terms of NEMA. It is submitted that assessing socio economic sustainability would include assessing the impact on the use of public funds to develop a nuclear technology given the scale of expenditure involved, and would therefore also include an assessment of the financial viability of the pebble bed as an electricity generating option.

27 DSR para 7.2

28 *Minister of Public Works v Kyalami Ridge Environmental Association* 2001(3) SA1151 ,at 1 176E-F

Item 9 deals with the issue of an international market for the future PBMR technology. As stated in the first EIA [29] "the purpose of the proposed plant is to assess the techno economic viability of the technology of the South African and international application for electricity generation and other commercial applications". In the previous EIR it is stated,[30] "the stated commercial potential of the PBMR for global application although outside of the scope of the EIA will be addressed to some degree within the EIR". It is inconsistent to totally exclude this consideration in current EIA. If local markets and real economic potential are identified as issues under economic aspects then by implication international markets should not be excluded from the EIA[31].

13. MITIGATION MEASURES TO MANAGE ENVIRONMENTAL IMPACTS

We note that the application for authorization states that 'the EIR for the 3O2 MW (t) PBMR DPP contained a comprehensive environmental management plan for the construction and operation/maintenance of the proposed project. The mitigation measures and recommendations regarding management of environmental impacts will be amended/augmented, as appropriated for the 400 MW (t) PBMR DPP."

This approach is objectionable. Mitigation, which is a requirement for an EIA should take place before authorization. However it is being deferred to an environmental management plan, which presumably is drawn up after the record of decision. Regulation 8(a)(ii) of GNR1183 states that an environmental impact assessment **must** contain a description of each alternative including particulars on the possibility of mitigation of each identified impact. The practice of deferring mitigation to an environmental management plan, which usually is located in one of the conditions of the record of decision, is legally improper.

29 Page 1 Executive Summary

30 Chapter 1, page 2

31 GAPS IN KNOWLEDGE AND UNDERLYING ASSUMPTIONS

The application for authorization contains no list of gaps in information predictive measures used and underlying assumptions. This is unacceptable given that the design is not final and the safety assessment has not been completed.

15. ENVIRONMENTAL ASPECTS WITH NO RADIOLOGICAL DIMENSION[32]

Table 7 of the DSR contains a summary of the screening assessment. Under waste management[33] generation of radioactive waste is included. It is not clear why this is included under a section dealing with environmental aspects with no radiological dimension.

A second section on waste management is included on page 77 and relates to "continued management of radioactive waste". However no assessment of the impacts of waste management is in fact recommended, rather it is suggested that the issue of continued management of radioactive waste is merely to be considered by the Department of Mineral & Energy Affairs. This is an abdication of responsibility to continue the impact of generation of large quantities of radioactive waste.

The impact of waste management during the decommissioning of the plant is divided into three sections, as follows:

1 Storage/management of long-term high-level waste. It is recommended that issues are considered by the Department of Mineral & Energy and included in the National Waste Policy. This constitutes an abdication of responsibility to consider the impacts of storage and management of long-term high-level waste.

31 EIA 1, para 3.3.2, page 15

32 Page 70

33 Page 76

2 Decontamination of irradiated materials. Here the issues are to be assessed by the NNR process and to inform the EIA process. It is submitted that any input provided by the NNR should take place before completion of decision making in terms of the EIA process, and be subject to procedural rights to comment by I and AP's and critical decisional scrutiny by the DEAT

3 Long-term disposal at the Vaalputs facility. Here the issues are to be considered by the DME and included in the National Waste Policy. Once again there is an abdication of responsibility to consider the assessment of impacts of long-term disposal of the Vaalputs facility (e.g. increased traffic, effects on adjacent communities of increased risk of accidents in the transportation of nuclear hazardous waste etc).

4 Dismantling of the plant, disposal of plant material and high-level waste storage plant. Under this item waste management also includes the issue of radiological waste. Issues are to be assessed by the NNR process and to inform the EIA process. The NNR process should precede the final ROD for the EIA.

The general point should be made that the management of waste, its storage and transportation, and the issue of decontamination of the site are issues that are not novel in the sphere of nuclear management. The environmental impacts of the generation of a known or easily estimable amount of nuclear waste can readily be ascertained from the available knowledge on the matter within the nuclear industry. There is no justification for deferring the consideration of the impacts hereof to other departments as is suggested in the DSR. The legislative provisions in terms of which for example the DME is to consider storage and management of waste are not spelled out. This precludes an evaluation of whether there will be substantial compliance with the assessment requirements of the ECA if this is indeed a lawful approach.

The same applies to the issue of decontamination of the site. Why does the DEAT need the NNR to deal with this issue? The consultants can draw up expert reports so that the DEAT can discharge its responsibilities of assessing the impacts hereof before giving a record of decision. If not, the approach adopted by the consultants needs to be properly justified in the DSR.

16. OTHER NOTES

On page 80 of the DSR under the issues designated “economic impacts” the issue “expenditure and support for the dismantling and rehabilitation” is indicated. The “recommendations” column states that “that the potential impacts (before and after mitigation) should be assessed during the EIA phase. Recommendations should be made

regarding appropriate mitigation measures required to minimize impacts.” This recommendation does not appear to make sense and also appears to contradict the recommendation contained in item 6 of table 6 on page 70 which suggests that the use of public funds to develop a nuclear technology is not an issue that falls within the EIA.

On page 82, mention is made of the ELA/DG/DEAT ruling and it is stated that more information is needed regarding epidemiological studies. However no clarification is given of the responsibilities of either the NNR or DEAT in regard to this issue.

This constitutes a material failure to consider highly relevant issues.

17. APPLICATION FOR EXEMPTION

It is noted that Eskom’s EIA Application under section 21 of the Environment Conservation Act 73 of 1989 (ECA) includes a reference to an application for exemption in terms of s28A of ECA[34]. In terms of this application, Eskom sought exemption from the process to assess energy/technology alternatives and site alternatives, and from the associated public participation process. We are advised that Eskom has withdrawn this application. This fact should be recorded in the DSR in order for it not to be misleading.

34 EIA Application, section 12, page 19.

Angela Andrews

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7 March 2006

Annexure A

Issues for consideration in the environmental impact assessment

In addition to the issues mentioned in the above submission the following issues should be pertinently considered in the environmental impact assessment.

1. Impact of a graphite fire
2. Physical, economic and social impact of a catastrophic incident
3. Economic and safety impacts of generating a significant quantity of high level of radioactive waste without there being provision for a safe long term depository
4. Impact of release/s (venting) of additional radiation into the atmosphere to avoid a major accident and the likelihood of this taking place
5. Impact on spatial planning and land use for the City of Cape Town as a result of the construction of the PBMR on the Koeberg site
6. Impact of the proposed expenditure of R14.5 billion on the availability of funds for alternative sustainable energy research
7. Impact of lack of secondary containment on safety and economics of the plant

8.8.2 SAFETY OF THE PROPOSED SOUTH AFRICAN PEBBLE BED MODULAR REACTOR:

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SAFETY OF THE PROPOSED SOUTH AFRICAN PEBBLE BED MODULAR REACTOR: Technical issues, status of knowledge, and their documentation

by

Gordon Thompson

7 December 2004

A report for

Legal Resources Centre Cape Town, South Africa

About the Institute for Resource and Security Studies

The Institute for Resource and Security Studies (IRSS) is an independent, nonprofit, Massachusetts corporation, founded in 1984. Its objective is to promote sustainable use of natural resources and global human security. In pursuit of this mission, IRSS conducts technical and policy analysis, public education, and field programs. IRSS projects always reflect a concern for practical solutions to resource and security problems.

About the author

Gordon Thompson is the executive director of IRSS and a research professor at Clark University, Worcester, Massachusetts. He studied and practiced engineering in Australia, and received a doctorate in applied mathematics from Oxford University in 1973. Dr. Thompson has been based in the USA since 1979. His professional interests encompass a range of technical and policy issues related to international security and protection of natural resources. Dr. Thompson has conducted numerous studies that address the environmental and security impacts of nuclear facilities, and options for reducing these impacts.

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Abstract

A type of commercial fission reactor known as a pebble bed modular reactor (PBMR) is currently under development in South Africa. This report addresses the reactor's safety, defined here as the potential for an unplanned release of radioactive material to the environment. The release could be caused by human error, equipment failure, natural forces, or acts of malice or insanity. Documents relevant to the safety of the PBMR are discussed here, especially a Final Environmental Impact Report (FEIR) and a Safety Analysis Report (SAR). Technical issues of PBMR safety are summarised, and the treatment of these issues in the FEIR and SAR is reviewed.

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The status of knowledge about safety of the proposed PBMR

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1. Introduction

This report addresses the safety of the proposed South African pebble bed modular reactor (PBMR), a nuclear fission reactor under development in South Africa for commercial application in that country and internationally. Reactors of a similar design have operated in other countries. The design concept of the South African PBMR draws heavily from German experience. Eskom, South Africa's national electricity generating company, proposes to build and operate a demonstration plant, employing this design concept, at the site of the existing Koeberg nuclear power station.[1]

In this report, the word "safety" refers to the potential for an unplanned release of radioactive material to the environment. A high level of safety corresponds to a low potential for unplanned release. The release could be caused by human error, equipment failure, natural forces (e.g., earthquake), or acts of malice or insanity. An unplanned release is distinct from the comparatively small, planned release of radioactive material that accompanies the operation of any reactor.

The industrialised world has accumulated a half century of experience with commercial nuclear power. During that period, this industry has become controversial, and is opposed by many people. Proponents of nuclear power have recognized that significant problems must be overcome if the industry's prospects are to improve. A study group at the Massachusetts Institute of Technology (MIT) has identified four such problems: cost; safety; radioactive waste; and proliferation of nuclear weapons.[2] The proposed South African PBMR will be judged by its ability to overcome each of these problems. This report focuses on the safety of the proposed PBMR, but that focus does not imply that other problems are less important or have been resolved.

In June 2000, Eskom and its partners applied to the South African Department of Environmental Affairs and Tourism (DEAT), seeking authorisation to build and operate the proposed PBMR demonstration plant at the Koeberg site. This application was supported by a Final Environmental Impact Report (FEIR) dated October 2002.[3] Authorisation was granted in June 2003, with various stipulations.[4] The FEIR made reference to a Safety Analysis Report (SAR), and included a portion of that SAR as Annexure 23 to the FEIR.[5] IRSS's understanding is that no other portion of the SAR has been published. The authorship, table of contents and date of completion of the SAR have not been disclosed.

1 FEIR, 2002.

2 MIT, 2003, page ix.

3 FEIR, 2002.

4 Olver, 2003a.

5 SAR/FEIR Annexure 23.

Statements about the safety of the proposed PBMR were made in the FEIR and the available portion of the SAR. These documents are reviewed here. (See Sections 6.1 and 6.2, below.) Neither document is found to be a complete or scientifically defensible assessment of the safety of the PBMR. To IRSS's knowledge, no other document has been published in South Africa that addresses the safety of the proposed PBMR to more than a superficial extent.

Assessment of the safety of a reactor requires access to design information. This report relies primarily on design information that has been provided to the US Nuclear Regulatory Commission (NRC) and the US Department of Energy (DOE) as part of an effort to promote the eventual sale of South African PBMR technology in the USA. IRSS is not aware of any document published in South Africa that provides more than superficial information about the design of the proposed PBMR. Neither the FEIR nor the available portion of the SAR provided design information beyond a superficial level.

The design of the proposed PBMR has passed through at least two substantial changes since 2001, as discussed in Section 2.2 of this report. These changes, and the absence of a prototype reactor, indicate that the proposed PBMR should be considered as a design concept rather than a design that is ready to be built. Design changes of the magnitude that have occurred for this PBMR can substantially affect the safety of a reactor. Thus, no significant conclusions can be drawn regarding the safety of the proposed PBMR until two conditions have been satisfied. First, the design must have been finalised. Second, the final design must have been subjected to a safety assessment performed according to best international practice. Section 7.1 of this report discusses the features of such an assessment.

The remainder of this report begins, in Section 2, with a discussion of the basic features of the proposed PBMR and the evolution of its design. Section 3 describes safety issues that are relevant to this reactor. Criteria that have been set forth for judging the safety of the PBMR, and the safety of modern reactors in general, are summarised in Section 4. Processes for assessing safety are discussed in Section 5. Available information about safety assessment for the proposed PBMR is reviewed in Section 6, with special attention to the FEIR and the available portion of the SAR. Section 7 summarises the current status of knowledge about the safety of the proposed PBMR, and the actions needed to improve this knowledge. Conclusions are set forth in Section 8, and a bibliography is provided in Section 9. Footnotes cite entries in the bibliography.

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2. Characteristics of the proposed PBMR 2.1 Basic features

The proposed PBMR would use low-enriched uranium fuel in a graphite-moderated core cooled by helium. Uranium dioxide fuel kernels of about 0.5 mm diameter would be surrounded by carbon and silicon carbide layers to make TRISO coated particles of about 0.9 mm diameter. These particles would be incorporated into fuel pebbles of about 60 mm diameter.[6] Graphite pebbles would also be present in the reactor core to provide neutron reflection and moderation. Fuel and graphite pebbles would descend slowly through the core in a continuous process of draining and replenishment. Helium would pass through the reactor in a closed loop. After leaving the reactor, the helium would pass through a power conversion system employing a recuperative Brayton cycle with intercooling. A power turbine in this system would drive an electricity generator.[7]

2.2 Evolution of the design

A November 2002 report by PMBR Ltd. described the status of the design of the proposed PBMR as follows:[8]

> "The Basic Design of the plant, which will constitute a baseline for Detailed Design to proceed, has been largely completed and is currently being documented in accordance with international Nuclear Quality Assurance norms."

The report went on to say that aspects of the design would be "reviewed" and "optimized" during an extended development phase. Through this process, the "initial basic design" (PB100-00), which was the subject of the EIA and the nuclear license application, would evolve to the "final basic design" (PB100-10). The nominal power output of each unit would rise from 106 MW(e) to 120 MW(e), reflecting an increase in operating pressure and core size. As explained below, the design has actually changed to a much greater degree than PBMR Ltd. predicted in its November 2002 report.

The design information that is publicly available in South Africa is superficial, and does not allow any conclusion to be drawn about the safety of the proposed PBMR. Better information is available in the USA, resulting from submissions and presentations to NRC and DOE. The latter information, although also limited in scope, at least allows one to understand how the design has evolved.

A report submitted to NRC in August 2001 provided a modest amount of technical information and some drawings, allowing a reader to gain a general impression of the

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6 Slabber, 2003.,

7 Nicholls, 2000

8 Ferreira et al, 2002, Section 2.1.4.1.

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PBMR design that was envisioned at that time.[9] The unit's nominal power output was 110 MW(e). One significant feature of the design was that the reactor core had two regions with no separating wall. A central, cylindrical region, composed of graphite pebbles, was surrounded by an annular region composed of fuel pebbles. This configuration was to be maintained by dropping graphite pebbles onto the center of the top surface of the core while dropping fuel pebbles onto this surface at points distant from the center. Both the fuel and graphite pebbles would then move downward through the core. Some mixing of fuel and graphite pebbles would occur at the interface between the two regions. Fuel and graphite pebbles would be discharged through a single drain hole at the base of the reactor vessel. After leaving the vessel, the fuel and graphite pebbles would be separated, and would then be re-used in the core or stored as radioactive waste.

This two-region core arrangement would result in a power distribution across the core that would be more uniform than would be the case for a one-region core. If a more uniform power distribution could be achieved, this would result in a more uniform temperature distribution. Limiting the variation of temperature across the core is an important requirement for a pebble bed reactor, and concern has been expressed within NRC that the proposed PBMR may not meet this requirement.[10] An internal NRC memo

stated: 11

> "So what we may really have here is nothing at all like a uniform 900 C outlet temperature, but rather an outlet flow with very large radial and azimuthal temperature variations, perhaps on the order of plus or minus 200 C or more."

In the (US) spring of 2002, the MIT Nuclear Engineering Department conducted a design project on the dynamics of pebble motion in a PBMR.[12] The project involved experiments and theoretical modeling to estimate the movement of pebbles in a tworegion core as described above. The report on the project strongly suggests to IRSS, although the report did not state this explicitly, that the design under investigation was that of the proposed South African PBMR. Reference was made in the report to a PBMR Safety Analysis Report that was, it appears, freely available to members of the MIT team. In describing the importance of understanding pebble motion, the report stated:[13]

> "Despite its advantages over the conventional reactor as seen above, the PBMR core also has a serious problem. The neutron physics that allows reactors to predict the power/heat output and U-235 burn-up of fuel at a given location is dependent on the distribution of fuel and reflector materials, the position of

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9 Borton, 2001.

10 Experience with the AVR pebble bed reactor (reviewed in: Thadani, 2001) showed coolant temperatures exceeding 1280 C in parts of the reactor during normal operation, while the nominal average outlet temperature was 950 C.

11 Carlson, 2001.

12 MIT, 2002.

13 MIT, 2002, page I-10.

absorbers, which are used to reduce power levels where appropriate, and the shape of the core..........In the PBMR, the positions of each fuel and reflector [graphite] pebble change. Therefore, calculation of the flux profile becomes very complicated if the distribution of pebbles within the core is not known."

In August 2003, PBMR Ltd. explained its technology in a presentation to DOE.[14] The design described in this presentation was significantly different from that submitted to NRC in August 2001. Each unit's nominal power output was increased to 160-170 MW(e). Drawings indicate that the concept of a reactor core with two regions (fuel pebbles and graphite pebbles) was retained, but the regions were separated by a wall that would apparently be made primarily from graphite.[15] The height of the core barrel was increased from 15.7 m to 22 m, while its outside diameter remained at 5.85 m. In the new design, fuel and graphite pebbles would not mix at any point. Each type of pebble would be added to the top, and removed from the bottom, of the core by its own pebbletransfer system.

One can infer that the introduction of a wall between the two regions of the core was a response by the PBMR designers to the difficulty of predicting pebble motion. Sharp separation of the core regions by the wall would improve the designers' ability to predict the location of pebbles and, as a result, the power and temperature distributions across the core. However, the presence of the graphite wall would pose new safety issues. Collapse of this relatively fragile wall, spontaneously or during fault conditions, could block helium flow or increase reactivity, causing temperature spikes in parts of the core. Fault conditions could lead to collapse of the wall as a result of differential pressure between the core regions. Faults causing differential pressure could include a pipe break in one of the pebble-transfer systems.

The reactor core was not the only part of the PBMR that exhibited substantial design change between August 2001 and August 2003. In the August 2003 version a system designated CBCS – presumably being the core barrel conditioning system – provided a helium flow loop, external to the reactor vessel, that penetrated the bottom and top of the vessel. By contrast, the analogous system in the August 2001 design – the reactor pressure vessel conditioning system – penetrated the reactor vessel only at the bottom. Introducing penetrations at both the top and bottom of the vessel, as was done in the August 2003 version, would, other factors being equal, reduce the safety of the design. The potential would exist for a fault condition – such as a loss of helium from the primary cooling circuit combined with a pipe break in the CBCS – to create air flow through the core, thereby feeding combustion of fuel and graphite pebbles.

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14 Matzner, 2003a.

15 An alternative core configuration would be one in which the graphite pebbles in the central region of the core would be replaced by non-moving graphite structures. The FEIR hinted (FEIR, 2002, Section 4.20.5) that this alternative was considered. However, IRSS interprets the August 2003 presentation to DOE (Matzner, 2003a) as indicating that graphite pebbles would be used. The PBMR Ltd. website (www.pbmr.com, accessed 2 December 2004) referred to the use of fuel pebbles and graphite pebbles.

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Beginning in the latter part of November 2004, the website of PBMR Ltd. was altered to reveal yet another design of the PBMR, one that was substantially different from both the August 2001 and August 2003 designs.[16] The nominal power output per unit would be approximately 165 MW(e). The limited information provided for the new design included several schematic diagrams. These drawings did not show the reactor core. No naming or explanation of systems or structures was provided. This limited information was sufficient to show that the design of the entire plant, outside the reactor vessel, had been radically altered since August 2003.

The drawings that were revealed in November 2004 indicated that the power turbines, turbo-compressors and electricity generator would share a common, horizontal axis, and would be coupled together by drive shafts. This arrangement would necessitate the presence of rotating seals where the drive shafts penetrated the primary pressure boundary. The previous design had avoided the use of such seals. Moreover, in the new design the helium turbo-machinery would be separated from the external environment by a comparatively light-weight building, thus creating the potential for a breach of the primary pressure boundary to be caused by an external insult such as a crashing aircraft or an attack with explosives. Other parts of the primary pressure boundary would be similarly vulnerable to external insults. The potential would exist for a fault condition that creates air flow through the core, thereby feeding combustion.

In June 2000, Eskom and its partners applied to DEAT for authorisation to build and operate a PBMR demonstration plant. The discussion in the preceding paragraphs shows that the proposed South African PBMR has undergone major design changes at least twice since that application was made. At least one of these changes occurred after the FEIR was completed in October 2002. Similarly, at least one of the changes occurred after DEAT's authorisation was granted in June 2003. The changes revealed in November 2004 included an increase in nominal power output per unit to 165 MW(e), compared with the nominal output of 120 MW(e) specified in DEAT's authorisation.[17]

This situation is puzzling. Three alternative explanations, all unsatisfying, present themselves. The first explanation is that the design of the proposed demonstration plant underwent major changes after the application to DEAT for authorisation was made and granted. If correct, this explanation indicates that the authorisation process lacked substance. The second explanation is that the design of the proposed demonstration plant was essentially frozen before the FEIR was completed, while the design of hypothetical follow-on plants has undergone major changes. If correct, this explanation indicates that the demonstration plant would be obsolete before its construction began. The third explanation is that the safety findings set forth in the FEIR were not based on an actual design of a PBMR, but rather on a design concept.[18] If correct, this explanation, like the

16 PBMR Ltd. website (www.pbmr.com), accessed on 9 November 2004, 23 November 2004 and 2 December 2004.

17 Olver, 2003a.

18 This explanation gains credence from Section 4.20.5 of the FEIR (FEIR, 2002), which discussed the PBMR's compliance with NNR safety criteria. The discussion mentioned PBMR versions with nominal

first explanation, indicates that DEAT's authorisation process lacked substance. IRSS interprets the balance of evidence as favouring the third explanation.

3. Safety issues

3.1 Generic safety issues for a high-temperature gas-cooled reactor

In this report, the word "safety" refers to the potential for an unplanned release of radioactive material to the environment. The available types of fission reactor exhibit differing behaviours in this respect. An event that could cause an unplanned release from one type of reactor might not have this effect on a different type of reactor. Thus, at a generic level, one can compare the safety characteristics of different reactor types. The safety of a specific reactor is, however, determined not only by its generic characteristics but also by its detail design and the manner in which it is constructed and operated.

Any type of reactor could release a large fraction of its radioactive inventory if subjected to a sufficiently powerful insult. For example, a military attack with conventional or nuclear weapons could achieve this result. Below this level of severity is a spectrum of potential release-initiating events, including attack by a sub-national group, earthquake, random equipment failure, operator error, etc. The discussion here generally applies to that spectrum of events.

A high-temperature gas-cooled reactor, such as the proposed South African PBMR, can be designed to ride out events that would lead to fuel damage in other types of reactor. Notably, the reactor core can have a negative temperature coefficient of reactivity, so that power output falls naturally under fault conditions that lead to a rise in temperature. Also, the reactor can be designed so that radioactive decay heat is removed from the core by natural conduction, convection and radiation. Nevertheless, the fuel will suffer severe damage if events cause the fuel temperature to rise substantially above the design level. For the proposed PBMR, it is expected that the fraction of failed fuel will reach 100 percent if fuel temperature rises to 2400 C.[19] Thus, it is important to thoroughly understand the circumstances that could lead to high fuel temperature.

Ingress of air and/or water into the reactor core is recognized as an event that could lead to high fuel temperature and hence to severe fuel damage. A review of design issues for high-temperature pebble-bed reactors has stated:[20]

> "The hot graphite in the core reacts with air and water so that ingress of these materials may result in core damage. This is compounded by the fact that ingress may also inject positive reactivity at a rate that will result in fuel failure before the ratings of 268 MW(t) and 302 MW(t), the latter version having a "solid central column" in the reactor core. There was no recognition of the safety significance of variations in design.

19 Borton, 2001, Figure 11.

20 Gougar et al, 2003, pp 288-289.

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> negative reactivity feedback of the subsequent temperature increase can prevent it. Proper design must include an assessment of water and air ingress reactivity."

Safety issues for pebble-bed reactors were identified at a workshop held in the USA in October 2001.[21] Three selected issues are summarised in this paragraph. One issue was that test data for the fuel pebbles have been obtained by holding fuel at a fixed temperature. There had been no tests involving temperature transients that could lead to thermal shock to the silicon carbide cladding of the fuel particles. A second issue was that the reaction of air with graphite can be catalysed by transition metals and cesium hydroxide. A third issue was that irradiated graphite can release energy under hightemperature conditions, potentially exacerbating these conditions. In regard to the third issue, a report on the workshop by Dana Powers stated:[22]

> "Though most seem to be aware of the Wigner energy that can be stored in irradiated graphite at low temperatures, there does not seem to be a keen awareness of the radiation damage that can occur in graphite at high temperatures. These high temperature radiation damage processes involve higher energies than the Wigner effect. The energy stored in graphite by these radiation damage processes will be released if the graphite is heated to sufficiently high temperatures in an accident or if the graphite is chemically reacted. It is not apparent that accident analyses have considered this source of stored energy in predicting the response of the reactor."

An Annexure to the FEIR responded to this concern as follows:[23]

> "Again the absence of a PBMR expert at the meeting dr. Powers attended was regrettable as the irradiation dependent properties play an important role in the design and much work on being able to predict these from past experiments is presently in progress. PBMR has combined the knowledge and database of several graphite experts from around the world to ensure that the best possible data are used."

This response evaded the issue. To the extent that the response had substance, it revealed that PBMR proponents were still studying the irradiation-dependent properties of graphite. A scientifically credible assessment of this issue is needed, but was not provided in the FEIR. A credible assessment would not attempt to evade the issue by claiming that high-temperature conditions are so unlikely that they should not be considered. Instead, the assessment would provide strictly scientific information about the high-temperature release of energy from irradiated graphite.

An issue that arises in any discussion of the safety of a high-temperature gas-cooled reactor is the design of the secondary envelope that surrounds the primary pressure

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21 Powers, 2001.

22 Powers, 2001, page 6.

23 FEIR, 2002, Annexure 10, Issue 5.1.4.1.3.

boundary, and the risk implications of that design.[24] Some analysts argue that a closed containment structure, as is used for light-water reactors in the USA, should be used. Others argue for a vented confinement structure, as is envisioned for the proposed South African PBMR. This issue is addressed further in Section 3.3, below.

3.2 Vulnerability to acts of malice or insanity

There is a rich history of events showing that acts of malice or insanity pose a potential threat to civilian nuclear facilities around the world.[25] Consider some examples. Nuclear power stations under construction in Iran were repeatedly bombed from the air by Iraq in the period 1984-1987. Yugoslav Air Force fighters made a threatening overpass of the Krsko nuclear power station in Slovenia -- which was operating at the time -- a few days after Slovenia declared independence in 1991. So-called research reactors in Iraq were destroyed by aerial bombing by Israel in 1981 and by the United States in 1991. In 1987, Iranian radio threatened an attack by unspecified means on US nuclear power stations if the United States attacked launch sites for Iran's Silkworm anti-ship missiles. Bombs damaged nuclear power stations under construction in Spain in 1977 and in South Africa in 1982. Anti-tank missiles struck a nuclear power station under construction in France in 1982. North Korean commandos were killed while attempting to come ashore near a South Korean nuclear power station in 1985. These and other events illustrate the "external" threat to nuclear power stations. Numerous crimes and acts of sabotage by nuclear-power-station personnel illustrate the "internal" threat.

The attacks of 11 September 2001 on buildings in New York and Washington have drawn new attention to the threat of attack on nuclear power stations. Governmental and non-governmental entities in various countries have studied this threat.[26] In the USA, the National Strategy for The Physical Protection of Critical Infrastructures and Key Assets, published in February 2003, identifies nuclear power stations as key assets, defined as

follows: 27

> "Key assets represent individual targets whose destruction could cause large-scale injury, death, or destruction of property, and/or profoundly damage our national prestige, and confidence".

Continuing concern in the USA about the threat of attack on nuclear power stations was evident in a November 2004 report from the US Central Intelligence Agency (CIA) to the US Congress, which stated in part:[28]

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24 See, for example: Williams, 1991; Kugeler and Phlippen, 2001; Kugeler et al, 2001; Powers, 2001; Thadani, 2001; Borton, 2002b 25 Thompson, 1996

26 See, for example: POST, 2004.

27 White House, 2003, page 7.

28 CIA, 2004, page 8.

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> "In addition, we are alert to the very real possibility that al-Qa'ida or other terrorist groups might also try to launch conventional attacks against the chemical or nuclear industrial infrastructure of the United States to cause panic and economic disruption."

A determined, sophisticated group planning an attack on a nuclear power station could employ a variety of modes and instruments of attack. Table 3-1 shows some potential modes of attack, and the corresponding defenses that are currently provided by nuclearpower-station licensees in the USA pursuant to NRC requirements.

Table 3-1

Potential Modes and Instruments of Attack on a Nuclear Power Station[29]

Mode of Attack	Characteristics	Present Defenses at Nuclear Power
Commando-style attack	• Could involve heavy weapons and sophisticated tactics • Successful attack would	Alarms, fences and lightly-armed guards, with offsite backup
Land-vehicle bomb	• Readily obtainable • Highly destructive if	Vehicle barriers at entry points to Protected Area
Anti-tank missile	• Readily obtainable • Highly destructive at point	None if missile launched from offsite
Commercial aircraft	• More difficult to obtain than before 11 September 2001 • Could destroy larger	None
Explosive-laden smaller aircraft	• Readily obtainable • Could destroy smaller,	None
10-kilotonne nuclear weapon	• Difficult to obtain • Assured destruction if	None

29 Adapted from Table 1 of: Thompson, 2003.

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A form of explosive that might be used in an attack on a nuclear power station is a shaped charge. These have many civilian and military applications, and have been used for decades. They are used, for example, as human-carried demolition charges or as warheads for anti-tank missiles. The largest known shaped charge was the German MISTEL, developed late in World War II. This warhead was 2 m in diameter, weighed 3,500 kg and contained 1,700 kg of explosive. It was carried in the nose of an unmanned bomber aircraft. The Japanese used a smaller version of this device, the SAKURA bomb, for kamikaze attacks against US warships.[30]

A US government laboratory has developed, and described in a published report, a shaped charge specifically intended to penetrate large thicknesses of rock or concrete. 31 This device is intended for mounting in the nose of a cruise missile. The charge is a cylinder with a diameter of 71 cm and a length of 72 cm. It has a total mass of 410 kg and contains 270 kg of Octol explosive. When tested in November 2002, this device created a hole of 25 cm diameter in tuff rock to a depth of 5.9 m. The charge's purpose is to be the first stage of a "tandem" warhead, opening a hole in rock or concrete so that the second stage can penetrate deeply into the attacked structure before exploding.

One means of carrying a warhead to a nuclear power station would be a general-aviation aircraft, piloted remotely or by a suicidal pilot. In illustration, a Beechcraft King Air 90 will carry a payload of up to 990 kg at a speed of up to 460 km/hr.[32] A used King Air 90 can be purchased in the USA for US$0.4-1.0 million.[33] Such an aircraft could be used for a precision attack on a comparatively small and robust structure such as a nuclear power station. It is noteworthy that the US General Accounting Office (GAO) expressed concern, in September 2003 testimony to the US Congress, about the potential for malicious use of general-aviation aircraft, stating in part:[34]

> "Since September 2001, TSA [the Transportation Security Administration] has taken limited action to improve general aviation security, leaving it far more open and potentially vulnerable than commercial aviation. General aviation is vulnerable because general aviation pilots are not screened before takeoff and the contents of general aviation planes are not screened at any point. General aviation includes more than 200,000 privately owned airplanes, which are located in every state at more than 19,000 airports. Over 550 of these airports also provide commercial service. In the last 5 years, about 70 aircraft have been stolen from general aviation airports, indicating a potential weakness that could be exploited by terrorists."

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30 Walters, 2003.

31 This citation is withheld by IRSS.

32 Raytheon Aircraft Company, "Technical Data, Beechcraft King Air C90B", 16 June 2004.

33 The website www.aircraftdealer.com, accessed 6

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3.3 Options for improving safety

Various design options are available, or could be developed, that could potentially improve the safety of a PBMR. These options include improved fuel pebbles and core structures, underground siting, a closed containment system, a filtered confinement system, or combinations of these and other options. Each option would involve some additional cost.

At the Julich Research Centre in Germany, an effort has been made to develop what Professor Kugeler of the Centre has described as a "catastrophe-free" pebble bed reactor.[35] Part of this effort has been the testing of silicon carbide coatings of 0.1-0.2 mm thickness to cover fuel and graphite pebbles and fixed graphite structures in the reactor core. If successfully developed, a silicon carbide coating could prevent self-sustaining graphite oxidation in the event of air ingress to the reactor.[36] Other parts of the Julich effort have included the scaled testing of burst-protected reactor pressure vessels, and the development of systems that use sand or other granulates to block air ingress after a vessel break.

Underground siting is a design option that could potentially improve the safety of a PBMR in two respects. First, it could protect the plant against external insults such as a crashing aircraft or an attack with explosives. Second, it could facilitate the provision of a closed containment system or filtered confinement system with a high pressure capacity, because the surrounding soil would enhance the system's strength. An outline design of an "inherently safe" 300 MW(t) pebble bed reactor has been described, featuring underground siting and a vented confinement system with filters and sedimentation chambers in the venting pathway.[37] It is interesting that the design of the General Atomics modular high-temperature reactor, a competitor to the South African PBMR, places the reactor and power conversion system below ground level in a concrete building.[38]

Various containment and confinement systems have been used or considered for gascooled reactors.[39] A confinement system could be built without any filtration in the vent path to the atmosphere, as is apparently envisioned for the proposed South African PBMR. Alternatively, wet or dry filter systems, perhaps combined with sedimentation chambers, could be used in the vent path.

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36 The coating could also prevent the reaction of graphite with water vapour, in the event of water ingress.

38 Nuclear Energy Institute website (www.nei.org), accessed 2 November 2004.

39 Williams, 1991.

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4. Criteria for judging safety

4.1 Criteria set by the National Nuclear Regulator

South Africa's National Nuclear Regulator (NNR) has established safety criteria for licensing of the proposed PBMR. IRSS could not obtain these criteria directly from NNR, because the NNR website was inoperative. The criteria have, however, been published elsewhere. They are shown in Table 4-1.

Table 4-1

NNR Safety Criteria for PBMR Licensing[40]

Event Frequency	Safety Criteria
Category A: events with frequency more than 1 per 100 yr	Individual radiation dose limit: • 20 mSv/yr to plant personnel • 0.25 mSv/yr to the public
Category B: events with frequency more than 1 per 1 million yr but less than 1 per 100 yr	Individual radiation dose limit: • 500 mSv per event to plant personnel • 50 mSv per event to the public
Category C: Category A and B events plus events with frequency less than 1 per 1 million yr	Risk limit (where risk = expected number of fatalities per yr across a population): • for plant personnel: peak individual risk of 1 per 20,000; average risk of 1 per 100,000 • for the public: peak individual risk of 1 per 200,000; average risk of 1 per 100 million per site

Employing risk-based criteria of this type places a premium on obtaining the best possible knowledge about the probabilities and other characteristics of potential hazardous events. There are fundamental difficulties in obtaining such knowledge, as discussed in Section 5.2, below. Also, a risk-based approach to licensing can hinder the consideration of acts of malice or insanity, because quantitative probabilities cannot be estimated for such acts. This point is taken up in Section 7.2, below.

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40 FEIR, 2002, Table 1.

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4.2 Other criteria

Entities other than NNR have articulated criteria for judging the safety of modern reactors, including pebble bed reactors. For example, as mentioned in Section 3.3, an effort has been made at the Julich Research Centre to develop a "catastrophe-free" pebble bed reactor. A criterion for judging the safety of such a reactor has been articulated as follows:[41]

> "Catastrophe-free nuclear technology is achieved if the radioactive substances remain contained inside the reactor plant in all possible cases of accidents so that no significant radiological consequences will result for the environment, i.e.,
>
> - no immediate fatalities;
> - no late fatalities;
> - no evacuation;
> - no relocation, and
> - no changes in eating and drinking habits."

The crucial phrase in this statement is "all possible cases of accidents". There will inevitably be varying opinions about the scope of the events to be included in this category. If that scope could be clearly delineated, this criterion would have the merit that compliance with the criterion could be demonstrated without regard for the probabilities of hazardous events.

A representative of Eskom has set forth a similar criterion for judging the safety of the proposed South African PBMR. The representative stated:[42]

> "There must be no physically credible event which can cause off-site actions to be required".

In this formulation, the crucial phrase is "physically credible event". As for the Julich formulation, opinion will vary about the scope of the events to be included.

4.3 Consideration of acts of malice or insanity

Neither of the safety criteria discussed in Section 4.2 explicitly addresses acts of malice or insanity. However, some reactor designers have explicitly included such acts within their safety criteria. For example, the designers of the PIUS reactor – a type of lightwater reactor – established safety objectives as follows:[43]

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41 Kugeler and Phlippen, 2001, page 6.

42 Nicholls, 2000, page 232.

43 Hannerz, 1983, page 3.

"Thus, we want to achieve complete protection against core melting or overheating in case of:

- any credible equipment failures;
- natural events, such as earthquakes and tornadoes;
- reasonably credible operator mistakes; and
- combinations of the above;

<u>and</u> against:

- inside sabotage by plant personnel, completely knowledgeable of reactor design (this can be considered an envelope covering all possible mistakes);
- terrorist attacks in collaboration with insiders;
- military attack (e.g., by aircraft with "off-the-shelf" non-nuclear weapons); and
- abandonment of the plant by the operating personnel."

The aspects of this safety objective that address acts of malice or insanity could be made precise. This would be done by establishing a set of "design-basis" acts of malice or insanity. That set of events could be incorporated into safety criteria of the type articulated in Section 4.2.

5. Processes for assessing safety

5.1 Safety-assessment processes in the USA

In the USA, licensing of civilian nuclear facilities is the exclusive responsibility of NRC, a federal-government agency that operates within a statutory framework established by the US Congress. Within that framework, NRC and its predecessor -- the US Atomic Energy Commission (AEC) -- have created a complex web of regulations, orders, procedures, guidance documents and other instruments that govern the granting of licenses and the oversight of licensees. As part of its standard practice, NRC requires the licensee of each nuclear facility to assess the safety of the facility. NRC has also conducted its own safety assessments. A brief sketch is provided here of the safetyassessment processes that are required or conducted by NRC, with a focus on nuclear power stations.

Before NRC grants a license to construct a nuclear facility, the applicant must complete a Final Safety Analysis Report (FSAR) for the facility. The US fleet of nuclear power stations is comparatively old, the majority of stations having operated for at least two decades. Thus, there have been no recent applications to construct a nuclear power station. The FSAR continues, however, to be part of the licensing record for each operating station. New FSARs have been prepared in recent decades for non-reactor facilities such as independent spent fuel storage installations (ISFSIs).

The FSAR for a nuclear power station is a multi-volume document containing a large amount of technical information, typically including cross-sectional drawings of the station buildings. A portion of the FSAR examines a set of "design-basis accidents" that the station could experience. These accidents do not involve severe damage to nuclear fuel, either in a reactor or after discharge from a reactor. The purpose of the examination is, indeed, to show that the hypothesised accidents do not cause severe damage to fuel. Design-basis accidents are analysed deterministically. No attempt is made to estimate their probabilities.

NRC staff review the analysis that the applicant performs while preparing the FSAR, and must approve the final version of the analysis that appears in the FSAR. The staff's approval is expressed in a Safety Evaluation Report (SER).

Operating experience and safety research have shown that the design-basis accidents considered in an FSAR do not provide a complete, realistic picture of the accident potential of a nuclear power station. Relevant operating experience includes accidents at the Three Mile Island station in 1979 and the Chernobyl station in 1986, both of which involved severe damage to fuel. In recognition of the potential for severe fuel damage, AEC began work in the early 1970s to develop the art of probabilistic risk assessment (PRA) for nuclear power stations. This work was continued by NRC when it took over AEC's regulatory role. The first major publication from this work was the Reactor Safety Study (WASH-1400), published in 1975.

The purpose of PRA in the context of a nuclear power station is to estimate the probabilities and other characteristics of potential sequences of events that involve severe fuel damage. Further information about PRA is provided in Section 5.2, below. NRC has conducted PRAs for a number of US nuclear power stations, as part of NRC's work to develop the art of PRA. Pursuant to NRC requirements, the licensee of each US nuclear power station has conducted for that station either a PRA or a less rigorous study known as an Individual Plant Examination (IPE).

Findings from PRA work guided the development in the late 1970s and early 1980s of new regulations and practices for emergency response planning in communities surrounding nuclear power stations. PRA findings came too late to affect the basic designs of the current generation of US nuclear power stations. Findings from PRAs done by NRC and licensees have, however, influenced the introduction of many plant modifications, together with many changes in maintenance and operating practices. NRC is moving toward increased reliance on PRA findings to guide its oversight of the operation of nuclear power stations, under the rubric "risk-based regulation".

A federal statute, the National Environmental Policy Act (NEPA), obliges each federalgovernment agency to prepare an environmental impact statement (EIS) when the agency takes an action with significant impacts on the environment. NRC has prepared many EISs pursuant to its obligations under NEPA, including EISs that describe the impacts of granting licenses to operate nuclear power stations. Beginning in the early 1980s, EISs associated with new operating licenses used PRA findings to estimate the offsite impacts of potential reactor accidents that would involve severe damage to fuel.

5.2 Probabilistic risk assessment

A large body of experience with nuclear-station PRAs has been accumulated. The bulk of this work has been done for light-water reactors. However, the basic principles apply to a PBMR.

In 1990, NRC completed a major PRA study -- NUREG-1150 -- that examined five nuclear power stations in the USA.[44] One and a half decades later, this study remains a reference point for PRA practice internationally. There has been no study of comparable size and scope in the intervening period. Refinements of PRA practice have occurred, within the framework set by NUREG-1150.

The author contributed to a detailed review of PRA practice that was published in 1989.[45] This review, which accounted for the work that led to NUREG-1150, showed that PRA findings can be very useful. It also showed that there are fundamental obstacles to estimating the overall risk posed by a nuclear power station. There are obstacles to identifying the significant event sequences, estimating their probabilities, understanding the relevant physical and chemical phenomena, and estimating radioactive releases to the environment. Gross errors in design, construction or operation, together with acts of malice or insanity, are simply ignored in PRAs. Events of this type could, however, be the major source of risk. Thus, in view of the various limits to PRA completeness and accuracy, decision makers should be very conservative in using PRA findings for regulatory purposes.

5.3 Assessing vulnerability to acts of malice or insanity

As stated in Section 5.2, PRAs ignore acts of malice or insanity, because quantitative probabilities cannot be estimated for such acts. However, the logical structure of PRA can be useful in studying the vulnerability of a nuclear power station to postulated acts of malice or insanity. For example, the explosion of a specified vehicle bomb could be postulated to occur at a certain location near a nuclear power station. Then, analytic techniques used in PRA could be applied to: (i) determine if the explosion would lead to a release of radioactive material from the station; and (ii) estimate the magnitude of the release.

NRC acknowledges that it has sponsored studies of this kind, typically at US national laboratories. The scope and pace of this work increased substantially after the attacks of

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44 NRC, 1990.

45 Hirsch et al, 1989.

11 September 2001 in New York and Washington. However, very little information about this work and its findings has been published.[46]

State and local governments and citizen groups in the USA have argued for greater openness in assessments of the vulnerability of nuclear facilities. They argue that an EIS that accounts for acts of malice or insanity can be prepared without disclosing sensitive information, and is required by law. A lawsuit calling for such an EIS is pending before the 9th Circuit of the US Court of Appeals, in connection with the licensing of an ISFSI at the site of the Diablo Canyon nuclear power station. A citizen group, Mothers for Peace, brought this suit.[47] The states of California, Massachusetts, Utah and Washington support the suit.

6. Available information about safety assessment for the proposed PBMR 6.1 The Final Environmental Impact Report

The FEIR contained a number of statements about the safety of the proposed PBMR. The most significant statements are reviewed in the remainder of Section 6.1. Findings set forth in the available portion of the SAR, which was provided as Annexure 23 to the FEIR, are discussed in Section 6.2. In making a statement about a safety issue, the FEIR generally did not cite a specific source. It implied that its statements were backed up by its Annexures, especially Annexure 23. Making un-attributed statements in this way is a practice that falls below the standards of a nuclear-facility EIS prepared by NRC or DOE.

As mentioned in Section 3.1, overheating of fuel pebbles is a particular concern for a high-temperature pebble-bed reactor. The FEIR briefly discussed this issue, stating:[48]

> "The peak temperature that could be reached in the fuel under the most extreme foreseen conditions is 1600 C. This means that the plant cannot experience thermal fuel damage. As a further safety measure, the fuel is designed to retain its density up to temperatures of over 1700 C, and will maintain its integrity at a sustained temperature of 2000 C."

This statement is imprecise and internally inconsistent. The word "cannot" in the second sentence makes a sweeping claim that lacks any technical justification. By contrast, the phrase "foreseen conditions" in the first sentence meets the standards of rational discourse, allowing the reader to ask what conditions were foreseen. However, the FEIR did not provide any answer to that question.

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46 NRC, 2004.

47 See the website: www.mothersforpeace.org.

48 FEIR, 2002, Section 2.2.6.

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A fire in the reactor core is a mechanism that could lead to severe damage to fuel. The FEIR briefly discussed this issue, stating:[49]

> "A free flow of air through the reactor is needed for a self-sustaining fire to occur. This requires the vessel head to be breached as well as a breach at the bottom of the structure and a failure of the citadel (to allow air in). The design target is such that no event can lead to this level of damage. What can occur is a graphite corrosion event caused by a single hole in the primary circuit leading to a mixing of air and helium."

This statement has the merit of disclosing that a "free flow of air through the reactor" is a condition to be feared and avoided. A reader could reasonably expect that the FEIR would discuss events that could lead to this condition, their probabilities (where predictable), and the means by which the condition could be avoided. Alternatively, a reader could expect a citation to a technical document containing such a discussion. The FEIR did not satisfy either expectation.

An accidental aircraft crash or an act of malice or insanity – a category of act that could include a deliberate aircraft crash – are potential events that deserve consideration from a safety perspective. One concern about such events is that they might create the conditions for a reactor fire. The FEIR briefly addressed aircraft crash, terrorism and sabotage, stating:[50]

> "PBMR has investigated the events of an aircraft crash {civil aircraft = Cessna 210; military aircraft = German KTA (F4 Phantom @ 227 km/hr) and commercial aircraft = Boeing 777} or terrorist attack for inclusion in the design basis and produced a methodology to mitigate the release of radioactive material into the environment. The nuclear regulatory bodies will furthermore produce a design basis for such extreme events towards the end of 2002 and this methodology will then be expanded to provide for any additional design requirements………The module building, which comprises the entire structure that houses the power plant and its ancillary systems, is designed to withstand significant external forces such as aircraft impacts and tornadoes. It is also highly resistant to explosions from potential saboteurs."

This statement raises questions, but the FEIR neither provided any answer nor cited a document that might provide an answer. Questions include: (i) what is a "methodology to mitigate the release of radioactive material"?; (ii) what is encompassed by the phrase "significant external forces"?; and (iii) what does "highly resistant" mean? Readers of this statement will also wonder if the South African nuclear regulatory bodies did produce a "design basis for such extreme events" during 2002 or subsequently, and with

49 FEIR, 2002, Section 2.2.11.

50 FEIR, 2002, Section 2.2.10.

what effect. Moreover, were such events considered by DEAT before that department issued its authorisation of the demonstration PBMR in June 2003 and, if so, what analysis was presented to DEAT?

Safety criteria set by NNR are shown in Table 4-1. The FEIR claimed, citing the SAR, that compliance with these criteria had been demonstrated. The FEIR stated:[51]

> "The result of the preliminary analysis, based on conservative assumptions in consequence assessment modelling, confirms the compliance of the PBMR Plant (268 and 302 MWt core) with the NNR safety criteria for the public. The analysis must be verified by the NNR as part of their licensing process to assure final acceptance of the results."

This claim is discussed further in Section 6.2, where the compliance findings in the FEIR and the SAR are compared.

6.2 The Safety Analysis Report

Here, the available portion of the SAR, as provided in Annexure 23 of the FEIR, is discussed. In the remainder of this report, the acronym SAR refers to the available portion.

The SAR was poorly structured and poorly written. It did not meet the standards of a typical FSAR for a nuclear facility in the USA. It is difficult to read, and its quantitative findings could not be validated without obtaining information from many other sources.

As explained in Section 5, above, an FSAR prepared in the USA examines design-basis accidents, but does not estimate their probabilities. By contrast, a US-prepared PRA examines beyond-design-basis accidents that involve severe damage to nuclear fuel, and does estimate their probabilities. FSARs and PRAs are separate documents that are prepared according to different standards. They play different roles in the licensing process.

The SAR under review here was a hybrid that combined aspects of FSAR and PRA practices used in the USA.[52] The SAR examined a set of hypothesised licensing-basis events (LBEs) that were analogous to the design-basis accidents examined in an FSAR. As will be seen below, none of the LBEs involved severe damage to nuclear fuel. PRA techniques were used to estimate the probabilities of the LBEs and the accompanying releases of radioactive material to the environment. This information was used to determine if the proposed PBMR complied with the NNR safety criteria.

51 FEIR, 2002, Section 4.20.6.

52 FEIR, 2002, Annexure 18, Section D.

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Table 6-1 shows the LBEs that were considered in the SAR. Estimated probabilities were provided in the SAR for each of the LBE variants shown in this table. These probabilities ranged from a high of 1 per 23 plant-yr (LBE-4b) to a low of 1 per 100 million plant-yr (LBE-11a).[53]

Table 6-1

Licensing-Basis Events Considered in the PBMR SAR[54]

Basic Event	Variants
• LBE-1: loss of power conversion unit	• LBE-1a: with RCCS cooling • LBE-1b: without RCS/RSS trip • LBE-1c: without RCCS cooling
• LBE-2: control rod group withdrawal	• LBE-2a/2b: with CCS/RCCS cooling
• LBE-3: primary coolant leak with isolation	• LBE-3a/3b/3c: with SBS/CCS/RCCS cooling
• LBE-4: primary coolant leak without isolation with pumpdown	• LBE-4a: small leak • LBE-4b: heat exchanger tube leak
• LBE-5: as LBE-4 without pumpdown	• LBE-5a: small leak • LBE-5b: heat exchanger tube leak
• LBE-6: primary pressure boundary (PPB) break with isolation	• LBE-6a/6b/6c: with SBS/CCS/RCCS cooling
• LBE-7: as LBE-6 without isolation • LBE-8: beyond-design-basis PPB break with isolation	• LBE-7a: medium break • LBE-8a/8b: with SBS/CCS cooling
• LBE-9: as LBE-8 without isolation	• LBE-9a: with RCCS cooling
• LBE-10: large earthquake	• LBE-10a/10b: 0.3g with SBS/CCS cooling • LBE-10c: 0.4g with intact PPB
• LBE-11: large earthquake with PPB break	• LBE-11a: 0.4g with PPB break

Radioactive releases were estimated, but not for each LBE separately. They were estimated for a set of release categories: RC-1; RCF-1; RCF-2; RCP-1; RCPF-1; and RCPF-2. This analytic approach is similar to PRA practice in the USA. Table 6-2 shows the estimated potential atmospheric releases for each release category, for three selected radionuclides. A larger set of radionuclides was considered in the SAR. The quantities shown were described in the SAR as "inventory available for release", which could conservatively be assumed to be the amount released. Also shown in Table 6-2 is the total core inventory.

53 SAR/FEIR Annexure 23, Table 6.2-7.

54 SAR/FEIR Annexure 23.

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Table 6-2

Radionuclide Inventories or Potential Releases Estimated in the PBMR SAR[55]

Inventory or Potential Release	Amounts of Selected Radionuclides (Bq)		
	Xe-133	I-131	Cs-137
Core inventory	6.1 E+17	2.7E+17	1.6E+16
RC-1	9.1 E+10	5.2E+05	1.6E+04
RCF-1 immediate	4.6E+10	2.6E+05	8.0E+03
RCF-1 delayed	7.3E+11	3.3E+11	1.9E+10
RCF-2 immediate	9.1 E+10	5.2E+05	1.6E+04
RCF-2 delayed	7.3E+11	3.3E+11	1.9E+10
RCP-1	9.1E+10	3.5E+09	8.1E+10
RCPF-1 immediate	9.1E+10	3.5E+09	8.1E+10
RCPF-1 delayed	7.3E+11	3.3E+11	1.9E+10
RCPF-2 immediate	9.1E+10	3.5E+09	8.1E+10
RCPF-2 delayed	7.3E+11	3.3E+11	1.9E+10

One sees from Table 6-2 that the largest potential releases of Xe-133 and I-131 would represent about 1 part in 1 million of the core inventory of each radionuclide.[56] This result demonstrates clearly that none of the LBEs examined in the SAR involved severe fuel damage, because xenon and iodine would be liberally released from severely damaged fuel. The largest potential releases shown in Table 6-2 for Cs-137 are puzzling, because they would represent 1 part in 160,000 of the core inventory of this radionuclide, a larger release fraction than is shown for Xe-133 or I-131.[57] One would expect, from the respective volatilities of these three species, that xenon would be released more liberally than iodine, which would in turn be released more liberally than cesium.[58] Xenon is a non-reactive noble gas whose release would not be inhibited by chemical reactions or particulate deposition along the release pathway, as could occur for cesium. This anomaly in Table 6-2 requires explanation, but none was provided in the SAR. The anomaly does not affect the conclusion that none of the LBEs involved severe fuel damage.

55 SAR/FEIR Annexure 23, Tables 6.2-8 and 6.3-2.

56 For example, the estimated RCF-1 release (immediate plus delayed) of Xe-133 would be 7.8E+11 Bq, whereas the core inventory of Xe-133 would be 6.1E+17 Bq. In this instance the release would represent 1 part in 780,000 of the core inventory.

57 For example, the estimated RCPF-1 release (immediate plus delayed) of Cs-137 would be 1.0E+11 Bq, whereas the core inventory of Cs-137 would be 1.6E+16 Bq. In this instance the release would represent 1 part in 160,000 of the core inventory.

58 The boiling-point temperatures of xenon, iodine and cesium are, respectively, about –110 C, 180 C and 680 C.

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A suspicion arises that the authors of the SAR avoided examining LBEs that would involve severe fuel damage. This suspicion gains credence from a disclosure in the SAR that event sequences involving air ingress to the reactor core were excluded from examination. As is acknowledged in the FEIR, air ingress could feed combustion, potentially leading to severe fuel damage. The disclosure occurred during the SAR's discussion of LBE-9a, an event involving a "large break" in the primary pressure boundary.[59] In this context the SAR stated:[60]

> "As for the medium size break, the possibility of air ingress will be the subject of future studies to be performed on the detail design and on the premise that unlikely events also need to be analysed."

This statement reveals three significant points. First, the SAR was performed, not for a "detail design" of PBMR, but for a design concept. Second, the SAR did not address the possibility of air ingress. Third, the authors of the SAR assumed, although no evidence to this effect was presented in the SAR, that events involving air ingress would be "unlikely". The SAR attributed to LBE-9a a probability of 1 per 220,000 plant-yr.[61] Moreover, as mentioned above, the SAR considered LBEs with estimated probabilities as low as 1 per 100 million plant-yr. Should one infer that events involving air ingress would have had estimated probabilities less than 1 per 100 million plant-yr, or less than 1 per 220,000 plant-yr? The SAR provided no answer.

Both the SAR and the FEIR presented findings that purported to demonstrate compliance with the NNR safety criteria. Table 6-3 shows these findings. The quantities shown are individual risks (peak and average) as estimated in the SAR and the FEIR, together with the NNR risk limits. The risks estimated in the SAR and the FEIR supposedly encompassed all the LBEs that were considered in the SAR.

59 The SAR defined a "large break" in the primary pressure boundary as a breach with an area greater than the cross-sectional area of a pipe with a diameter of 65 mm.

60 SAR/FEIR Annexure 23, Section 6.0.4.9.2.

61 SAR/FEIR Annexure 23, Table 6.2-7.

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Table 6-3

Comparison of Findings in the FEIR and the SAR Regarding Compliance with NNR Risk Limits for the PBMR

Risk Limits and Compliance Findings (Category C events)	Risk to the Public (Risk = expected number of fatalities per yr across a population)	
	Peak Individual Risk	Average Risk
NNR risk limits for the PBMR[62]	5.0E-06	1.0E-08
Compliance findings in the FEIR[63]	9.7E-10	4.6E-13
Compliance findings in the SAR 64	5.8E-08	6.7E-11

One notices that the risk estimates shown in the FEIR were two orders of magnitude lower than the risk estimates shown in the SAR. Yet, the FEIR cited the SAR as the source of its estimates. This discrepancy occurred in a context where each document summarized the findings of a large body of analysis, in order to demonstrate regulatory compliance. These findings should be identical. The discrepancy between them indicates an extraordinary degree of carelessness in the preparation of one or both documents. No confidence can be placed in a document exhibiting such a low standard of preparation.

Table 6-3 shows that the risks estimated in the SAR were two orders of magnitude below the NNR risk limits. However, Table 6-2 shows that the releases of radionuclides underlying these risk estimates were five or more orders of magnitude lower than the core inventories of these radionuclides. A comparison of these tables strongly suggests that inclusion in the SAR of LBEs involving severe fuel damage would have led to risk estimates substantially higher than the NNR risk limits.

62 FEIR, 2002, Table 1.

63 FEIR, 2002, Section 4.20.5.

64 SAR/FEIR Annexure 23, Sections 6.0.10.4 and 6.0.10.4.1.

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6.3 Information from other sources

Some information about safety assessment of the proposed PBMR was available from sources other than the FEIR and SAR. For example, a presentation by PBMR Ltd. to DOE disclosed a finding that a Boeing 777 aircraft striking the PBMR would penetrate the plant's outer structure.[65] This finding is significant in view of the potential for a penetrating aircraft to cause a breach in the primary pressure boundary.

A presentation to NRC argued that water ingress to the PBMR core would be precluded during normal operation, because the water in the secondary cooling system would be at a lower pressure than the helium coolant. The presentation noted, however, that helium pressure would be reduced during maintenance outages. 66

The same presentation to NRC addressed the potential for air ingress to the core in the event of a large break in the primary pressure boundary, stating: 67

> "Depending on the location of the large break, two-way flow is conceivable and air transport to and through the reactor core is possible. Assuming that the total inventory of air in the building passes through the reactor, a fraction of <0.01 of the graphite will be oxidized."

This statement assumed that the postulated breach in the primary pressure boundary would occur without any breach in the building. Combustion would then be limited by the amount of air in the building. That assumption would not be valid if both the pressure boundary and the building were breached by the same event, such as an aircraft crash or an attack with explosive devices. Thus, it seems clear that external insults have the potential to initiate a self-sustaining fire in the reactor.

7. The status of knowledge about safety of the proposed PBMR 7.1 Current knowledge

Preceding sections of this report show that currently available knowledge provides no useful guidance to a South African decision maker who is concerned about the safety of the proposed PBMR. The FEIR and SAR were poor-quality documents that provided, by their own admission, an incomplete picture of safety. Moreover, the safety findings presented in these documents were for a design concept, not a design that was ready to be built.

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67 Koster, undated, page 10.

65 Matzner, 2003a.

66 Koster, undated, pp 6-7.

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A presentation by a PBMR Ltd. representative at an October 2004 NRC conference showed that the proposed PBMR will remain a design concept for some time.[68] The presentation described test programs that are scheduled to run through 2006, in areas such as: (i) validation of helium flow codes; (ii) validation of heat transfer coefficients in a pebble bed; and (iii) performance testing of components. Preparation of a design that is ready to be built must await the completion of such programs.

7.2 Actions needed to develop improved knowledge

To develop a thorough understanding of the safety of the proposed PBMR, three major steps would be necessary. Step 1 would be to conduct a set of empirical and theoretical investigations to improve understanding of physical and chemical phenomena that relate to fuel damage. One issue that requires better understanding is the role of hightemperature radiation effects in graphite, as discussed by Dana Powers. Other issues to be better understood include: (i) the set of conditions that could lead to a self-sustaining fire in the reactor core; and (ii) the release of radioactive material in the event of a fire.

If and when a final design of the proposed PBMR emerges, the improved scientific knowledge gained in Step 1 would be used in a comprehensive safety assessment of the design, which would constitute Step 2. The safety assessment would examine the full range of potentially hazardous events, including events whose probabilities are difficult or impossible to estimate. Acts of malice or insanity would fall into this category. Analyses would be published except where they contain information that is sensitive from a security perspective. In those instances, public stakeholders would be asked to nominate independent experts who would review the analyses under protective order. Independent review would enhance the quality and credibility of the analyses.

Assuming for the moment that NNR continues to employ risk-based safety criteria, Step 3 would translate the findings of Step 2 – the safety assessment – into findings of risk. For event sequences initiated by acts of malice or insanity, this translation poses a problem, because the quantitative probabilities of the initiating acts cannot be estimated. That problem could be addressed by engaging stakeholders in democratic processes that would, for the purpose of estimating risk, assign probabilities to postulated acts of malice or insanity.

68 Wallace, 2004.

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8. Conclusions

Major conclusions are as follows:

Conclusion 1: Statements made in the FEIR and SAR about the safety of the proposed PBMR were based on the examination of a design concept, not a design that was ready for construction. The design changed radically after the FEIR was completed in October 2002, with significant implications for safety.

Conclusion 2: The FEIR and SAR were poorly written, badly constructed documents that did not meet the standards of analogous documents in the USA. Statements made in the FEIR about safety were generally not supported by analysis or by citation of another document. The quantitative findings presented in the SAR could not be validated without obtaining information from many other sources.

Conclusion 3: None of the hypothesised licensing-basis events examined in the SAR involved severe damage to nuclear fuel. Events that could cause severe fuel damage were arbitrarily excluded from examination, with no evidence being presented in the SAR regarding their probabilities. Examination of such events was deferred to "future" studies.

Conclusion 4: Ingress of air to the reactor vessel of the proposed PBMR could feed combustion of graphite in the core, leading to severe fuel damage. Given the plant design revealed on the PBMR Ltd. website in late November 2004, there are potential events that could breach the primary pressure boundary and cause a flow of air through the reactor vessel, leading to sustained combustion of graphite. These events include accidental or deliberate aircraft impact and the use of explosive devices.

Conclusion 5: The FEIR stated that the proposed PBMR "is designed to withstand significant external forces such as aircraft impacts and tornadoes" and "is also highly resistant to explosions from potential saboteurs." This statement implied that accidental or deliberate aircraft impact and the use of explosive devices should be examined in a safety analysis, but such events were not examined in the SAR.

Conclusion 6: Findings of overall risk were presented in the FEIR and SAR, purporting to show compliance with the NNR risk limits. The individual risk findings presented in the FEIR were two orders of magnitude below those presented in the SAR, demonstrating extraordinary carelessness in the preparation of one or both documents. According to the SAR, individual risks were two orders of magnitude below the NNR risk limits, indicating compliance. It is likely, however, that inclusion in the SAR of licensing-basis events involving severe fuel damage would have led to risk estimates substantially higher than the NNR risk limits.

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Conclusion 7: Neither the FEIR nor the SAR can provide, in the versions reviewed here, any useful guidance to a decision maker who is concerned about the risk posed by the proposed PBMR.

Conclusion 8: A risk-based approach to licensing, as employed by NNR, can hinder the consideration of acts of malice or insanity because quantitative probabilities cannot be estimated for such acts. This problem could be addressed by assigning probabilities to postulated acts of malice or insanity through democratic processes of stakeholder engagement.

Conclusion 9: Design options are available, or could be developed, that could potentially reduce the risk posed by a PBMR. Such options include improved fuel pebbles and core structures, underground siting, a closed containment system, a filtered confinement system, or combinations of these and other options. Each option would involve some additional cost.

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8.8.3 SAFETY OF THE PROPOSED SOUTH AFRICAN PEBBLE BED MODULAR REACTOR:

The Economic Impact of the Proposed Demonstration Plant for the Pebble Bed Modular Reactor Design

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1. Executive Summary

1.1 The Issues

This report examines the economic case put forward in the Final Environmental Impact Report (FEIR) submitted in respect of the application by Eskom to build a Demonstration Plant at the Koeberg site in the Western Cape, using the Pebble Bed Modular Reactor (PBMR) nuclear technology being developed in South Africa. The analysis of the economic impacts is required under the terms of the National Environmental Management Act.

In June 2003, the Director-General, Chippy Olver, of the Department of Environmental Affairs and Tourism (DEAT) approved (a positive 'Record of Decision' (ROD)) the Eskom's Environmental Impact Assessment for the building of a demonstration PBMR and an associated fuel manufacturing plant. Earthlife Africa (ELA) launched a High Court application in Cape Town, which sought to review and set aside this ROD.

On January 26 2005, ELA obtained a judgement in the High Court in the Cape Provincial Division which set aside the PBMR's authorisation. By August 2005, the process to authorise the demonstration PBMR had not been re-opened.

The report focuses especially on the life cycle costs of the Demonstration Plant and any commercial successor plants. In isolation, the Demonstration Plant will inevitably be a heavily loss-making project, but it is hoped by the promoters of the project that profits from an export-led programme of commercial units will more than pay for these losses. It is therefore necessary to analyse not only at the economics of the Demonstration Plant, but also the prospects for commercial sales to assess the economic case for the Demonstration Plant.

Section 2(3) of the National Environmental Management Act stipulates that the state should ensure that development must be socially, environmentally and economically sustainable[1]; while section 2(4)(i) requires that "the social, economic and environmental impacts of activities, including disadvantages and benefits must be considered, assessed and evaluated and decisions must be appropriate in the light of such consideration and assessment".

The main publicly available sources of information on the PBMR programme are:

- The Final Environment Impact Report (FEIR) (PBMR, 2002b) prepared by the PBMR EIA Consortium for the Applicant, Eskom;
- The Detailed Feasibility Report or DFR (PBMR, 2002a) prepared by PBMR (Pty) Ltd; and
- The Register of Comments and Responses on Draft EIRs (Register of Comments, 2002) published in June 2002, which contains responses by the consultants to public comments to the Applicant, Eskom, on the draft Economic Impact Assessment "DEIR".

The main factors that must be considered in the economic analysis of the Demonstration Plant are:

- The partners in the PBMR venture, especially foreign companies;
- Safety licensing;

[1] principle 2(3)

- Construction cost and cost of other new facilities required;
- The cost of capital;
- The plant's maximum electrical output;
- Operating performance especially reliability;
- Operations & maintenance cost, including fuel supply and spent fuel disposal;
- Decommissioning cost; and
- Operating life.

Forecasts of the economic parameters are also required to assess the prospects for the commercial programme. In addition, a world market evaluation is required. The documentation provided in the FEIR provides almost none of the information required to assess the economic sustainability of the PBMR Demonstration Plant. To consider this, it is necessary to look at the life-cycle costs of the Demonstration Plant. However, given that by its nature, a demonstration plant will not be economically viable by itself, it is necessary to look at who will bear the uneconomic costs of the plant and also what the prospects of success for commercial PBMR units are.

1.2 Conclusions

1.2.1 The Demonstration Plant

Conclusion 1: Regardless of its success or otherwise, the Demonstration Plant will leave a substantial liability that will fall on South African public funds caused by the need to decommission the plant and the associated facilities, and to pay for the disposal of the spent fuel. The FEIR and the DFR do not quantify these liabilities, providing no information on spent fuel disposal and no usable information on expected decommissioning cost. However, experience in other countries suggests that decommissioning costs could be of the same order of magnitude as construction costs.

Conclusion 2: Since details of the project were made public in 1998, costs of the Demonstration Plant have escalated by a factor of more than seven. The project leadtime has slipped so that it is now apparently further away from commercial exploitation than it was in 1998 when commercial orders were forecast to take place from 2003. Now, seven years on, commercial orders are not forecast for about ten years. This shows that the developers failed to understand the scale and nature of their task. There is still considerable scope in the next phase for further cost escalation and delay due to changes to the design and construction problems. The developers' poor record to date gives little confidence in their ability to control costs and time schedules in the next, more expensive phase.

Conclusion 3: Forecasts of other economic parameters, such as operating performance, operating cost and decommissioning cost have not been updated since 1998 and appear implausibly optimistic. It is understandable that developers of a project have an optimistic view of the project's prospects – 'appraisal optimism'. However, investment decisions should be taken on the basis of sober, unbiased judgements of the most likely outcomes, not the views of the project's promoters.

Conclusion 4: PBMR (Pty) Ltd successfully diversified some of the risk away from the South African public for the feasibility phase with foreign partners, Exelon and BNFL Ltd, sharing the costs. However, the cost of this phase (about R2bn) was far more than forecast and the absolute amount paid for by the South African public was not reduced. PBMR (Pty) Ltd has spoken optimistically over the past three years about the prospects of recruiting new partners to replace Exelon and BNFL (if as seems likely it cannot participate), but nothing has come of these negotiations. Until there is solid evidence of new partners being bought in, it must be assumed that the cost of the demonstration phase will fall substantially on the South African public, through Eskom, IDC, or direct government subsidies.

1.2.2 The commercial programme

Conclusion 5. PBMR (Pty) Ltd's analysis of the world market for PBMRs is simplistic, taking no account of any of the commercial or political factors that would apply in key export markets. A particular concern is finance for export orders. This is an important issue for developing countries, which are likely to account for a significant proportion of the forecast orders. Such countries frequently have difficulty financing large investments. The World Bank and most other International Financial Institutions do not provide finance for nuclear investments. The South African PBMR could face strong competition from other types of high temperature reactor, notably a very similar Chinese design and models offered by Areva and the US company, General Atomics. Until a rigorous market analysis has been carried out and subjected to independent scrutiny, and arrangements for helping finance export orders made explicit, PBMR (Pty) Ltd's assumptions on the likely world market have no basis.

Conclusion 6. Pressure is mounting on Eskom to commit to buy large numbers (24) of commercial units even before the technology has been technically and economically proven at a cost in excess of R25bn. Eskom appears, rightly, to be holding to its position of only buying it if the PBMR is the cheapest option available, something that will not be known until the Demonstration plant is in service and has operated for some time. If Eskom is required to make such an advance commitment, it could be forced to purchase uneconomic plants, raising the price of power to consumers, and adversely affecting public welfare and the competitiveness of the South African economy.

Conclusion 7. The future of Eskom is uncertain. The South African government has been considering reforms to Eskom for a number of years, including its privatisation and its break-up into competing units. There can be no guarantee that in 2013 or later, when the first commercial orders for a PBMR might be placed that Eskom will exist in any recognisable form, much less one that can be obliged to order a particular type of power plant, especially if it does not represent the best commercial option.

1.2.3 Overall conclusions

Conclusion 8: The PBMR project is a highly risky venture. The feasibility phase has cost more than R2bn, about two thirds of which has been paid by South African public money. Despite this expenditure, there is still ample scope for the project to fail. The next phase will require a much higher level of expenditure, at least R14.5bn, with more than half of this again coming from the South African public. If the project fails, there will be significant consequences for the South African public either through higher electricity prices (if Eskom is forced to bear much of the risk) or through taxation if the government has to write-off the costs.

Conclusion 9: The National Environmental Management Act (NEMA) requires developers to demonstrate that their projects are economically sustainable. The FEIR does not provide the data necessary to make such a judgement. This information strongly suggests there is a high risk that the project will not be economically sustainable. On the available evidence, the project does not meet the requirements of the NEMA and the applicants, Eskom, should not be given approval.

Conclusion 10: The current high fossil fuel prices and the measures to reduce greenhouse gas emissions seem to give a new impetus to generation technologies that do not use fossil fuels. However, it should be remembered that previous oil price spikes (1974 and 1980) were short-lived and resulted in little nuclear investment apart from in France. Investors are unlikely to make multi-million dollar investments in new nuclear power plants on the basis of a short-term oil price spike which could have disappeared long before a nuclear plant could be brought on-line. On greenhouse gas emissions, nuclear power faces competition from renewable technologies and energy efficiency measures, options that generally do not encounter the public acceptability problems that nuclear power suffers from.

2. Introduction

This report examines the economic case for building a Demonstration Plant at the Koeberg site in the Western Cape, using the Pebble Bed Modular Reactor (PBMR) nuclear technology being developed in South Africa. An analysis of economic impacts is required under the terms of the National Environmental Management Act. The report focuses especially on the life cycle costs of the Demonstration Plant and any commercial successor plants. In isolation, the Demonstration Plant will inevitably be a heavily loss-making project, but it is hoped by the promoters of the project that profits from an export-led programme of commercial units will more than pay for these losses. It is therefore necessary to analyse not only at the economics of the Demonstration Plant, but also the prospects for commercial sales to assess the economic case for the Demonstration Plant.

This report covers most of the main costs involved in the operation of a nuclear power plant. This report does not cover the costs of radioactive waste disposal, disposal of spent nuclear fuel, nor does it consider the cost of a catastrophic accident, although these factors are clearly important.

It also does not cover the cost of competing fossil fuel technologies. However, it should be noted that while the current high fossil fuel prices and the measures to reduce greenhouse gas emissions seem to give a new impetus to generation technologies that do not use fossil fuels, this may not lead to a revival in nuclear ordering. It should be remembered that previous oil price spikes (1974 and 1980) were short-lived and resulted in little nuclear expansion apart from in France. Investors are unlikely to make multi-million dollar investments in new nuclear power plants on the basis of a short-term oil price spike which could have disappeared long before a nuclear plant could be brought on-line. On greenhouse gas emissions, nuclear power faces competition from renewable technologies and energy efficiency measures, options that generally do not encounter the public acceptability problems that nuclear power suffers from.

3. The legal context

The analysis of the economic impacts is required under the terms of the National Environmental Management Act. Section 2(3) of the Act stipulates that the state should ensure that development must be socially, environmentally and economically sustainable[2]; while section 2(4)(i) requires that "the social, economic and environmental impacts of activities, including disadvantages and benefits must be considered, assessed and evaluated and decisions must be appropriate in the light of such consideration and assessment". Such decisions must moreover be taken in an open and transparent manner and access to information must be provided in accordance with the law[3]. The assessment of environmental impacts in terms of NEMA must include the assessment of potential impact on the socio economic conditions and the assessment of the significance of that potential impact[4].

Paragraph 7.4.4 of the Scoping Report for the proposed PBMR set out the issues and concerns to be studied for the purposes of the EIA under the heading 'Economic aspects' as follows:

- The economic potential of a local based nuclear industry for local applicatory (sic) and export, should the plant prove its techno economic viability;
- Impact on eco-tourism in the region around Koeberg, i.e. 50km radius;
- Impact on supply side management based on the assumption that the plant is viable.

The issue of life cycle costing was added by the DEAT after receipt of the plan of study for scoping.[5]

The main documents backing the case for the Demonstration Plant are the Detailed Feasibility Report or DFR (PBMR, 2002a) and the Final Environment Impact Report or FEIR (PBMR, 2002b).

3.1 Economic sustainability

The National Environmental Management Act provides no guidance on what constitutes ‘economic sustainability’. For a commercial project, that is, one that does not require (public) subsidies, economic sustainability would be relatively easy to define. It would require that the facility being built would have a high probability of being profitable. However, for a demonstration plant, the issue is more difficult to define. Clearly, the PBMR Demonstration Plant will not be an economic source of electricity on a full-cost basis, that is, including the cost of construction. It is therefore necessary to examine who will pay for the uneconomic cost of construction of the plant. It may not be an economic source of power even on a marginal cost basis, that is, revenues from the sales of the electricity it produces may not even cover the running cost of the plant. It is therefore necessary to examine who will be liable for the additional uneconomic operating costs.

However, the Demonstration Plant can only be properly evaluated in the context of the commercial programme of reactor sales that it is hoped will follow from the Demonstration Plant. This is clearly acknowledged in the conclusions of the DFR (PBMR (Pty) Ltd, 2002a, p 62), which state:

In all scenarios, the PBMR is predicted to have a non-negligible effect on the South African economy. The macro-economic impact of building the demonstration plant only is small. The key benefit to the economy will come from the commercialization and sale of the PBMR on the international market. In these more optimistic scenarios, this impact is extreme, adding thousands of jobs a year and billions of South African rands to the GDP. Moreover, a larger portion of this money is anticipated to flow to the lower income groups than the average for the manufacturing sector. The results of this study indicate that the PBMR programme can add sufficient value to South Africa to offset the risks associated with building this first-of-a-kind nuclear reactor on South African soil.

Despite this, in the Register of Comments and Responses on DEIRs, the Applicant’s consultants continually state (in 15 responses): ‘the present EIA is limited to a single demonstration module PBMR’ in response to questions about the overall programme.

This report therefore examines both the economic impact of the full life-cycle costs of the Demonstration Plant and also the likelihood that the Demonstration Plant would lead to a successful programme of sales of commercial PBMR units.

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principle 2(3)

3 Principle 2(4)(k)

4 NEMA section 24(7)(b)

5 DEAT Director-General’s letter to the EIA consortium dated 2/5/01

To evaluate the life-cycle costs of the Demonstration Plant, it is necessary to forecast:

- Construction cost and cost of other new facilities required;
- The cost of capital;
- The plant's maximum electrical output;
- Operating performance especially reliability;
- Operations & maintenance cost, including fuel supply and spent fuel disposal;
- Decommissioning cost; and
- Operating life.

The FEIR and the DFR do not provide clear forecasts of any of these parameters.

For the commercial programme, it is necessary to evaluate the competitiveness of the PBMR against other electricity generation technologies. This would require forecasts of all the above parameters. A detailed and convincing market analysis is also required, especially for a controversial technology like nuclear power, where it may not be sufficient to provide an economically competitive product if it is not politically acceptable. Again, no serious analysis of potential markets is provided.

3.2 Provision of information

The National Environmental Management Act states that 'access to information must be provided in accordance with the law'. In its Demonstration Feasibility Report, PBMR (Pty) Ltd (PBMR (Pty) Ltd, 2002a, pp 48-49) pays lip service to this requirement. It states:

> Since nuclear has traditionally been associated with a cloud of secrecy, preconceived notions and inaccurate reporting, the overriding philosophy in PBMRCo's Public Relations philosophy has been one of open and honest communication.
>
> This approach has been to:
>
> - share as much non-proprietary information as possible with all stakeholders;
> - provide proactive awareness using available media;
> - within reasonable limits, react swiftly and professionally to enquiries from the media and other interested and affected parties;
> - follow a general approach of collaboration rather than confrontation;
> - demonstrate a readiness to listen to, take note of and act upon the legitimate concerns of interested and affected parties;
> - communicate the benefits of the project and deal constructively with any perceived negative issues; and
> - confirm Eskom's and PBMR's commitment to a transparent EIA in which all interested and affected parties are encouraged to participate.
>
> The programme is ongoing and will continue beyond the demonstration phase of the PBMR.

The DFR, the FEIR and the more general flow of information on the programme to the South African public show the hollowness of this claim. Almost none of the economic information needed to evaluate the Demonstration Plant or the PBMR programme in general has been provided. The most recent set of data was written (for a British audience) five years ago (Nicholls, 2000). Most of the data used in this report has been gleaned from international sources, mainly Nucleonics Week, which is an authoritative trade journal, but which has a negligible circulation in South Africa. There is little evidence that PBMR (Pty) Ltd has provided: 'proactive awareness using available media', particularly for the South African public. This is especially reprehensible given that PBMR (Pty) Ltd and Eskom expect the South African public to be the major financial underwriter for the project.

3.3 Earthlife Africa's legal challenge

In June 2003, the Director-General, Chippy Olver, of the Department of Environmental Affairs and Tourism (DEAT) approved (gave a positive 'Record of Decision' (ROD)) Eskom's Environmental Impact Assessment for the building of a demonstration PBMR and an associated fuel manufacturing plant. Earthlife Africa (ELA) launched a High Court application in Cape Town, which sought to review and set aside this ROD.

On January 26 2005, ELA obtained a judgement in the High Court in the Cape Provincial Division which set aside the PBMR's authorisation. The basis of the judgement was that the ROD granting the authorisation was fatally flawed in that ELA had not been given an opportunity to make submissions to the DEAT on the FEIR even though it differed materially from the earlier report on which it was given a chance to comment. The Director-General made his decision without having heard ELA and without even being aware of the nature and substance of ELA's submission. The judge ordered that ELA be afforded an opportunity to address further written submissions on the FEIR. As of August 2005, the process to authorise the demonstration PBMR had not been re-opened.

4. The PBMR project

The Pebble Bed Modular Reactor (PBMR) is a new design of nuclear power plant developed from a German model built only as a demonstration plant in Germany, THTR 300, which was in service from 1983-89.

The main publicly available sources of information on the PBMR programme are the Detailed Feasibility Report or DFR (PBMR, 2002a) and the Final Environment Impact Report or FEIR (PBMR, 2002b). Also important is the Register of Comments and Responses on Draft EIRs (Register of Comments, 2002) published in June 2002, which contains responses to public comments on the draft Economic Impact Assessment. Note that the FEIR was substantially drafted before the withdrawal of Exelon. It contains a short section on the withdrawal of one of the partners in the project, the US utility, Exelon, but its sales projections are still based on Exelon buying the first 10 commercial units from 2006 onwards (PBMR, 2002b, p 194) even though it was by then clear that Exelon's commitment had lapsed with its withdrawal from the project. The most comprehensive independent review of the economic prospects for the PBMR programme was published by Auf der Heyde & Thomas (Auf der Heyde & Thomas, 2002). An earlier response by the Legal Resources Centre drew partly on this paper and some, mostly inadequate answers were provided by in a Register of Comments (Register of Comments, 2002).

4.1 The technology

The South African PBMR differs markedly from the designs of nuclear power plant that are dominant worldwide, the Pressurised Water Reactor (PWR, the type operating at the Koeberg site in the Western Cape, where Eskom expects to build the Demonstration Plant) and the Boiling Water Reactor (BWR) in five important respects:

- Coolant. The energy from a PWR or BWR is transferred from the nuclear core to the turbine (the equipment that transforms the heat energy into electricity) using water. The turbine, similar to that used in a conventional coal plant, is driven by steam. In a PBMR, the coolant is helium gas, which drives a gas turbine (similar to a jet aircraft engine);[6]
- Moderator. The moderator, the medium that ensures the energy of the nuclear reaction is efficiently exploited, is water in PWRs and BWRs, whereas it is solid graphite (a form of carbon) in a PBMR;

- Fuelling. In a PWR or BWR, the nuclear fuel is enriched (the proportion of the 'fissile' uranium isotope) from about 0.7 per cent in naturally occurring uranium to about 3.5 per cent. The fuel is in the form of uranium oxide fuel rods and the reactor must be shut down about once a year for about a third of the old fuel rods to be replaced with fresh fuel. In a PBMR, the fuel is expected to be enriched to about 8 per cent and is in the form of 'pebbles' the size of a snooker ball. These are continuously fed into the top of the reactor vessel and replace 'spent' pebbles, which are removed from the bottom of the reactor vessel;
- Size. A typical PWR or BWR produces an output of about 1000MW (1MW is equivalent to 1 million kilowatts), whereas an individual PBMR unit is expected to produce about 110-165MW;
- Modularity. The PBMR is conceived as modular and its economics are expected to be optimal if built in a group of 8-10 units, sharing some facilities such as the control room. PWRs and BWRs are generally built as individual self-sufficient units or in pairs.

All the major nuclear design countries have pursued high temperature gas-cooled reactor (HTGR) designs (those that use graphite as moderator and helium as coolant although not necessarily the other distinctive features of the PBMR) usually dating back to the 1950s, but none has resulted in a design that was built on a commercial basis. HTGR programmes existed in UK, France and Germany, but were abandoned, while research in Japan and USA continues only at a low level.

The PBMR is based on a German design of plant offered by a company called HTR. This company was based on an amalgamation of work carried out by two mainly German based companies, Siemens and ABB. ABB had built a demonstration plant, THTR 300, which achieved criticality (a sustained nuclear chain reaction) in 1983, but, after a very problematic history during which it operated for the equivalent of only about 30 full-power days, it was formally closed in 1989 because of a mixture of technical and economic issues. THTR 300 was somewhat larger than the PBMR (about 300MW) and also used a conventional steam turbine rather than a gas turbine (the coolant helium passed through a secondary circuit in which the energy was transferred to water) to generate the electricity. However, the 'pebble' fuel design was essentially the same as that expected to be used in the PBMR.

The PBMR has been under development in South Africa since about 1993, although it was not until 1998 that these efforts were publicised. Eskom formally took a license with HTR for pebble bed technology in 1999. The terms of this technology license have not been made public and the technology license is not discussed in the FEIR or the DFS. However, typically, a technology license would give the licensor a fee based on units sold, some rights over the new technology, and over the markets in which it could be sold.

It was expected in 1998 that work on construction of a demonstration plant would begin in 1999 and be complete before 2003 to allow commercial orders soon after (see D R Nicholls, 2000). Eskom projected that the market would be about 30 units per year, about 20 of which would be exported. In April 2000, the South African Cabinet approved Eskom's continuation and completion of a Detailed Feasibility Study (DFS) on the proposed PBMR. Subsequently, Eskom formed a company, PBMR (Pty) Ltd to develop and market the technology. PBMR (Pty) Ltd foresaw four phases: research and development (already then completed), feasibility study (then underway), demonstration, and commercial application.

Since then, the timetable has slipped so that the Demonstration Plant, to be built at Koeberg, is not now expected to be in service before 2010 at the earliest.

[6] Note that the Chinese version of the PBMR may use a steam cycle, at least for the initial units, in which the helium coolant passes through a heat exchanger in which steam is produced, which would drive a conventional steam turbine.

4.2 The commercial arrangements

The PBMR was developed within Eskom until June 2000. Then British Nuclear Fuels Limited (BNFL), a UK government owned company active in all major aspects of nuclear power from reactor sales and servicing, fuel manufacture, wasted disposal etc became the first foreign investor in the project taking a 22.5 per cent stake in the venture. They were quickly followed by the US electric utility based in Philadelphia, PECO, taking 12.5 per cent of the venture. Subsequently PECO merged with another utility, Commonwealth Edison, to become Exelon. The South African governmentowned Industrial Development Corporation (IDC) took 25 per cent of the venture leaving 40 per cent with Eskom of which 10 per cent was reserved for an Economic Empowerment Entity, but this has not been taken up. The agreement left all the shares in PBMR (Pty) Ltd in the hands of Eskom Enterprises, a subsidiary of Eskom, but committed the partners to provide funding in proportion to their stakes in the business to the end of the feasibility phase. Then, the company would be reconstituted in preparation for the demonstration phase with the partners entitled to take a stake in the new company equal to their percentage contribution to the feasibility phase. The costs of development would be recovered as royalties from reactor sales. It is not clear whether partners that did not take up their shareholding in the reconstituted company would be able to recover their share of the development costs, for example, by selling their rights to a third party.

David Nicholls, formerly PBMR project manger in Eskom, was the first Chief Executive Officer of PBMR (Pty) Ltd. He was succeeded in this post by Nic Terblanche, also previously with Eskom, when Nicholls moved back to Eskom in August 2003. In August 2004, Jaco Kriek from IDC replaced Terblanche and Alastair Ruiters of the South African Department of Trade & Industry became the Chairman.

4.3 The cost of development

The DFR (PBMR (Pty) Ltd, 2002a, p 19) reported that costs of development to end April 2001 were R437m. with a further R80m approved in May 2001. It stated that further funding had been approved in December 2001, but the sum was not specified. In the FEIR, PBMR (Pty) Ltd (PBMR (Pty) Ltd, 2002b, p 200) said that the total amount that had been spent on the PBMR to July 2002 was R684.2m and forecast that the total amount to take the project to the end of the feasibility stage (then expected at end 2002) would be R1013m of which R461m would be provided by Eskom.

However, in August 2003, Terblanche[7] stated that PBMR development had cost R1.5bn of which R550m had come from Eskom, a total of R240m from IDC and BNFL with the balance coming from Exelon. BNFL and IDC appear to have spent much less than they were required to, Exelon spent significantly more and Eskom a little less. The additional money had been spent on further design work and letting a number of design and supply contracts. Since then, expenditure has continued on a short-term basis but it is not clear who has funded it, nor what the total development costs to date are. Terblanche[8] indicated that monthly costs were ‘a lot more than’ R50m even at the reduced level of activity that had prevailed since the completion of the feasibility phase. Assuming costs were just R50m per month this would mean the development costs to the end of October 2004 were in excess of R2bn. In October 2004, the government announced support of up to R500m for the PBMR venture to pay for running costs for the company and design development costs (turbine development and construction of a helium test facility were mentioned as particular requirements).[9]

[7] Nucleonics Week August 28, 2003, p 1.

[8] Financial Mail, March 26, 2004, p 14.

[9] Business Day, October 29, 2004 and Nuclear News November 2004 / Business News N°51 / 04

However, while this announcement was interpreted as government backing for the demonstration phase, these costs are most appropriately categorised as part of the feasibility phase. In February 2005, when the government's budget was announced, the government support had increased from R500m to R600m. It is not clear whether this government money was a loan or a grant or whether it represented an increase in the government's stake in the PBMR project. It remains uncertain who will fund the demonstration phase.

Overall, substantial sums have been spent on developing the PBMR, about two thirds of which was South African public money. However, the next phase of demonstration will take the level of spending to a far higher level, requiring at least seven times as much money as has been spent so far.

5. The economic aspects

For commercial facilities, those able to survive on the commercial income received, the issue of economic impact is relatively easily bounded. But, for the Demonstration Plant, which by its nature will not be profitable in isolation, the issues are broader and the data subject to a much greater level of uncertainty because of the technological immaturity of the plant design. To evaluate the economic impact of the PBMR Demonstration Plant it is useful to divide the analysis into the costs, risks and benefits of the Demonstration Plant and those involved with the commercial programme.

The main factors that must be considered in the economic analysis of the Demonstration Plant are:

- The partners, especially foreign companies;
- Safety licensing;
- Construction cost and cost of other new facilities required;
- The cost of capital;
- The plant's maximum electrical output;
- Operating performance especially reliability;
- Operations & maintenance cost, including fuel supply and spent fuel disposal;
- Decommissioning cost; and
- Operating life.

Since the Demonstration Plant will not be an economic source of power, it is necessary to estimate who will bear the losses that the Demonstration Plant will incur: taxpayers, electricity consumers or private investors? As well as estimating the value of the economic parameters it is essential to try to estimate the risks that economic performance will be worse than forecast and again, who will be liable for the costs of worse than expected performance. Of course, it is theoretically possible that performance will be better than forecast, but the history of nuclear power contains very few examples of plants that were built ahead of schedule, or with lower than forecast costs, or better than expected reliability.

The analysis for the commercial programme must be much wider ranging and include:

- The economic competitiveness of the PBMR compared to other electricity generation technologies in different markets;
- The likely world market for the PBMR;
- The South African market for PBMRs

None of these factors can be estimated with any precision at this stage and the analysis of risk and who will bear the cost of poorer than expected performance is particularly important.

Despite the legal requirement to demonstrate the 'economic sustainability' of the project, the PBMR's FEIR (PBMR (Pty) Ltd, 2002b, pp 144-202) contains only about 60 pages out of a total of nearly 500 pages on the economic aspects. Of these 60 pages, most of them are devoted to impacts on spatial planning, tourism and supply side management, with only about 10 pages explicitly covering the PBMR. Little of the information needed to assess the costs of the Demonstration Plant and the prospects of success of the subsequent programme is provided and it is necessary to look at other sources to try to glean the necessary information.

It is particularly regrettable that a report by an international Panel of Experts commissioned by the Department of Minerals & Energy (DME) to review the overall project has not been made public in any form. The report was expected to inform a Cabinet decision on the PBMR project. This Panel of fifteen international experts reviewed the overall case for the PBMR as presented in the Detailed Feasibility Study in 2001/02. They were given full access to all information they required and submitted a report to the DME in early 2002. The author of this paper was one of two experts assigned the task of reviewing the economic case.

However, the Panel members were required to promise not to disclose any information they learnt through their meetings and their report has not been made public. All the information presented here is available in publicly accessible sources. Panel members were assured by the DME that Eskom and PBMR (Pty) Ltd would not have access to their report, so it would appear that the only people that have seen the report are DME officials and Cabinet Members. PBMR (Pty) Ltd and Eskom cannot therefore claim that any of their evidence in the FEIR was endorsed by the DME review panel. Note that the DEAT also established a Review Panel to review the Draft Scoping Report for the EIR. The DEAT Panel was entirely separate from the DME's Panel, but like the DME's Panel, its report does not appear to have been made public.

It is difficult to know how the South African public can participate meaningfully in a decision on the PBMR if they do not have access to the most authoritative independent report on the project, that of the DME's International Panel. This need for information is strong because South African taxpayers and electricity consumers have funded most of the development work so far, and it seems likely they will bear an even higher proportion of the much greater costs and risks of building the Demonstration Plant. If the project proves a failure in the long-term, it will be the South African public that will end up bearing much of the cost.

There may, in some instances, be a case to withhold information contained in the Panel report or required to demonstrate the economic sustainability of the PBMR project from the public on grounds of commercial confidentiality. However, since the public is providing much of the funds the presumption should be that all information should be released and the onus should be on PBMR (Pty) Ltd to argue the case specifically where it does believe information should be withheld.

6. Demonstration Plant costs

6.1 The partners

Introducing partners to the venture has three main potential advantages:

- Sharing of development costs;
- Introduction of new skills; and
- Access to foreign markets.

The downside of having partners would be that any benefits to Eskom and the South African public would be diluted, so ideally any foreign partners should bring more than just finance to the project. Eskom brought in three partners in 2000: IDC (25 per cent), BNFL (22.5 per cent), and Exelon (12.5 per cent) leaving Eskom with 40 per cent. Eskom's partners in the development phase have fulfilled their obligation to the programme and have no further legal commitment to fund the programme, leaving the project entirely in the hands of Eskom Enterprises, although the partners will be entitled to take shares in a newly constituted PBMR company if the demonstration phase is launched.

Exelon's main contribution to the project was its promise to open up the North American market. Exelon committed to pilot the design through safety certification by the US Nuclear Regulatory Commission (NRC). Certification by the NRC (or a national regulatory authority with a comparable level of expertise and prestige) will be essential for sales to most markets outside South Africa, not just sales to the USA. Exelon also pledged to buy 10 commercial units and suggested they would buy 40 or more units in the first decade of the commercial phase. The 10 initial sales were the only apparently firm sales for the PBMR there have been (sales to Eskom are conditional on it being the cheapest generation option). These sales would have been an excellent 'shop-window' for the technology for the potentially huge US market and would allow the setting up of reactor manufacturing facilities, which subsequent commercial sales could take advantage of. As an electric utility rather than a plant designer, Exelon's technical contribution to reactor design was limited but as an experienced nuclear power user, its input would have still have been valuable.

Exelon left the project in April 2002 and, while the FEIR explains Exelon's departure on grounds of it not wishing to be a 'reactor supplier' (PBMR (Pty) Ltd, 2002b, p 192), there seem to be additional factors behind their withdrawal. The decision to enter the venture appears to have been very much a personal one by the CEO of PECO, Corbin McNeil (later joint CEO of Exelon). When he left the company, the commitment to the PBMR was quickly withdrawn.[10] John Rowe, the new CEO of Exelon was quoted as saying: 'the project was three years behind schedule and was "too speculative,"'[11]. He also said: "a detailed review that Corbin and I started late last summer yielded a recommendation from the people in charge of the project that ... [operation and testing was] three years further out than we had thought a year ago." Since then, schedules have slipped substantially further, probably by more than a further three years. Despite claims by Eskom and PBMR (Pty) Ltd that a large number of interested replacement investors existed, no replacement for Exelon has been found.

BNFL entered the venture at about the same time as Exelon and their technical contribution appears to have been in fuel manufacture. At the time they joined the venture, BNFL's Westinghouse reactor vendor subsidiary does not appear to have been involved in the decision and it is not clear whether Westinghouse has had a major input to reactor design. BNFL would provide no significant advantages in terms of access to markets.

BNFL has been in severe financial difficulties for a number of years. In fiscal year 2002, it lost £2.32bn (R25bn) and in fiscal year 2003, it lost £1.09bn (R12bn). It had liabilities of about £30bn (about R350bn) with few assets available to discharge these liabilities. In July 2003, UK government plans to part-privatise the company were abandoned and a major part of its business, waste disposal, reactor operation and reprocessing is to be taken away from it and placed in a new government agency, the Nuclear Decommissioning Agency.

[10] 'Corbin was the cheerleader for this technology, and without him, it can't go forward.' Electricity Daily, April 17, 2002.

[11] Energy daily, April 24, 2002.

The UK government is currently reviewing the future of its other activities. In June 2005, the British government announced it was looking to sell the Westinghouse reactor vending, nuclear fuel manufacture and reactor servicing activities leaving BNFL as primarily a clean-up company. A number of companies are reported to have expressed an interest, including Areva and GE, although by August 2005, only Mitsubishi had made a bid.[12] It is expected that completion of the sale would take until mid-2006.

It appears that BNFL's primary motivation for getting involved with the PBMR was selling fuel rather than reactor sales. Whichever the case, the management that will be responsible for BNFL's contribution to the PBMR is far from certain to be able to continue the commitment even if they wish to. Terblanche has said that BNFL could take 10-12 per cent of the next phase or 25 per cent of the fuel business.[13] This appears unduly optimistic and BNFL/Westinghouse management is not in a position to make such a commitment on behalf of the new owners.

IDC appears to have brought only finance to the venture. As it is owned by the South African government, in terms of risk reduction to the South African public, it contributed nothing. Terblanche was quoted in August 2003 as saying the IDC would take no more than 12.5 per cent of the next phase.[14] However, following a government review in January 2004, IDC is expected to take a more prominent role in the project, and in November 2004, the CEO of Eskom told the Parliamentary Portfolio Committee on Trade & Industry that IDC would be replacing Eskom as project leader.[15] It has been reported elsewhere that Eskom wants to take about 10 per cent of the PBMR Company in the demonstration phase.[16] Kriek has said that he expects the South African public sector to retain at least 51 per cent of the project through Eskom, IDC and the government.[17] On present evidence, it seems unlikely that private investors willing to take the remaining 49 per cent of the project can be found. So, as a minimum, the South African public will be asked to pay for at least half of the R14.5bn the next phase was forecast to cost in August 2005. If costs escalate or private partners cannot be found, the cost to the South African public will be much higher.

A number of other potential investors have been mooted and Eskom has had discussions with the French company, Areva, since February 2004. Areva is a publicly owned company with similar interests to BNFL.

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12 Nucleonics Week, July 14, 2005, p 1.

13 Nucleonics Week, August 28, 2003, p 1.

14 Nucleonics Week, August 28, 2003, p 1.

15 Sunday Times, November 10, 2004.

16 Financial Mail, December 3, 2004, p 14.

17 Financial Mail, December 3, 2004, p 14.

However, it has its own HTGR technology, which differs significantly from the PBMR (the fuel is prismatic rather than pebbles) and which Areva claims is superior to the PBMR.[18] It does not seem likely that the two technologies could be readily merged. Areva has shown no indication of being prepared to give its technology up in favour of the PBMR. It has also indicated that it is not prepared to fund the Demonstration Plant. Its interests and its potential contribution appear very similar to those of BNFL and it may not be possible to accommodate both in the next phase even if either company was interested and had the scope to participate.

A number of other potential investors have been mentioned, but these appear to be highly speculative and by far the most realistic investors in the next phase are the existing investors with Areva as an outside chance.

The expected sale of Westinghouse may restrict the possibilities and it seems unlikely that the companies owning the world's two largest nuclear vendors, Framatome and Westinghouse, would want to co-operate even if such an arrangement was acceptable to the competition authorities.

Required information

A realistic assessment is required of what the probability of attracting funds other than from South African public sources is. An assessment of what advantages and disadvantages any identified partners would bring is also required.

6.2 Licensing efforts

It is acknowledged by all sides that for sales to most markets outside South Africa to be possible, certification by a highly experienced, high credibility nuclear safety regulatory agency is required. This is not to denigrate the competence of the South African regulatory authorities, but reflects the risk aversion of electric utilities and those that supply finance to power station construction particularly as electric utilities are exposed more to investment risk. One of Exelon's main contributions to the venture was their role in piloting the design through the US NRC procedures. The NRC had begun to review the design and had collaborated with the South African National Nuclear Regulator (NNR) on design issues but when Exelon withdrew, the NRC quickly wound down licensing activities.[19] It has been reported that PBMR (Pty) Ltd officials met with NRC officials in October 2004 to discuss design progress[20] but it does not appear that NRC is carrying out any substantial design evaluation.

Without NRC approval for its design, it is not clear that the Demonstration Plant would have much value in promoting foreign sales. Until the design had been approved by the NRC and finalised, construction cost of the commercial export design cannot be estimated accurately. If the Demonstration Plant design differed significantly from what was required by the NRC (for example if the Demonstration Plant was built without a pressure containment and the NRC indicated it would require one for any plant built in the USA) potential buyers would see construction and operation of the Demonstration Plant as having only limited demonstration value.

Required information

The FEIR should state what strategy has been developed to obtain internationally credible regulatory clearance for the commercial PBMR design and how this would fit in with the Demonstration Plant.

6.3 Construction cost and cost of associated facilities

Repaying the cost of construction of the plant has always been expected to be the major element in the overall cost of power from any nuclear power plant. Its importance has increased in the last decade as attempts to introduce competition to the electricity industry have increased the cost of capital raising the charge for repaying the construction cost.

The FEIR contains no information on the expected construction cost of the Demonstration Plant or on the commercial plants. It merely states: 'The cost to build the PBMR demonstration module will probably be available on completion of the project business plan (year end 2002).' The DFR contained no details on the cost of the Demonstration Plant.

In 1999, Nicholls (Nicholls, 2000) forecast that the construction cost would be about US$100m (then equivalent to about R600m) for a single commercial module, presumably as one of 8-10 units installed on one site. The strategic importance of this estimate was that it placed the price of the PBMR at around the US$1000/kW of installed capacity, a level above which it was widely assumed that nuclear could not compete with gas-fired technology.[21]

Nicholls22 was quoted separately as estimating the cost of the Demonstration Plant as double the settled down commercial cost with a further US$100m for a fuel sphere production plant. The total cost of the Demonstration Plant was therefore then estimated to be about US$300m or a little less than about R2bn.

18 Nucleonics Week, March 25, 2004, p 6.

19 Inside NRC, May 20, 2002, p 4.

20 Nucleonics Week, November 4, 2004, p 1.

21 The US Department of Energy's New Generation Nuclear Plant programme launched in 2002 has a target capital cost of US$1000/kW for new nuclear power plants. The PBMR (Pty) Ltd Feasibility Report (PBMR, 2002b, p 23) notes a target price of US$1000-1100/kW.

22 Nucleonics Week, October 14, 1999, p 7.

In 2002, the DFS (PBMR (Pty) Ltd, 2002b, p 23) suggested some cost increases had occurred and the target construction cost for commercial units was now placed at US$1000-1200/kW. However, there appear to have been major cost increases. These have been masked by three factors. First, it is not clear whether the current cost estimates cover as full a range of costs as the original estimates, for example, if the cost of the first fuel load was omitted (conventionally this is included in the construction cost), the apparent cost would fall masking real cost increases. Also, it is also not clear whether the new estimates are now a cost or a price (i.e. including the profit). Second, there has been some depreciation (about 10 per cent) of the Rand against the US dollar between 1998 and

2004. However, the third factor is the most important. In 1998, the design was expected to produce a net output of 110MW but commercial plants are now expected to have an output of 165MW, an increase of 50 per cent. This would allow the cost of a module to rise by 50 per cent without increasing the cost per kW.

In September 2001, Nicholls[23] admitted the original schedule for the Demonstration Plant had slipped. He then projected start of construction for 2002, with completion expected in 2005 and commercial sales to begin in 2009. There was discussion about up-rating the output of the plant to 130MW to be achieved without significant cost increases.[24] The Chief Executive of one of the partners in the project, Corbin McNeil of Exelon, was quoted in the same article as saying the upper limit on output was 150MW but he assumed the final figure would be 130MW. McNeil also stated the cost of the first module had risen to about US$300m. This article also acknowledged delays in the design work particularly with the turbine and the graphite liner

In 2002, the DFR, (PBMR (Pty) Ltd, 2002a, p 50) stated the design could be up-rated to 137MW 'without a significant increase in cost'. This meant that costs per module could increase by nearly 20 per cent whilst still remaining within the US$1000/kW target.

In April 2002, Exelon withdrew from the PBMR venture[25], although it agreed to fulfil its commitment to fund the venture until completion of the feasibility study phase, then expected to be finished in September 2002. Forecast start of construction of the Demonstration Plant had by then slipped to 2004.

By May 2002, Nicholls[26] was much less precise in his estimate of the cost of the Demonstration Plant, estimating a cost of between US$2000-5000/kW. At the bottom end of the range, assuming a unit size of 110MW and US$2000/kW and an exchange rate of US$1=R6, this would translate into a total cost of R1.3bn, while at the upper end, with 130MW and US$5000/kW, it would translate into R4bn. It is not clear whether these estimates included the cost of a fuel production facility. Nicholls still adhered to the US$1000/kW estimate for commercial orders provided these were built in groups of 8-10 per site and only after 20 units had been sold.

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[23] Nuclear News, September 2001, p 35.

By December 2002, the target output of commercial units had increased to 165MW, 50 per cent higher than originally planned. Nicholls27 admitted that the US$1000/kW would not be achieved until 32 units had been sold. Further delays were announced in the programme. Earlier in 2002, the shareholders of PBMR (Pty) Ltd had expected to announce whether they would proceed beyond the feasibility stage by the end of 2002. This decision was postponed into an unspecified date in 2003 and appeared still not to have been taken in December 2004. In July 2003, the Demonstration Plant was expected to be 125MW with subsequent units producing 165MW.28

A particular issue was the supplier of the gas turbine. This would be the first-of-akind and would be the first commercial gas turbine to use helium gas as the energy carrier (normally gas turbines are driven by the exhaust gas from the combustion of the oil or gas fuel) and represents a significant engineering challenge. The contract to design the turbine was originally placed with the French company, Alstom but they were replaced in 2001 by Mitsubishi for unspecified reasons. It is not clear how far development problems with the gas turbine have delayed the programme and have increased costs.

In November 2004, PBMR (Pty) Ltd announced a major design change in the gas turbine moving to a horizontal turbine generator set rather than the three-shaft vertical configuration that had been planned. It should also be noted that the frequency of the North American electrical system is 60Hz, compared to 50Hz in Europe and South Africa.

China is 50Hz, but Japan is part 50Hz and part 60Hz. This means the speed of rotation of the gas turbine is different and generally gas turbines that produce power at 60Hz are of a significantly different design to those that produce power at 50Hz. It is not clear who would pay the cost of development of 60Hz machines for exports to the USA.

The main extra cost for the demonstration programme apart from the generating plant itself was the fuel manufacture plant expected to be built at Pelindaba. In 1999, Nicholls estimated this would cost about US$100m (R600m) but more recent forecasts for the demonstration programme have not separated the fuel plant from the reactor, so it is impossible to determine how far escalation in the cost of the demonstration programme has been the result of increases in the cost of the fuel plant.

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24 Nucleonics Week, October 11, 2001, p 1.

25 Nucleonics Week, April 18, 2002, p 1.

26 Nucleonics Week, May 2, 2002, p 10.

27 Nucleonics Week, December 19, 2002, p 1.

28 Nucleonics Week, July 3, 2003, p 1.

29 Africa News, October 29, 2004.

Once the end of the feasibility phase had been reached, the partners' commitment to fund the venture came to an end and essentially PBMR (Pty) Ltd had no further guaranteed access to funding. It was planned that in the demonstration phase, PBMR (Pty) Ltd would be reconstituted and the previous partners would have the right to take up a shareholding in proportion to the funding they had provided for the feasibility phase. It is not clear how PBMR (Pty) Ltd has been funded since the end of the feasibility phase. It appears most likely that a combination of government and Eskom money has allowed PBMR (Pty) Ltd to continue operations, albeit on a severely reduced scale.

By August 2003, PBMR (Pty) Ltd was seriously short of cash and was appealing to the South African government for support.[30] A review of the project was begun by the government in January 2004 and it gave PBMR (Pty) Ltd 'two months to propose a way forward for the PBMR.'[31] The Demonstration Plant was then projected to cost US$1.3bn (R8bn) and it was still hoped to begin site work at the Demonstration Plant in 2004. In March 2004, Terblanche estimated the cost of the Demonstration Plant would be R10bn and it could not be in full operation before 2010, implying a 2007 construction start and the launching of commercial sales after 2012.[32] Ferreira[33] broadly confirmed these figures in September 2004.

However, a August 2005 Ferreira confirmed that the estimated cost of the demonstration phase had increased again to R14.5bn.[34] If this increase of nearly 50 per cent in a little over a year is confirmed, this would add to the evidence that costs are seriously out of control. It is not clear whether the US$1000-1200/kW estimated cost for commercial units still stands.

In the period 1999-2005, the estimated cost of the demonstration programme appears to have escalated by a factor of more than seven. Until the detailed design is completed: equipment design development, for example on the turbine, has been carried out; design approval by the National Nuclear Regulator (NNR) is given; and the plant has actually been built, the cost estimates must be treated with scepticism. Experience with other nuclear projects shows these processes provide ample scope for further major cost escalation.

A particular regulatory issue is that of containment/confinement to the reactor. The containment serves to prevent the contents of the reactor escaping into the environment if there is an accident in the reactor or if there is an external accident, for example, an aircraft hitting the plant. The arguments are complex, but, in essence, it is argued (PBMR, 2002b, p 29) that a pressure producing accident is implausible so an expensive pressure-retaining containment would not be necessary. PBMR (Pty) Ltd argues that a containment that need only withstand, for example, aircraft impact would be much cheaper.

In September 2003, a spokesman for the NNR said '"At this stage, we don't have the answer" about whether a pressure-resistant containment is required, the NNR executive said. "It's a long shot to say the regulator has accepted" that confinement suffices.'[35] However, PBMR (Pty) Ltd (for Eskom) not only has to convince the South African NNC, it also has to convince a high credibility international regulator, most likely the US Nuclear Regulatory Commission (NRC). It would make no economic sense nor would it be politically acceptable for PBMR (Pty) Ltd to design one model for South African use and another (apparently safer) for international orders. So until this issue is resolved, there must be a significant risk that construction cost estimates will increase. The issue of containment is by no means the only significant licensing issue still to be resolved.

30 Nucleonics Week, August 28, 2003, p 1.
31 Nucleonics Week, September 2, 2004, p 5.
32 Financial Mail, March 26, 2004, p 14.
33 Nucleonics Week, September 2, 2004, p 5.
34 Business Day, August 16, 2005, p 2.

Required information

An up-to-date estimate of the cost of the Demonstration Plant is required, broken down into the cost of the plant itself, the fuel supply plant and any other significant facilities. An analysis of the cause of the delays to the programme and of the factors behind the massive cost escalation that has occurred is required. An analysis of the remaining risks of cost escalation, for example from design changes, unexpected equipment development problems, should also be provided.

6.4 The cost of capital

While the construction cost of the plant has been of continual concern, there has been little debate about the cost of capital. Traditionally, the cost of capital for power plants was very low, typically a real annual rate of 5-8 per cent. This low cost of capital reflected the fact that, as monopolies, electric utilities were generally able to pass on whatever costs they incurred to consumers, so there was very little risk that the loan would not be repaid. Of course, this did not make constructing new power plants a low economic risk, it simply meant that electricity consumers were bearing the risk rather than the company. Also government-owned utilities were regarded as being fully underwritten by government and the credit rating of government owned utilities was generally the same (very high) as that of the government itself and the cost of borrowing correspondingly low.

In the past decade, with the opening up worldwide of the electricity industry to competition and the privatisation, at least in part, of many utilities, the position has changed dramatically. Many electric utilities, the potential customers for the PBMR, have been privatised and wholesale electricity markets introduced. This is planned to take place in South Africa with the splitting up of Eskom into regional distribution companies, a transmission company and a requirement to sell 30 per cent of its generation. This plan, notably the sell off of generation, appeared to be under review in October 2004 and it may be that Eskom will continue to be able to pass on the costs of its investments to consumers no matter how ill-conceived these decisions turn out to be.

However, in other markets, investment in generating plants is now a high risk to the owners of companies and the companies providing them with finance. The privatised utilities can no longer rely on government backing to support their credit rating.

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35 Inside NRC, September 22, 2004, p 8.

In Britain, the country that pioneered electricity privatisation and opening to competition of electric utilities, this risk is very real. In 2003, about 40 per cent of Britain's generating capacity was owned by financially distressed companies.[36] Half of this capacity was the nuclear plants while the rest was a mixture of coal and gas-fired plants. At one point, the second largest owner of power plants in Britain was the consortium of banks that had lent money to investors and had repossessed the plants when they began to lose money.

Even before this stark demonstration of the economic risk of owning power plants, the real annual cost of capital for new generation plants in Britain was in excess of 15 per cent compared to about 6-7 per cent for investment in the parts of the industry that remained a regulated monopoly (essentially the distribution and transmission networks). In developing countries where currencies are less stable, there would be an additional risk premium on capital and, for example, the real cost of capital in Brazil would be at least 20 per cent. Given that repaying the capital charges is the largest element of the cost of nuclear power, it is easy to see if this cost is increased by a factor of 2-3, the impact on the economics of nuclear is going to significant and probably disastrous.

Nicholls (Nicholls, 2000) used a real cost of capital of 6 per cent and although this appears to have been increased to 8 per cent for subsequent analyses, this is far below the level that will be applied in many of the PBMR's target markets.

A decision to allow use of too low real cost of capital would have significant consequences, especially in a country like South Africa that has limited access to capital and very heavy demands for public spending in areas such as health and education where the returns on investment would be high and the risks low. Using capital on a low-return, high-risk project like the PBMR would risk crowding out more attractive and socially useful projects.

The issue of rate of return was raised by the Legal Resources Centre (Register of Comments (2002), 28.137), but the response suggests the person replying either did not understand the question or chose not to answer it: 'The PBMR project has been thoroughly evaluated by the respective investors on a commercial basis. Although their required Return on Investment (ROI) varies, normal commercial benchmarks were used in this evaluation process.'

Required information

The FEIR economic assessment should specify and justify the cost of capital that will apply to the Demonstration Plant and the associated facilities.

6.5 Maximum electrical output

There has been considerable confusion about the output of the Demonstration Plant, which has been variously reported as 110MW, 125MW, 137MW and 165MW. The DFR (PBMR, 2002a, p 25), stated the Demonstration Plant would be 110MW but would be modified in service to produce 125MW. The extent of the modifications necessary was not specified. It was implied that the first 10 commercial units would produce 125MW, but later units would produce 137MW. The DFR spoke of a later move to a core producing a thermal output of 400MW core and improvements in the conversion efficiency so that this would generate 200MW of electricity. The design changes necessary to achieve the 137MW output were expected to be such that earlier units could not be retrofitted to produce this higher level of output. In September 2003, Nicholls[37] was quoted as saying the Demonstration Plant would produce 125MW, while a year later, Nucleonics Week[38] reported 'the first unit would be limited to 110 MW'. In November 2004, Nucleonics Week[39] reported the thermal output of the plant would be 400MW, sufficient to generate 165MW. It reported: 'Eskom will file for revision of the EIA to take account of the higher electrical capacity' after final Record of Decision (ROD) was given.

This confusion needs to be resolved to clarify exactly what the Demonstration Plant will prove. Up-rating the output of a plant by 50 per cent is clearly not a trivial step and the International Panel discussed in detail the implications of the increase from 110MW to 125MW. If the design of the Demonstration Plant is significantly different to that of the commercial units, there must be doubts about how far the Demonstration Plant will indeed be a useful demonstration of the technology.

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[36] S D Thomas (2004) 'Evaluating the British model of electricity deregulation' Annals of Public and Cooperative Economics' 75, 3, 367-398.

Alternatively, if the design is the same but only operating at two thirds of its capability, potential buyers may not be convinced that the Demonstration Plant does demonstrate the commercial technology.

Clarification is also needed on how far regulatory approval for a 110MW unit would be transferable to a 165MW unit. In this context it should be noted that Westinghouse obtained regulatory for its new AP600 design in 1999 but this design proved not to be economic. Westinghouse up-rated the output by about 50 per cent to gain scale economies and had to begin again the process of gaining license approval in March 2002 for the replacement AP1000. Final approval by the US regulatory body, the NRC, is not expected before December 2005.[40]

It is not clear how far the up-ratings to the PBMR are due to simple changes to optimise the output of the plant (for example, operating at a higher temperature) and how far it is due to attempts to use scale economies to compensate for failing economics. It should be noted however that the design taken on from HTR produced a thermal output[41] of 226MWth, this was up-rated to 265MWth, then 300MWth and now commercial plants are expected to produce more than 400MWth, an increase on the original design of nearly 80 per cent.

Required information

Clarification is required on the expected output of the Demonstration Plant, how the design will relate to that of any subsequent commercial units. In particular it should show extent to which the Demonstration Plant will 'demonstrate' the commercial technology and how far safety licensing for the Demonstration Plant will be applicable to the commercial units.

6.6 Operating performance

For any technology with high up-front costs, operating reliability is essential for good economic performance. To illustrate this, let us assume that the load factor[42] of a nuclear plant is expected to be 90 per cent and at this level, fixed costs will represent two thirds of the overall cost of power per kWh. If load factor is actually 60 per cent, this alone will raise the overall kWh cost by a third. Extra repair and maintenance costs to reflect the issues that produced this poor performance will increase costs even more.

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37 Nucleonics Week, September 25, 2003, p 10.

38 Nucleonics Week, October 7, 2004, p 3.

39 Nucleonics Week, November 4, 2004, p 1.

40 Nuclear Engineering International, October 2004, p 5.

41 Only about 40% of the thermal energy is converted into electricity.

[42] Load factor is calculated as the saleable electrical output of a plant in a given period (usually a year, or over its lifetime) as a percentage of the output it would have produced had it operated at its full design output rating uninterrupted

Reliability of nuclear power plants worldwide has been extremely variable and has generally been well below the levels forecast. For example, the Dungeness B nuclear power plant in Britain, which was selected ahead of other options partly on the basis that it would have a high lifetime load factor of 85 per cent has, after 20 years of operation, a lifetime load factor of only 36 per cent. The two existing Koeberg PWR units, also after nearly 20 years of operation, have lifetime load factors of only about 65 per cent.43

Nicholls44 forecast that the lifetime load factor of the PBMR would be 94 per cent. This is hard to justify on a number of grounds. First, it would make the PBMR more reliable than any operating reactor worldwide. In 2004, the best lifetime load factor for any nuclear plant was 93.5 per cent and only 6 out of more than 400 operating units had achieved a lifetime load factor over 90 per cent. Second, much is made by PBMR (Pty) Ltd and Eskom of PBMR's ability to 'load-follow', in other words vary its output as demand changes (PBMR (Pty Ltd, 2002a, p II and PBMR (Pty) Ltd, 2002b, p 24). Clearly if the units are operating at below their design rating 'loadfollowing' for any significant part of the year it will be impossible to achieve load factors as high as forecast and the economic performance will be similarly reduced. The ability to load-follow would be an optional feature that would also increase the construction cost.

For the Demonstration Plant, it might be expected that reliability would be poorer than for commercial units partly because of the need to carry out testing and demonstration activities, and partly because the Demonstration Plant will inevitably throw up technical problems that will only become apparent when a real plant is actually operated, and these will require shutdown for repair. If operating performance is expected to be significantly poorer than for the commercial units, this will make the power from the Demonstration Plant very expensive because the fixed costs will be spread over fewer saleable units of electrical output.

Operating performance

The forecast load factor for the Demonstration Plant should be specified and justified, and its impact on the cost of power identified.

6.7 Operations & maintenance cost

There is a common perception that once a nuclear power plant is built, the electricity is essentially free. Nuclear plants are assumed to be largely automatic and fuel costs are assumed to be low. While fuel costs are generally low, operations & maintenance (O&M) costs can be high. For example, a number of US nuclear power plants were closed down in the 1990s because it was judged it would be cheaper to pay the cost of building and operating a new gas-fired plant than paying the cost of simply operating an existing nuclear plant. Since then extensive efforts have been made in the USA to reduce costs. The USA is the only country to publish properly accounted O&M costs. In 2003, the cheapest plant to operate generated at about US 1.2c/kWh (US cents) of which, about US 0.4c/kWh was fuel cost. The most expensive plant cost US 2.6c/kWh and the median was about US 1.65c/kWh.

.[43] See Nuclear Engineering International, August 2004, p 38.

[44] Nucleonics Week, November 19, 1998, p 1.

No estimates of the operating cost of the PBMR have been published but Nicholls (Nicholls, 2000) estimated fuel costs at 0.4c/kWh, comparable to US figures. Given that in the same paper he forecast that total generating cost would be US 1.43c/kWh including repayment of capital, it seems likely Nicholls assumes the non-fuel O&M costs will be negligible. Given the non-fuel O&M costs alone for US plants average about US 1.2c/kWh, this assumption seems highly optimistic and cannot be accepted without detailed justification.

Required information

The O&M costs for the Demonstration Plant should be specified and justified, broken down by fuel and non-fuel costs.

6.8 Decommissioning cost

Decommissioning is an immensely complex area that cannot be fully covered here. If the South African government allows the PBMR project to proceed to the demonstration phase, it is important to note that this commits it not just to the cost of the facilities required, but also to pay for the decommissioning of the Demonstration Plant and other associated facilities such as the fuel manufacturing plant.

Decommissioning has significant economic, ethical and social dimensions as well as technical aspects. It is assumed that the 'polluter pays' principle should apply to the funding of decommissioning and this means:

- There should be clear plans to return the site to 'green-field' status after plant closure and decommissioning, i.e., the land should be fit to be released for unrestricted use including food production;
- Those that consume the electricity from the plant should pay for its decommissioning. This is generally done by creating a 'segregated' account[45] that accumulates funds provided by consumers throughout the life of the plant to pay for its ultimate decommissioning;

Decommissioning is conventionally assumed to be carried out in three phases: removal of fuel; removal of uncontaminated or lightly contaminated structures; and removal of contaminated structures, essentially the reactor itself. From a purely economic viewpoint, the incentives are always to carry out stage one as quickly as possible. A plant with nuclear fuel in it must be fully staffed because of the risk of criticality and once the fuel has been removed, the staffing level can be significantly reduced saving the labour costs. The economic incentives are to assume as long a delay for stages 2 and 3 as possible. Any fund created to pay for decommissioning will have longer to earn interest, reducing the provisions consumers must make to achieve the required sum. In practice, social and technological factors may over-ride this incentive. For example, it may be politically unacceptable to leave a potentially hazardous facility in place for several decades simply to allow the fund to accumulate sufficient interest to pay for decommissioning

The DFR (PBMR, 2002a, p 27) anticipates two possible strategies, early plant dismantling or 'safe enclosure', in which stages 2 and 3 would be delayed. The DFR does not specify the length of the delay, but it should be noted that the THTR plant in Germany is expected to be in safe enclosure for at least 30 years. The DFR states that: 'if the demonstration module is not successful, the plant will be mothballed in 'safestore' until the decommissioning of Koeberg I and II. However, negotiations with Eskom in this regard have not been finalized.'

Typically, it is assumed that the cost of decommissioning represents about a third of the construction cost. Since the decommissioning cost clearly has little direct relation to the construction cost, this indicates the immaturity of decommissioning technology and the only plants fully decommissioned worldwide are not representative. For example, they may have operated for only a short time and are little contaminated, or the plant may have been disposed of in a large hole without dismantling (Trojan, USA) or the plant is very small.

The FEIR (PBMR (Pty) Ltd, 2002b, p 201) states that 1.5 per cent of the capital cost is provided for decommissioning. It is not clear what is meant by this. Subsequent clarification by consultants (Register of Comments, 2002, 28.149) has suggested that: 'the PBMR Operator will provide 1.5 per cent of the capital cost of the plant on an annual basis over the useful life of the plant.' And that the proposed minimum provision would be based on a 15 per cent of original yet escalated, construction costs, (sic) be made available for decommissioning at the economic end of the plant (Register of Comments, 2002, 28.149).

This is still far from clear and the reliance on estimating the decommissioning as a percentage of the construction cost betrays the fact that little work has been done on estimating decommissioning costs. The FEIR does specify that a segregate (sic) fund will be set up.

Experience with the plants of similar technology to the PBMR in Germany is particularly salutary. The 15MWth pilot AVR plant (it produced heat but no power) is of similar technology to the PBMR and operated from 1967-88 before engineering problems caused its closure. The estimated cost of decommissioning and dismantling the AVR escalated from about €20-million during the early 1990s to as much as €490-million in 2002 (about R7bn).[46] So even after closure of the plant, decommissioning costs were subject to huge price escalation and if any provisions had been collected, they would have proved totally inadequate, leaving later generations to meet the cost.

The THTR 300 demonstration plant, also using pebble bed technology, was in service for only six years to 1989 but produced minimal amounts of power and is therefore likely to be lightly contaminated. It was de-fuelled only in 1995, placed in 'safe enclosure' in 1997 and it is not expected that decommissioning of the contaminated parts of the plant will start before about 2020. No recent cost estimates for decommissioning have been published. Again, if it had been assumed the plant would operate for, say 20 years and decommissioning provisions had been collected from electricity consumers on that assumption, any provisions would have been totally inadequate.

For a demonstration plant, which inevitably has a very uncertain length of operating life, it would seem more prudent to include the necessary provisions in the initial cost to reduce the risk of a shortfall in decommissioning funds if the plant operates for a shorter period than expected.

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[5] A segregated account is one which the owner of the plant cannot

draw on and as a result, if the owner of the plant fails financially, the decommissioning provisions are not lost.

Required information

The estimated decommissioning cost for the Demonstration Plant should be published broken down into the three main stages. The assumed timing of the three phases should also be specified and the arrangements for funding the process (how the money would be collected and kept, what rate of interest is assumed) given.

6.9 Operating life

The expected operating life of the plant will determine how long the owner has to repay the construction costs. The longer the life, the lower the annual repayments are. In practice, expected operating life is not as important as might be expected. Generally, commercial loans do not have a repayment period longer than 20 years so this is the maximum 'amortisation' period for a commercial facility.

Nicholls (Nicholls, 2000) projected a 40-year life for a commercial PBMR module. This would appear to be rather optimistic. No estimate has been given for the Demonstration Plant's lifetime. Demonstration plants often have quite a short life because they tend to be expensive to operate and once they have demonstrated (or failed to demonstrate as in the case of THTR 300) the technology, they are retired to reduce the losses consumers must bear. This is of particular concern if the decommissioning provisions are collected over the forecast operating life of the plant and this forecast proves too long.

Required information

The FEIR economic assessment should specify and justify the expected economic life (the time over which construction costs will be recovered and decommissioning provisions collected) of the Demonstration Plant

No mention is made of the operating costs. It could well be that with a relatively small fuel plant, operating unreliability and inexperience with operating PBMRs, the operating costs could be higher than those of, say, a coal plant. In this situation, Eskom would be left with a facility that would not be economic to operate even on a marginal cost basis and it would be left unused.

In evidence to the South African Parliament's Minerals and Energy Affairs Portfolio Committee, the CEO of Eskom, Thulani Gcabashe, only committed that Eskom would 'host' the demonstration unit.[47] It remains to be seen whether government is willing to provide subsidies or whether it will try to force Eskom to pass the extra costs on consumers.

Required information

The FEIR economic assessment should indicate precisely what Eskom will be expected to pay for the Demonstration Plant, how much the additional cost of power from the Demonstration Plant over and above the cost that would have been incurred if the power had been generated by commercial plants will be and who will pay these additional costs.

6.11 Analysis of risk

The PBMR project has always been a high-risk project. Thomas (Thomas, 1999) writing in 1999 said:

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46 Nucleonics Week, July 18, 2002, p 2.

47 Sunday Times, November 10, 2004

> 'The development of the PBMR by Eskom would represent a highly risky venture which would be underwritten by tax-payers and electricity consumers.'

These risks have been amply demonstrated over the following six years. The cost of the Demonstration Plant has increased by a factor of more than seven and completion of the Demonstration Plant, expected in 1999 to be in 2003, is now still at least five years off. If the risks had, by now, all been incurred, this poor history of technology development would be of limited relevance to the decision whether to go ahead with the Demonstration Plant. In economists' jargon, 'bygones are bygones'. In other words, the development costs have been incurred and cannot now be 'unspent': what matters for decisions being taken now are the remaining costs and risks. Of course the failure to control costs and the huge slippage in the time-table must be taken into account in judging the competence of the developers, PBMR (Pty) Ltd and the likelihood that the remainder of the programme can be completed to time and cost.

The previous analysis has shown that there are still many risks. The design is far from complete, for example, a major change to the turbine generator design was announced in October 2004, the design has not received South African NNR approval, nor has substantive progress been made with approval by the US NRC. Even when these processes are complete, the history of nuclear power amply demonstrates the large risk of cost escalation during the construction phase. So the risk that costs will escalate even further is high. The statement in the Register of Comments (Register of Comments, 2002, 28.144) that 'the PBMR detailed design has been finalised.' cannot be justified. Since then, the turbine generator design has been changed, the plant output upgraded, apparently requiring significant design changes and until NNR approval is given, clarifying, for example, whether a pressure containment is needed, the design cannot be regarded as finalised. The problems in completing the design also do not provide confidence in the abilities of PBMR (Pty) Ltd nor do they augur well for the technological success of the Demonstration Plant.

Attempts to reduce the risk to the South African public have had some success, with about a third of the development cost in the feasibility phase being met by foreign companies, notably Exelon, but also BNFL. However, for the much more expensive (at least seven-fold) demonstration phase, Exelon will not participate and BNFL seems unlikely to be in a position to make a substantive contribution. Attempts to bring in other foreign investors, such as US utilities, the French company Areva and Chinese interests have not yet succeeded and it now appears likely that if the Demonstration Plant is to go ahead, it will be largely underwritten by South African public money through the government, Eskom, or IDC. This will include not only the estimate of at least R14.5bn to build the plant and associated facilities, it will also include the cost of decommissioning the plant and the extra cost of buying the electrical output over and above the cost of generating in commercial power stations.

The FEIR was seriously inaccurate even before it was published. It acknowledged the withdrawal of Exelon but the sales projections were still heavily dependent on Exelon. Exelon would buy the first commercial unit, before Eskom, and in the crucial first five years of the commercial phase when the business has to establish itself, it assumed Exelon would buy half the units sold. In the three years since the FEIR was published, the date when the first commercial units are expected to be sold has slipped by eight years and no replacement for Exelon has been found. Inevitably, the pressure is on Eskom, underwritten by South African taxpayers and electricity consumers, to step in to fill the gap.

6.12 The cost of a catastrophic accident

This report does not examine the costs that would arise if the Demonstration Plant were to cause a catastrophic accident. However, it should be noted that the 1986 Chernobyl accident in Ukraine is expected to result in costs of US$235bn in the 30 years after the accident.48. It is therefore essential that the promoter's claims that such an accident is totally impossible should be evaluated fully, and if the probability is not zero, consideration needs to be given on how such astronomic costs could be met.

6.13 The cost of waste and spent fuel disposal

This report does not examine the cost of waste and spent fuel disposal. However, a number of points should be made.

First, worldwide, no spent fuel has been disposed of yet. All fuel used to date remains in temporary surface stores or has been reprocessed to produce plutonium. Note that reprocessing does not reduce the amount of waste to be disposed of,49 it merely splits it up into different 'packages'. Until facilities have been designed and built that give the public full confidence that spent fuel can be disposed of in such a way that there is no risk that this material will be exposed to the human environment over the millions of years that it will take for the material to become harmless, the costs must be regarded as speculative.

Second, worldwide, very few waste disposal facilities for low-level and intermediatelevel waste have been built in recent years and the waste that is being disposed of is mainly going to old sites designed fifty or more years ago. Until there is more evidence of the cost of designing, building and operating waste disposal facilities that meet current safety standards and are publicly acceptable, the cost of waste disposal must also be regarded as uncertain.

Third, as with decommissioning, the cost of waste and spent fuel disposal will be incurred decades after the waste is created. If funds are put aside at the time the waste is created, these funds can be invested and can be expected to grow substantially. For example, a fund that is invested for 40 years, earning an annual real interest rate of 2.5 per cent will grow by a factor of 2.7. However, this does point to the need to establish clear procedures to take money from consumers to pay for these activities and to keep it in secure investments so the risk that it is lost is minimised.

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48 http://www.chernobyl.info/index.php?userhash=745163&navID=34&lID=2

49 In fact, reprocessing produces a large volume of additional low-level and intermediate-level waste because all the facilities and chemicals used in reprocessing become contaminated.

7. The commercial programme

Construction of the Demonstration Plant only makes sense if there is a high probability that it will lead to a profitable (to South African interests) stream of orders for commercial PBMRs. It is therefore essential to examine the prospects for such sales if the economic case for the Demonstration Plant is to be properly assessed.

7.1 The economic competitiveness of the PBMR

The economic competitiveness was assessed in detail by the International Panel of experts in 2002 and their report would provide a proper basis to analyse the economic prospects for the PBMR programme. The estimates given by Nicholls in 2000 (Nicholls, 2000) are clearly out of date. The information required for commercial units is:

- Construction cost;
- The cost of capital;
- The plant's maximum electrical output;
- Operating performance especially reliability;
- Operations & maintenance (O&M) cost, including fuel supply and spent fuel disposal;
- Decommissioning cost and;
- Operating life.

In some cases, for example, maximum electrical output, the information will comparable for all markets, but in others it might vary. For example: PBMR (Pty) Ltd might sell units to Eskom at a discount to the cost other customers; construction cost will vary depending on how many units are being built on the site; the cost of capital will vary from country to country according to the commercial position of the customer and the economic conditions in the export country; operating performance will vary according to whether the plant is expected to be base-load or load-following; decommissioning cost will vary according to the cost of waste disposal in the country of installation.

A key assumption will be the construction cost. Let us assume the Demonstration Plant alone (not including the fuel plant) will cost about US$1.5bn (two thirds of the R14.5bn that the demonstration programme was estimated to cost in 2004) or about US$13,600/kW if the plant produces 110MW, the gap to commercial units costing US$1000-1200 is huge. If the design can be stretched to produce 165MW at no extra cost, the cost per kW would be about US$9000/kW. This still leaves a huge reduction in costs to get down to the target levels. Some of this will come from not having to incur the technology start-up costs the Demonstration Plant would require. The rest must come from various scale economies and learning effects. These include: building ten units on a site; scale economies in manufacturing if a minimum number of units are sold. The DFR did not publish any details of these scale economies claiming the information was commercially confidential (PBMR (Pty) Ltd, 2002a, p 56)

Required information

The government should publish the report by the international Panel of Experts. Eskom should publish the latest cost and performance estimates for the commercial plants as well as the assumptions on factors such as cost of capital by market. It should also specify how the unit cost is expected to be reduced by a factor of at least nine from the Demonstration Plant to a fully commercial unit.

7.2 The likely world market for the PBMR;

PBMR (Pty) Ltd and Eskom have always been very vague about target markets and countries as wide-ranging as Chile, Cyprus, Turkey, Saudi Arabia and Egypt have all been mentioned as possible targets. There appears to be little basis for this speculation and these markets should be discounted until there is some substantive evidence to back them up.

The DFR (PBMR (Pty) Ltd, 2002a, p 50) is ludicrously over-optimistic, given the absence of anything remotely close to a firm order, suggesting that: 'the sale of PBMR plants and fuel is more likely to be constrained by supply capacity limitations than by demand.' It backs this up saying:

> The market analysis shows that the potential exists for the market to conservatively absorb up to 235 five-pack plants (1 175 modules) over the two decades following the start-up of the demonstration plant. This represents only 3.3 per cent of the world demand for new generation capacity. Notwithstanding this excellent potential, the base-case sales scenario adopted in the enterprise business plan forecasts the sale of only 258 modules over the evaluation period of 25 years, and is therefore conservative.

Despite the fact that Exelon had already withdrawn from the project when it was published, the FEIR (PBMR, 2002b) still anticipated commercial sales beginning in 2006 with 15 units going to Exelon in the period 2006-8 and a total of 44 units by 2017. Eskom sales were expected to be at a much slower rate, starting in 2007, completing the 10-unit order by 2012 and ordering a total of 20 units by 2017. Other customers were expected to buy 76 units by 2017. So in the first 12 years of the commercial phase, the FEIR forecast sales of 140 units, a slightly faster rate of sales than the DFR.

Given that over the past decade, the volume of nuclear plant ordered has been only one or two 1000MW units a year, this seems far from conservative. In fact, it seems clear that PBMR (Pty) Ltd has carried out no detailed market analysis on a countryby-country basis and projections are simply an arbitrary percentage of an overall market for power plants. This issue was raised by LRC as Comments on the DFR (Register of Comments, 2002, 28.137) but the response does not make much sense and does not answer the question. It states;

> The market studies were based on 53 plants, only one of which is to be sold to Eskom. Thorough market studies were done as part of the business case. We are not sure on what the statement "it seems likely that the world market for nuclear power may be no more than 1 or 2 units per year" is based, especially since the world market for new power stations is about $70 million per year.

No mention is made elsewhere of 'the market studies of 53 plants'. Since $70 million would only, on PBMR (Pty) Ltd's figures, cover about half the cost of one PBMR module, it is not clear what the response means.

The fact that a significant percentage of the market is effectively closed to nuclear power by political decision is not taken into account. Even so, it should be noted the DFR represents a significant downgrading of sales forecasts to about 10 units a year from earlier when Nicholls (Nicholls, 2000) forecast 30 units per year.

This weakness was acknowledged by the new CEO of PBMR (Pty) Ltd in September 2004 when he said there was a need for 'a "much more detailed marketing strategy" with "a strong focus on customers' needs. He said marketing strategies would be tailored to a given country or customer, versus a more generic strategy followed in the past.'[50]

Such studies would quickly reveal that for much of the world, new orders for nuclear plants are not feasible. In Europe, many countries have made a decision not to build nuclear power plants, e.g., Austria, Denmark, and Norway or are phasing out nuclear power, e.g., Germany, Italy, Sweden, Belgium the Netherlands and Switzerland or not expanding existing capacity, e.g., Spain. The UK government carried out a review of nuclear power in 2003 and found no case for new nuclear power orders. France decided in November 2004 to build a new nuclear power plant of a French design, EPR, a 1500MW design based PWR technology, and it seems highly unlikely it would abandon this in favour of the PBMR. The medium-term prospects for PBMR sales in Europe therefore appear minimal.

In the USA, PBMR (Pty) Ltd's hopes were based on Exelon getting license approval for the PBMR and launching the commercial programme by ordering 10 units. It is clear this will not happen now and while some utilities offer supportive statements to the technology, as expressions of intent to buy plants, these are essentially worthless.

For example,[51] the CEO of Exelon (John W Rowe) was reported in May 2005 that:

> 'the high price of natural gas is an incentive to build new plants, but that an offsetting factor is the continuing low cost of coal. The lack of a solution for nuclear waste is also a deterrent.'

While the CEO of Dominion, another large US utility often mentioned when new nuclear orders are mooted said

> "We aren't going to build a nuclear plant anytime soon. Standard & Poor's and Moody's would have a heart attack," said Mr. Capps referring to the debt-rating agencies. "And my chief financial officer would, too."

The main expected export market therefore appears to be China, but despite several years of discussions, China has made no commitment to South African PBMR technology. Tsinghua University has the only operating PBMR in the world, a 10MW unit that went critical in 2000 using German fuel technology. Tsinghua University is collaborating with US interests from the Massachusetts Institute of Technology on a competitor to the South African PBMR.[52] Overall it is far from clear who Chinese companies will choose to collaborate with, but all experience shows that Chinese interests will try to 'indigenise' any technology they pursue so even if they do collaborate with PBMR (Pty) Ltd, and orders are placed, South African content to these sales would low and the net benefit of these sales to South Africa small.

It seems more likely that China will produce its own design of PBMR, similar to that of PBMR (Pty) Ltd, which would supply any sales in China and would compete with the South African design in world markets. Nucleonics Week reported in June 2005 that Tsinghua University's Institute for Nuclear & New Energy Technology (INET) expected to complete the design for a commercial scale of plant (about 195MW) by 2006 and have a plant in operation by 2010.[53] These forecasts may be no more realistic than those of its South African counterpart but the intention to develop an independent design rather than import technology is clear.

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50 Nucleonics Week, September 2, 2004, p 5.

51 M. Wald, 'Interest in Reactors Builds, But Industry Is Still Cautious' New York Times, May 2, 2005, p 19.

52 Nucleonics Week, November 6, 2003, p 1.

53 Nucleonics Week, June 23, 2005, p 8.

If a world market for high temperature gas-cooled reactors does develop, as well as competition from a Chinese vendor, the South African PBMR may face competition in international markets from the US vendor General Atomics and from Areva, companies that are both developing designs using prismatic fuel.

General Atomics supplied the demonstration HTGR built in the USA (Fort St Vrain) and has the advantage of being US-based and therefore politically well-placed to receive US government funds. Areva has less experience with HTGRs but its huge experience in reactor design and sales gives it advantages in international markets.

A pre-condition for any international sales appears to be obtaining safety approval from the US NRC. Without a US partner and with no sales in prospect, it is not clear why the USA should spend US taxpayers' money reviewing the PBMR design. If PBMR (Pty) Ltd is to obtain licensing approval in the USA, it seems a large proportion of the cost will therefore have to be borne by PBMR (Pty) Ltd.

Required information

The Applicant should publish the PBMR (Pty) Ltd's marketing plan and its strategy for gaining license approval from the US NRC in the FEIR

7.3 The South African market for PBMRs

In the absence of foreign markets, this leaves Eskom as the most likely customer. Eskom has committed to build and operate the Demonstration Plant. It has said it will buy 10 units, but only 'provided it's the lowest-cost alternative at the time the utility needs to add capacity'.[54] Note that the DFR (PBMR (Pty) Ltd, 2002, p 50) misleadingly does not include this caveat on cost, saying only: 'Eskom has provided PBMR (Pty) Ltd with a letter of intent covering the purchase of a demonstration plant and 10 further units.'

Eskom does not say in the FEIR whether, on current expectations of cost of a commercial unit it expects the condition that it be the 'lowest-cost alternative' to be met. Eskom should provide a detailed analysis of the economic conditions that would have to be met, including costs of the alternatives, such as coal, gas and renewables, as well as the cost of the PBMR, for the PBMR to be the cheapest alternative.

Given that commercial orders cannot be placed before about 2013, such calculations are highly speculative. In that time frame, it cannot be assumed that Eskom will exist in anything like its present form and the attractiveness of alternative technologies, such as gas-fired plant and renewables could have changed dramatically.

In the second half of 2004, pressure on Eskom to commit unconditionally to buy several commercial units increased. In October 2004, Kriek said the PBMR (Pty) Ltd's business plan 'envisages Eskom committing up front to some 4,000 MW of PBMR capacity in South Africa, which would allow "economies of scale" and development of a commercially competitive product.'[55] This plan appeared to be endorsed by the government Minister for Public Enterprises, Alec Erwin, in his mid-term budget statement of November 26, 2004, when he said: 'plans include the additional generation of 4,000MW to 5,000MW of electricity from pebble bed units located around the country.' Tom Ferreira, communications manager for PBMR, said that around 4,000MW of electricity could be met by 24 PBMR units each with a generating capacity of 165MW.

[54] Nucleonics Week, August 28, 2003, p 1.

[55] Nucleonics Week, October 7, 2004, p 3.

If the cost of these units was no more than the target cost of US$1000/kW, this would mean that Eskom was being asked to commit to making an investment of at least R25bn before the technology was economically or technologically proven. It seems highly unlikely that the units bought by Eskom could be sold at this price and the figure of R25bn is therefore at the bottom end of the likely costs.

However, the signs are that Eskom itself wishes to distance itself from the project. The forecast time when new generating plant will be urgently needed is difficult to predict because of uncertainties about demand growth rates, the degree to which old plants can be refurbished and mothballed units returned to service. Steve Lennon, Eskom's MD for resources and strategy suggested that 1000MW of new peaking capacity (power stations only required for times of peak demand) would be needed each year from 2005-09 with base-load capacity (power stations that operate throughout the year) needed from 2010 onwards.[56] Clearly the PBMR, which cannot be in service as a commercial option before 2015[57] at the earliest, is of little relevance to this immediate need for new capacity.

The managerial changes in PBMR (Pty) Ltd in August 2004 when an IDC executive, Jaco Kriek, became CEO and a Department of Trade & Industry Director-General, Alastair Ruiters became Chairman, replacing the predecessor from Eskom, Nic Terblanche were reported as being 'intended to get the project out from under the management of South African utility Eskom, which does not want to be in the business of developing new nuclear technology.'[58]

This very much echoes the position taken by Exelon in 2002 when they withdrew from the project. These changes seem to be supported by the government. Nucleonics Week[59] reported:

> Up to now, the chairman of Eskom Enterprises, Eskom's subsidiary for unregulated industry, has automatically held the PBMR chairmanship, but now it's not even certain that Eskom will be represented on the board. An informed source said the government is "not eager for Eskom to continue as an investor and a potential customer," in part because that would inevitably lead to conflict-of-interest situations.

The CEO of Eskom confirmed this interpretation in evidence to the South African Parliament Portfolio Committee on Minerals and Energy. He said the IDC was to take over the leadership of the PBMR programme. Eskom would be "playing a lesser role (as a PBMR investor) as we go forward, because we are now going to take the role of customer".[60] He also seemed to suggest that the PBMR should not go forward without foreign investors. He said more international investors were needed "to be able to advance to the stage where we can construct the demonstration unit and have it commercially proven" and that Eskom would "dilute" its participation as an investor in the PBMR, and allow other investors to be brought in. He also seemed to confirm that PBMR would have to be the cheapest option if Eskom was to buy it: 'if all of our

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56 Financial Mail, December 10, 2004, p 36.

57 The Energy Minister, Phumzile Mlambo-Ngcuka said in August 2004 that 'the pebble-bed modular reactor was at least 10 years away from becoming a commercially viable project'. Business day, August 16, 2004, p 2.

58 Nucleonics Week, August 26, 2004, p 7.

59 Nucleonics Week, September 2, 2004, p 5.

60 Sunday Times, November 10, 2004.

technical and commercial criteria are met, we'll be taking the first set of units that are produced.'[61]

The South African government affirmed in October 2004 its commitment to open up the electricity generation sector to foreign investment. The Trade & Industry Minister, Alec Erwin[62], suggested that about a quarter of the investment needed up to 2009 would come from companies other than Eskom. This effectively removes from Eskom the obligation to ensure there is sufficient generating capacity for the country. It also in effect places Eskom in a competitive market. In this situation, it would be unreasonable to expect Eskom to compete with new generators if it was obliged to buy a number, specified by the government, of PBMRs regardless of whether they were the cheapest option or whether they were even required. The only logical commitment Eskom can be asked to make is that it orders PBMRs when it needs new capacity, provided it is the cheapest option available. In practice, this is a largely empty commitment because, if when it needed new capacity the PBMR was the cheapest option, it is hard to see why Eskom would not order it.

When the PBMR project was launched, it was expected to be primarily an export project producing about 30 units per year, with two thirds of the units for export. Thomas argued (Thomas, 1999) that the world market forecast was implausible and no more than one or two units per year would be sold. Six years later, the overall world market for nuclear power plants looks no more promising and PBMR (Pty) Ltd has failed to identify any firm prospects export sales.

Required information

The FEIR should specify what obligation Eskom has to purchase commercial PBMRs. **7.4 Benefits to the South African economy**

The PBMR programme has always been sold to the South African public as a generator of jobs and wealth. Nicholls (Nicholls, 2000) suggested that the programme would generate 204,546 jobs and additional annual GDP of R18331m (the apparent precision of these inevitably highly speculative forecasts is grotesque). This was on the basis of a total market of 30 units per year, 20 of which were for export a local content of 50 per cent and 10 of which were for South Africa with local content of 81 per cent. The DFR (PBMR (Pty) Ltd, 2002a, p 55) projects annual sales of 10 units with local content for South African units of 69 per cent (48 per cent for the Demonstration Plant) and for export units, the South African content would be 43-65 per cent depending on the market (developed or developing country) and on how many units were sold. These are no more than targets and the actual percentage would be negotiated on an individual basis. If the market for PBMRs was disappointing or a large market was opening up, it may well be necessary to accept lower percentages rather than jeopardising sales. For example, China would be likely to require a very high local content.

Clearly the lower forecast sales volume and local content figures will dramatically reduce the jobs and economic effects forecast by Nicholls in 2000, perhaps by 75 per cent and the DFR showed figures of 63,719 jobs and GDP of R8522m (again grotesquely over-precise).

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[61] Sunday Times, November 10, 2004.

[62] Business Day, October 27, p 2.

However, it is necessary to look at how these figures were generated. The DFR projects a unit cost for commercial units of about R180m. It forecasts that 40 permanent jobs will be created at the Demonstration Plant site plus about 1400 local construction jobs for about two years. The number of people working in manufacturing plants is forecast to be about 450 (PBMR (Pty) Ltd, 2002b, p 191). If we assume local content is on average about 60 per cent, this means the direct value to South Africa of 10 orders per year would be about R1000m. The number of direct jobs created would be of the order 1000.

It is therefore clear that projections of 60,000 jobs and GDP increase of R8.5bn must be based on 'second round' effects of jobs created in the companies servicing the PBMR programme, for example the steel industry might be able to sell some more steel and in jobs created servicing the needs of the workers employed. Complex computer models of the economy as a whole are used to model these effects but the results should be treated with care (see PBMR (Pty) Ltd, 2002a, p 55-62). Any large programme of spending, if fed into this type of computer model, would produce large numbers of extra jobs and a large amount of extra GDP. For example, if the South African government embarked on a large programme of construction of pyramids, this would generate new wealth and jobs perhaps in the cement and construction sector, but the money would be entirely wasted because the pyramids would be useless. The export orders for the PBMR would generate no permanent jobs in South Africa for operators, and few if any temporary jobs for construction workers, while the pressure from customers would be to maximise their local content, so factory jobs (and second round effects on supplying industries such as the steel industry) would be much less than forecast.

Required information

Eskom should specify how many jobs will be directly created by the programme, for example as plant operators and manufacturing plant employees, specifying the assumptions that lie beneath these forecasts.

7.5 Risk analysis

The risk has always been that if international orders did not materialise, the South African public would be required to bail out the project by placing uneconomic orders. Thomas in 2000 wrote (Thomas, 2000):

> However, what will happen if Eskom does go ahead without major international collaborators and the stream of orders does not materialise? Will South African politicians have the nerve to write off the project or will plants be built ahead of need in South Africa just to keep the capability in existence? National flagship projects have a tendency to live long after they should have been killed off and South African consumers will end up paying for a series of expensive white elephants.

Even if the Demonstration Plant appears to be technologically successful (it will take several years of reliable operation before risk-averse foreign utilities will be convinced of this), that is no guarantee of international sales. PBMR (Pty) Ltd's cost projections for the commercial units are based on very large and still entirely speculative scale economies. If these are not realised, the commercial design would not be competitive.

The government appears to be acting to take control of the PBMR project away from Eskom, with IDC taking the lead role, while attempting to oblige Eskom to buy the plants. Eskom is being asked to invest more than R25bn in a technology for which the design is not even complete, let alone demonstrated and proven. To some extent, these changes will be of limited interest to the South African public. From a theoretical point of view, if the government is going to oblige Eskom to build more PBMRs than would be economically optimal, it should reimburse Eskom from taxes. However, the public may be largely indifferent whether they pay extra to subsidise PBMRs through their taxes or through their electricity bills. It will be much more concerned about the potential huge loss of public money.

8. Conclusions

The National Environmental Management Act (NEMA) requires developers to demonstrate that their projects are economically sustainable. To judge economic sustainability, it is necessary to look at the life-cycle costs of the Demonstration Plant for the Pebble Bed Modular Reactor (PBMR). The Final Environmental Impact Report (FEIR) does not provide sufficient data to assess these. However, given that by its nature, a demonstration plant will not be economically viable in isolation, to judge whether the expenditure on the next phase is justified, it is also necessary to look at what the prospects of success for commercial PBMR units are.

Eskom and PBMR (Pty) Ltd are keen to justify the Demonstration Plant on grounds of forecast benefits of a programme of commercial PBMR orders to the South African economy in the FEIR and the associated Detailed Feasibility Report (DFR). However, the FEIR does not provide any information on the economics of a commercial programme and in the responses to comments on the Draft EIR (Register of Comments, 2002), the consultants refused to answer questions on the programme stating 'the present EIA is limited to a single demonstration module PBMR'.

However, it is possible to draw conclusions on the economic sustainability of the Demonstration Plant and on any subsequent commercial programme by drawing together the information supplied by Eskom and PBMR (Pty) Ltd officials to various news media.

8.1 The Demonstration Plant

Conclusion 1: Regardless of its success or otherwise, the Demonstration Plant will leave a substantial liability that will fall on South African public funds caused by the need to decommission the plant and the associated facilities, and to pay for the disposal of the spent fuel. The FEIR and the DFR do not quantify these liabilities, providing no information on spent fuel disposal and no usable information on expected decommissioning cost. However, experience in other countries suggests that decommissioning costs could be of the same order of magnitude as construction costs.

Conclusion 2: Since details of the project were made public in 1998, costs of the Demonstration Plant have escalated by a factor of more than seven. The project leadtime has slipped so that it is now apparently further away from commercial exploitation than it was in 1998 when commercial orders were forecast to take place from 2003. Now, seven years on, commercial orders are not forecast for about ten years. This shows that the developers failed to understand the scale and nature of their task. There is still considerable scope in the next phase for further cost escalation and delay due to changes to the design and construction problems. The developers' poor record to date gives little confidence in their ability to control costs and time schedules in the next, more expensive phase.

Conclusion 3: Forecasts of other economic parameters, such as operating performance, operating cost and decommissioning cost have not been updated since 1998 and appear implausibly optimistic. It is understandable that developers of a project have an optimistic view of the project's prospects – 'appraisal optimism'. However, investment decisions should be taken on the basis of sober, unbiased judgements of the most likely outcomes, not the views of the project's promoters.

Conclusion 4: PBMR (Pty) Ltd successfully diversified some of the risk away from the South African public for the feasibility phase with foreign partners, Exelon and BNFL Ltd, sharing the costs. However, the cost of this phase (about R2bn) was far more than forecast and the absolute amount paid for by the South African public was not reduced. PBMR (Pty) Ltd has spoken optimistically over the past three years about the prospects of recruiting new partners to replace Exelon and BNFL (if as seems likely it cannot participate), but nothing has come of these negotiations. Until there is solid evidence of new partners being bought in, it must be assumed that the cost of the demonstration phase will fall substantially on the South African public, through Eskom, IDC, or direct government subsidies.

8.2 The commercial plants

Conclusion 5. PBMR (Pty) Ltd's analysis of the world market for PBMRs is simplistic, taking no account of any of the commercial or political factors that would apply in key export markets. A particular concern is finance for export orders. This is an important issue for developing countries, which are likely to account for a significant proportion of the forecast orders. Such countries frequently have difficulty financing large investments. The World Bank and most other International Financial Institutions do not provide finance for nuclear investments. The South African PBMR could face strong competition from other types of high temperature reactor, notably a very similar Chinese design and models offered by Areva and the US company, General Atomics. Until a rigorous market analysis has been carried out and subjected to independent scrutiny, and arrangements for helping finance export orders made explicit, PBMR (Pty) Ltd's assumptions on the likely world market have no basis.

Conclusion 6. Pressure is mounting on Eskom to commit to buy large numbers (24) of commercial units even before the technology has been technically and economically proven at a cost in excess of R25bn. Eskom appears, rightly, to be holding to its position of only buying it if the PBMR is the cheapest option available, something that will not be known until the Demonstration plant is in service and has operated for some time. If Eskom is required to make such an advance commitment, it could be forced to purchase uneconomic plants, raising the price of power to consumers, and adversely affecting public welfare and the competitiveness of the South African economy.

Conclusion 7. The future of Eskom is uncertain. The South African government has been considering reforms to Eskom for a number of years, including its privatisation and its break-up into competing units. There can be no guarantee that in 2013 or later, when the first commercial orders for a PBMR might be placed that Eskom will exist in any recognisable form, much less one that can be obliged to order a particular type of power plant, especially if it does not represent the best commercial option.

8.3 Overall conclusions

Conclusion 8: The PBMR project is a highly risky venture. The feasibility phase has cost more than R2bn, about two thirds of which has been paid by South African public money. Despite this expenditure, there is still ample scope for the project to fail. The next phase will require a much higher level of expenditure, at least R14.5bn, with more than half of this again coming from the South African public. If the project fails, there will be significant consequences for the South African public either through higher electricity prices (if Eskom is forced to bear much of the risk) or through taxation if the government has to write-off the costs.

Conclusion 9: The National Environmental Management Act (NEMA) requires developers to demonstrate that their projects are economically sustainable. The FEIR does not provide the data necessary to make such a judgement. This information strongly suggests there is a high risk that the project will not be economically sustainable. On the available evidence, the project does not meet the requirements of the NEMA and the applicants, Eskom, should not be given approval.

Conclusion 10: The current high fossil fuel prices and the measures to reduce greenhouse gas emissions seem to give a new impetus to generation technologies that do not use fossil fuels. However, it should be remembered that previous oil price spikes (1974 and 1980) were short-lived and resulted in little nuclear investment apart from in France. Investors are unlikely to make multi-million dollar investments in new nuclear power plants on the basis of a short-term oil price spike which could have disappeared long before a nuclear plant could be brought on-line. On greenhouse gas emissions, nuclear power faces competition from renewable technologies and energy efficiency measures, options that generally do not encounter the public acceptability problems that nuclear power suffers from.

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8.9 APPENDIX 9: WILDLIFE AND ENVIRONMENT SOCIETY OF SOUTH AFRICA SUBMISSION

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WILDLIFE AND ENVIRONMENT SOCIETY OF SA

People caring for the Earth

6 March 2006

Mr. Ian MacFadyen

Mawatsan

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Hatfeild

0028

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Dear Mr. MacFayden

Comments on the Draft Environmental Scoping Report for the Proposed 400 MW(t) Pebble Bed Modular Reactor Demonstration Plant (PBMR DPP) at the Koeberg Power Station Site

The Wildlife and Environment Society of South Africa (WESSA) thanks you for the opportunity to comment on the above document. While studies from the previous EIA may be a useful starting point to inform this EIA process, WESSA urges that this new process be used as an opportunity to rectify and improve on the shortcomings of the previous EIA. WESSA trusts that information from the previous EIA will be critically reviewed and that the opportunity to update and supplement specialist information previously provided will be used. Furthermore, we trust that the public will have an opportunity to review all information submitted to the decision-makers.

Nuclear energy is a contentious issue worldwide and there are compelling arguments both for and against South Africa exploring this technology further. WESSA calls for wide and inclusive public debate on the subject. We do not believe that processes dealing with nuclear technology in South Africa have been open and transparent. This in itself has led to public mistrust, fear, difficulty in assessing proposals and has led to a great deal of frustration and time wastage on all sides.

Climate change is an inescapable reality, as is the current energy crisis facing the Western Cape. WESSA therefore suggests that there is an urgent need for South Africa to develop a comprehensive and holistic energy strategy that is broadly debated and accepted in the public realm. A participatory and transparent approach is essential to ensure public support. Such a strategy should include an in-depth assessment of our current and future energy requirements, including mechanisms to reduce demand through behavioral change and energy saving technology. There is a need to explore the social, environmental and economic costs and benefits of **all** energy generating options available to us, including nuclear. It is our opinion that existing policies and plans have failed to achieve the above. We suggest that only once this has been achieved, and a decision taken that nuclear energy is in fact a path we wish to follow, should we consider testing new nuclear technologies for possible wider roll-out.

The lack of the above strategy and a lack of transparency have, and will undoubtedly continue to, cloud this EIA process. This must not be allowed to happen. As the Draft Scoping Report (DSR) rightly points out, this EIA process is not the correct forum to address broader strategic issues around energy supply alternatives. However, these issues do need to be addressed and debated somewhere as they directly inform the need and desirability of the proposed development of the PBMR DPP.

The need for the proposed PBMR DPP:

It is useful to bear in mind that the stated purpose of the PBMR DPP is not to solve our energy crisis, but to "*assess the technological, environmental and economic viability of the technology*" (page 1 of the DSR). We understand that the proposed development will contribute little to our generation capacity. Considering this, we believe that it is imperative that the DSR establishes what the need for such an 'experiment' is. Without a clear energy strategy as discussed above, this will be difficult to do.

The White Paper on Energy does state that it would not be prudent to exclude nuclear energy as a supply option, but also suggests the evaluation of all candidate energy supply and demand resources in an unbiased fashion. In contrast the Summary Draft Status Quo and Gap Analysis: Towards the Development of an Integrated Energy Strategy for the Western Cape (June 2005) states the following: "*To maximize sustainability there needs to be a shift away from non-renewable sources of energy, and in the long-term from fossil-fuels and nuclear…*" The need to expand our nuclear energy production therefore is clearly still under debate and the specific need to explore PBMR technology has not, as far as we are aware, been identified.

It is unclear why we need to explore and test this technology, where other already-tested methods exist and similar technology is being tested elsewhere. There are substantial public concerns around nuclear energy in general and concerns around the feasibility, cost and potential environmental impacts of the proposed PBMR in particular. It must therefore be demonstrated that the technology is both necessary and desirable. The precautionary principle (as set out in the National Environmental Management Act (NEMA) (Act 107 of 1998)) must be observed. Thus far the DSR has failed to do this.

Alternatives

Consideration of alternatives is a cornerstone of the EIA process. This is an important mechanism to help identify the best practical environmental option, as required by NEMA. This means that the option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term must be perused. Given that the purpose of the proposed development is not to supply energy, but to test technology, we agree with the assertion in the DSR that the range of alternatives that should be considered here is indeed limited. We are nevertheless concerned that the consideration of alternatives, as suggested in the DSR, is far too limited. We also reiterate our suggestion that the alternative methods of energy production and demand reduction must be explored at a strategic level as a matter of urgency.

The no-go alternative

We believe that the dismissal of the 'no go' alternative is unjustified at this early stage of the EIA process. According to the DSR "*…the no-go option was not considered during the scoping process as the no-go option would imply that the technology would be lost from the suite of actions included in the White Paper on Energy*". We suggest that the logic of this is flawed. The White Paper, a policy document, cannot dictate the decisions made in terms of other legislation (in this case NEMA and the Environmental Conservation Act (Act 73 of 1989)). Furthermore, the 'no go' in terms of this application would not necessarily mean that the technology would be lost from the suite of actions included in the White Paper on Energy. An application to implement the technology elsewhere could be successful. Implementing the no go would not necessarily spell the end of all nuclear technology in South Africa as it is specifically PBMR technology that is in question here. It is worth noting that the White Paper does not specifically prescribe the construction of a PBMR demonstration plant. We therefore suggest that the no go alternative continues to be included and considered in this impact assessment process, as is legally required.

Location alternatives

We suggest that the location alternatives were prematurely dismissed based on unclear reasoning. It is not clear how the various alternative sites were originally selected and on what information the comparative assessment was based. Was this information up to date? How were the criteria selected? Were these weighted and if so, how? Was public input sought? Furthermore, we believe that conducting a comparative assessment during Scoping is inappropriate, as Scoping should involve information gathering not assessment. The comparative assessment should therefore have been part of the Environmental Impact Report. We suggest further that alternative sites should continue to be considered and assessed as part of this EIA process, unless they are found to be completely unsuitable. The public should have an opportunity to review information on which the assessment is based and suggest additional criteria for consideration. Transparency in this regard is key.

Two major concerns with the proposed Koeberg site are: 1) The proximity to a major urban center and 2) The risk implications of locating the PBMR adjacent to an existing nuclear power station - should there be a major incident at either plant what would the knock-on effect be? These issues do not appear to have been adequately considered in the comparative assessment.

Technology Alternatives:

What, if any, technology alternatives are available that will fall within the limited scope of the stated purpose of the project? This needs to be discussed and explored further.

We remind you that DEAT's Criteria for Determining Alternatives in EIA (2004) states that "*Failure to consider alternatives adequately from the outset is symptomatic of a biased process….*"

Issues

The relationship between this EIA decision making process and the National Nuclear Regulator (NNR) is confusing. WESSA is concerned that project-specific radiological issues are relegated to the NNR. We believe that the public must have an opportunity to review and comment on all relevant information that informs the decision made by DEAT. Naturally radiological issues should be considered in such a decision. Issues considered by the NNR should therefore inform the EIA process.

WESSA is concerned with the exclusion of issues as described in Table 6 (page 70) which lists significant issues that, according to the DSR fall outside the scope of the EIA for the PBMR DPP. Is the proposed PBMR financially viable as an electricity generating option? What is the environmental impact of uranium mining? What are the implications of the absence of approved procedures/regulations to deal with spent nuclear fuel and how does this relate to the precautionary principle? Should public funds be used to test this technology? Is there a market for future PBMRs? These are all highly pertinent questions, directly related to the need and desirability of the proposed development. We believe that these issues should be explored in this EIA process and that to dismiss them is unjustified.

WESSA is further concerned that other important issue directly relevant to the proposed development will not, according to the DSR, be considered in this EIA process. For example, transportation of nuclear fuel will apparently not be dealt with, as this will be considered in another EIA. WESSA does not support the piece-meal consideration and authorization of activities directly related to a proposed development. How will these separate EIA processes inform each other? Similarly, we believe that the ability to manage radioactive waste in the long term must be addressed. We are therefore concerned that issues surrounding the storage, management and disposal of the high level waste in the long term will also not be explored in this EIA process - the DSR states that these issues will be considered by the Department of Minerals and Energy (DME). We suggest that this is inappropriate to place this responsibility on solely on the DME and that issues concerned with the operation and entire lifecycle of the PBMR DPP are key to the EIA process. We urge that a holistic view of the proposed development and its potential impacts be taken.

Lastly, we suggest that safety issues be carefully assessed in this EIA process, including risks from unpredictable catastrophic events and sabotage (recent events at Koeberg indicate that the latter is possible, if not likely).

Thank you for taking the time to consider our concerns. We look forward to participating in the process further.

Yours sincerely

Samantha Ralston

Environmentalist

WESSA Western Cape Region

8.10 APPENDIX 10: AFRIKAANSE HANDELISINSTITUUT SUBMISSION

1 Desember 2005

Mnr Ian MacFadyen

Mawantsan

Geagte Ian

AHI Standpunt oor die indiensstelling van die korrelbed modulêre kernreaktor vir die opwekking van elektrisiteit

Die Energie werksgroep van die AHI se Kamer vir Handel en Nywerheid het gedurende 2003 `n vergadering met ESKOM gehad oor bogemelde, na aanleiding, van die omstrendenheid oor die voorgestelde produksie en indienstelling van hierdie reaktor, vir die doel om elektrisiteit op te wek terwyl dit nie meer ekonomies is om nuwe steenkool aangedrewe kragsentrales te bou of bestaandes op te gradeer nie.

ESKOM het toe al gemeen dat die tyd aangebreek het om na alternatiewe energie bronne oor te skakel. Die mees logiese daarvan is die aanwending van kernkrag om Suid Afrika se energie behoeftes aan te vul. ESKOM het die doel en werking van die korrelbed modulêre kernreaktor breedvoerig en tegnies aan die werksgroep verduidelik. Na afloop van die vergadering en verdere besprekings het die werkgroep `n kort memorandum opgestel wat aan AHI lede gesirkuleer is en ook in die AHI nuusbrief geplaas is.

Die Werkgroep was van mening dat:-

1. Die ontwikkeling en indienstelling van die korrelbed kernreaktor `n ekonomiese haalbare projek is en dat dit `n groot bydrae kan lewer om te voorsien aan die stygende elektriese energie behoeftes van Suid- Afrika.
2. Dat die prosesse wat deur die reaktor gebruik word om elektrisiteit op te wek uiters veilig is en dat die tegnologie wat aangewend word daarvoor baie deeglik nagevors en baie gevorderd is.
3. Dat die uraanbrandstof (korrels) wat vir die doel aangewend word veilig is, aangesien dit deur `n dik mantel van koolstofverbinding bedek word wat bestraling tot die absolute minimum, selfs onder die internasionale standaard, beperk.
4. Dat die sisteem "skoon" is, in die sin dat dit geen skadelike afval gasse of verbrande materiaal vrylaat, wat besoedeling in die atmosfeer of omgewing tot gevolg kan hê nie.
5. Dat die prosesse veilig is omdat die reaktor afgekoel word deur vloeibare helium; en sou iets tegnies verkeerd gaan, het die sisteem die vermoë om self af te skakel sonder enige nagevolge.
6. Dat dit op die langtermyn voordelig sal wees om hierdie reaktors in werking te stel aangesien `n baie klein oppervlakte terrein nodig is om hulle op te rig, wat sal beteken dat baie minder grond oppervlakte nodig is vir die oprigting daarvan; en

dat dit maklik in die bestaande elektriese verspreidingsnetwerk ingeskakel kan word.
7. Dat hierdie tegnologie waardevolle internasionale valuta vir Suid Afrika kan verdien as dit erns internasionaal bemark sou word.

Die Werksgroep het derhalwe aanbeveel dat:-

1. Eskom voortgaan om `n prototipe van die reaktor op te rig by Koeberg om die werking daarvan oor `n bepaalde tyd monitor.

2. Eskom in samewerking die georganiseerde Handel en Nywerheid (Sakekamers) voortgaan om die konsep landwyd bekend te stel en ook ander belangegroepe in ag neem in hulle bemarkingsveldtog.
3. Dat Eskom in die proses van ontwikkeling van die reaktor, ten nouste sal saaMW(e)rk met die Internasionale Kern-Agentskap van die VN, ten einde te verseker dat internasionale veiligheidstandaarde noulettend nagekom word.
4. Dat Eskom alle veiligheidsaspekte sal nakom ten opsigte van die veilige berging van kernafval, wat na die proses van verbranding vrygestel word, sal ag.
5. Dat, aangesien die AHI `n nasionale sake organisasie is, en wil toesien dat tegnologiese innovasie van hierdie aard ook tot sy lede se voordeel ontwikkel en aangewend word, die AHI daarop aandring dat die klein en mediumsake sektor by die ontwikkeling van die reaktor betrek word, veral met betrekking tot

   - Konstruksie en oprigting
   - Bemarking, plaaslik en internasionaal
   - Veiligheid en toesig
   - Ingebruikstelling rakende die projek
   - Enige ander aspek, wat tot werkskepping in die sektor kan lei, sal ondersoek

6. Dat Eskom gelukwens word met die tegnologiese deurbraak wat in belang van Suid Afrika ontwikkel is.

Uit die besprekinge op die AHI-Hoofbestuur en die AHI-wandelgang sedert 2003 het ek die volle vertroue om steeds die AHI se volle steun toe te sê aan die projek om `n korrelbed kernreaktor te Koeberg te vestig vir die opwerking van 400 MW elektrisiteit. Trouens met die toenemende voorkoms van kragonderbrekings, vanweë oorbelading versoek die AHI dat spoedig met die projek voortgegaan word.

Vriendelike Groete

Jacob de Villiers

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8.11 APPENDIX 11: CITY OF CAPE TOWN COMMENTS

CITY OF CAPE TOWN COMMENTS ON THE DRAFT ENVIRONMENTAL SCOPING REPORT (DSR) FOR A PROPOSED 400MW(t) PEBBLE BED MODULAR REACTOR DEMONSTRATION POWER PLANT AT THE KOEBERG POWER STATION SITE IN THE WESTERN CAPE

6 March 2006

Report prepared for National Department of Environmental Affairs and Tourism and the Provincial Department of Environmental Affairs and Development Planning

Report Prepared by Mawatsan: Ref: PBMR *160106*

1. General Comments

1.1 Previous comments on the PBMR EIA by City of Cape Town

During the first PBMR EIA process *(1999* - 2003), City comment was submitted and included extensive input from relevant services including Town Planning, Economic Development, Transport and Roads, Emergency Services and City Health. Political endorsement of City comments was obtained in order to ensure that the inputs to the EIA reflected the City's interests broadly.

The City's comment at that time on both the Revised Draft Scoping Report and the draft Environmental Impact Report concluded that neither report was adequate for a decision regarding the EIA authorisation process. This conclusion was based on the omission of key issues raised by the City from the EIA.

Nevertheless, the EIA process continued and a final EIR was submitted to the Department of Environment Affairs and Tourism (DEAT) by the PBMR Consortium. The City was asked by DEAT to comment on the final EIR. The review and comment concluded that the final EIR was an inadequate basis for a decision to proceed with the PBMR at Koeberg as key environmental risks and concerns raised by the City were not assessed.

The City appealed against the approval of the EIA in 2003. However, the appeal was never considered by the Minister of Environmental Affairs as the Record of Decision was over-turned on judicial review.

Eskom have now initiated a second EIA process for a PBMR to be located at Koeberg. The proposed PBMR has potentially significant spatial, health, transport, environmental and safety implications for the City over the 40 year lifespan of the nuclear plant, plus the additional time during which high level nuclear waste is stored at Koeberg. The proposal also has significant implications for the future supply of electricity and for economic development in the region.

1.2 Key issues raised in the previous CCT appeal

Many of the concerns and issues raised by the City were not reflected in the previous EIA and subsequent ROD and conditions of approval for the PBMR. These concerns and issues formed the basis for the City's Notice of Appeal and included –

- High level nuclear waste storage at Koeberg: Financial and environmental costs
- Current and future emergency planning measures: Costs to the CCT
- Health monitoring, health risk assessment and ambient radiation monitoring
- The City of Cape Town's role as a key stakeholder
- A number of important principles and requirements of the National Environmental Management Act 107 of 1998

These issues have not been sufficiently addressed in the Draft Scoping Report (DSR). Relevant sections from the appeal document are referred to here with regard to these issues.

1.2.1 Financial and environmental costs of waste:

The full life cycle financial and environmental costs of storing the high level nuclear waste from the PBMR at Koeberg for the 40 year life span of the plant, and until a final depository for nuclear waste is licensed some time in the future must be addressed in the EIA. (Refer also to comments under section 5 NEMA principles).

1.2.2 Costs of emergency planning

The costs of current and future emergency planning and related infrastructure are direct costs due to the activity and should thus be borne by the developer, not the City of Cape Town. There is no indication in the DSR of how current and future emergency planning measures are to be addressed.

1.2.3 Health risks and radiation monitoring

Health monitoring is needed both to reassure the public and surrounding communities, and to timeously identify any health impacts that may occur. The City Of Cape Town requested (during the previous EIA comment process) that a health risk assessment be undertaken. The DSR proposes that the health issue will be addressed by means of an international literature review. This approach is questioned as there are no PBMRs of equivalent scale or technology combinations operating elsewhere in the world. Applicability of the information found via the literature review to this particular project may therefore be questionable.

The Directorate: City Health has requested that a team of respected epidemiologists undertake an "independent and unbiased study to generate sufficient epidemiological evidence".

1.2.4 The City of Cape Town's role as a key stakeholder:

The City's role in service delivery, emergency services, land use management, housing delivery and community health was emphasised in comments submitted by the City during the previous EIA process. The current 2006 EIA must include an assessment of the role of the City and its existing and future obligations in terms of relevant legislation and the effect that approval of the proposed PBMR could have on City functions and services.

1.2.5 Principles contained in the National Environmental Management Act (NEMA)

The CCT raised a number of key principles contained in NEMA that must be taken into account in the EIA. These are summarised in the next section, together with additional comments on the 2006 DSR.

1.3 Summary of comments in terms of NEMA principles

NEMA provides sustainable development principles which are to be taken into account in planning and decision-making. The comments below are presented in terms of relevant NEMA principles which should therefore be considered and addressed in the EIA for the proposed PBMR.

1.3.1 Development must be socially, environmentally and economically sustainable.

The generation and storage on site at Koeberg of high level nuclear waste which potentially poses a significant threat to human health and the environment cannot be considered sustainable. The presence of this waste effectively sterilises the site for any alternative use and the location of the existing and any future new nuclear plants has an impact on the future sustainable development of the West Coast region.

1.3.2 That waste is avoided. .and otherwise disposed of in a responsible manner.

Insufficient information is provided in the DSR on the volumes and radioactivity of waste likely to be generated. No long term repository for high level waste exists and the DSR therefore indicates that waste will be stored on the site for the lifetime of the plant (pg 30 of DSR).

This issue continues to be of concern to the City Of Cape Town as indicated in the appeal submitted to the Minister of Environmental Affairs and Tourism in August 2003. The DSR indicates that waste impacts will be addressed in the forthcoming EIA (pg 88) but the precise scope of these studies is not clear. The radioactivity and volumes of the spent fuel and other waste components is not indicated in the DSR and no clarity is given with regard to how radioactive waste will be stored or managed.

1.3.3 That a risk averse and cautious approach is applied which takes into account the limits of current knowledge about the consequences of decisions and actions.

Locating a 'demonstration' plant adjacent to a large and growing city does not appear to be a *risk averse or cautious approach*. It is questioned whether it is wise or appropriate to 'test the operability, *safety* and maintainability of the integrated plant system' in an urban environment where there are growing human populations located 2 km away from the proposed plant and there is significant urban growth northwards (pg 45 of DSR indicates that there is growth north of Milnerton and Table View). The presence of the Koeberg Nuclear Power Station already creates an opportunity cost in terms of city planning and this will be further extended by the existence of the PBMR and the presence of radioactive waste on the site for an indefinite period.

There does not appear to be any comparable nuclear plant elsewhere in the world at a similar scale and combination of technology components which would enable a reasonable assessment of potential risk and impact. Page *119* of the DSR states that the proposed PBMR design is 'unique in its different feature components'.

1.3.4 Responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity exists throughout its lifecycle.

The potential costs of the PBMR and the lifecycle costs of storing and final disposal of nuclear waste must be assessed. Decommissioning of the PBMR and the final disposal of nuclear waste should be addressed in the EIA. The national Policy on Radioactive Waste and the agreement between DEAT and the NNR both provide a framework for the assessment of the potential impacts of the proposed PBMR throughout its lifecycle.

*1.3.5 Investigation of the potential impact, including cumulative effects of the activity and its alternatives on the environment, soclo-economic conditions and cultural heritage***.**

The DSR indicates that alternatives (site and technology) will not be assessed in the EIA. However, Eskom were requested by DEAT to scope Pelindaba as a potential site (pg 12). The DSR does not present a balanced evaluation of the two sites and instead the point of departure seems to be 'Is there a better site than Koeberg?'

Information contained in the DSR indicates that the Pelindaba site may be feasible, albeit at a higher direct (infrastructural) cost. However, factors such as the savings incurred by not having to transport fuel to the Cape (as it is manufactured at Pelindaba) do not appear to have been included. Table *I* (pg 24) fails to fully evaluate the costs and benefits of these two sites.

For example, there is no indication of the volumes of cooling water required or the feasibility of installing a dry cooling system. In an inherently water-scarce country, dry cooling systems must be regarded as increasingly important. The Directorate: Water Services of the CCT have requested that security of water supply also be considered (are there two separate supply points?). Given the scarcity of water sources, the omission of a dry cooling system as a process alternative is questioned.

The feasibility of the PBMR is proposed to be evaluated in a situation where a nuclear power plant is already located, with readily available infrastructure and expertise. No comparable site would exist for potential future PBMRs in South Africa and thus any viability studies based on the Koeberg situation would be misleading.

The DSR is not required to make detailed evaluations but the forthcoming EIA should undertake a balanced and comprehensive assessment of both sites. There is no indication that the proponents have applied to DEAT for an exemption from considering alternative sites and technologies.

It is not clear from the report how long Koeberg will continue to operate and whether the PBMR and Koeberg will be operating at the same time. If so, what are the cumulative implications in terms of safety and security and other impacts? What would be the impacts on Koeberg should there be a significant incident at the PBMR (or vice versa)?

1.3.6 Investigation of mitigation measures to keep adverse impacts at a minimum as well as the option not to implement the activity.

The 'no go' option is necessary to assist in determining whether the PBMR should be included in the suite of options for energy supply. Even though this is a 'demonstration plant', it will run for a full life cycle with the associated costs and benefits and is therefore very similar to a commercial plant. The ISEP identifies options to be investigated — not only in terms of techno-economic feasibility, but also in terms of environmental impact and social acceptability. Therefore the no go option must remain part of the EIA.

1.3.7 Public information. ..Independent review and conflict resolution in all phases of the investigation and assessment of impacts.

The City has previously requested that an independent 3rd party review of the EIA be undertaken prior to decision-making by DEAT. This request is repeated for the current EIA.

1.4 Legal Framework

The draft Scoping Report (section 6.2.2) lists the Land Use Planning Ordinance (Ordinance 15 of 1985) as relevant to the current application. However, the fact that a rezoning application to the City of Cape Town is required is not mentioned. This requirement has been raised by the City during the previous EIA process. Copied below is a section from the City's previous comment on the previous draft EIR:

"The opinion of the Urban Planning Branch of the Blaauwberg Administration is that the proposed site of the PBMR would require a rezoning application in terms of the Land Use Planning Ordinance (LUPO). This opinion was included in the City's comments during the scoping stage of the EIA but is nevertheless only mentioned indirectly in the draft EIR (under Social Impact Assessment and not in terms of the legal requirements of the proposal).

The draft EIR indicates that approval in terms of the Physical Planning Act (PPA) is needed. The reasons for both the exclusion of LUPO and the inclusion of the PPA are unclear...."

(Source: City of Cape Town comment on the draft Environmental Impact Report, dated 5 December 2002).

The City of Cape Town would be the relevant authority for an application in terms of LUPO for a PBMR demonstration plant to be located at Koeberg. In terms of the relevant legislation, the decision-making authority would be elevated to the Provincial Government of the Western Cape only if an objection or appeal is submitted by another government body.

1.5 Future electricity supply and evaluation of the alternative supply options

The DSR states that SA will need additional peak generation capacity by 2007 and additional base load capacity by 2010.

The PBMR DPP, if approved, would be operational by around 2012. However, the proposed DPP is also in response to the need to evaluate a number of power generation technologies not yet implemented in South Africa on a commercial basis in terms of technical, socio-economic and environmental aspects.

Clarification is sought on the following aspects of the proposed evaluation of the technical, socio-economic and environmental aspects:

- What other supply side generation options are being investigated for the Western Cape?
- What criteria will be used to both evaluate the PBMR DPP and to compare it to the above alternative supply options?
- Will the data and information to be used for this evaluation be open to the public and other stakeholders for review?
- How will the price of PBMR's be determined? How will this influence the average cost of the electricity to the City?
- Under what circumstances would the PBMR DPP be 'decommissioned and dismantled', as stated in the DSR?

1.6 Public involvement process

There are several concerns about the public involvement process and how it has been recorded.

- The notes of the meetings held do not include an attendance list which makes it difficult to gauge level of participation.
- At several of the meetings, questions were raised which were not answered or only partially answered. An attempt has been made to address the issues in the issues

trail but information provided is still very superficial. (Example, the request for the Safety Case Report — pg 133). Each issue needs to be clearly addressed in an issues trail and not just 'noted'.

- Issues raised in the previous EIA have apparently been 'included (where appropriate) into this process' (pg 59). It is not clear on what basis issues have been incorporated or dropped. It is recommended that a full list of issues be included in the RFSR together with an indication of which ones will not be considered any further.
- The DSR reports that an interested and affected party noted that the current NNR CEO used to be the Manager of Licence at the PBMR and therefore could not be both referee and player. In the response to this issue, the comment is 'noted'. If this is indeed the case, the neutrality of the NNR is to be questioned and must be addressed.
- The newly formed Regional Electricity Distributor, or RED 1, does not appear to have been involved in the scoping process.
- The web site has been dysfunctional. For example, repeated attempts to download the ISEP have been unsuccessful.

2. Specific comments

Pg 1 Introduction

The introductory sections of the report should indicate the regulatory framework for EIAs and also note that South Africa is a member of the International Atomic Energy Agency. It should also indicate to what extent the proposed project is a modification of a nuclear plant versus a brand new technology.

Pg 11 Coal

South Africa has committed to a reduction of 10% use of coal from 2012 due to climate change issues. This is not reflected in the statements with regard to energy sources.

Pg l7 Pelindaba

Pelindaba is located west of Pretoria and not east as stated in the DSR.

Pg 28 Pelindaba infrastructure

Why was supporting infrastructure for the PBMR at Pelindaba 'dismantled'? Would the site be technically feasible if such infrastructure were still in place?

Pg 30 Waste management

Clarification and further detail is needed with regard to the proposals to "accommodate all spent fuel" on site 'processing' of low and medium level waste. Would low and medium level waste also be stored on-site or would it be transported to Vaalputs for disposal?

Pg 31 Demonstration of the commercial performance

Will data on the "key commercial parameters ... such as construction costs, plant availability and efficiency, operational and maintenance costs and mid — life upgrade requirements" be available to the public? How will the cost savings of locating the plant at an existing nuclear site be calculated in order to estimate the comparable costs for a green field site remote from such infrastructure?

Pg 32 Tunnels

Why would *underground* tunnels connect the reactor building with the services and ancillary buildings?

Pg 42 Faults

There is insufficient information on the stability (or otherwise) of the three faults.

Pg 45 and 88 Urban growth

There is brief mention of growth northwards of Milnerton and Tableview. This issue needs to be comprehensively addressed in the EIA, making reference to all relevant planning documents (not only the West Coast Biosphere Policy as mentioned on pg 88).

Pg 47 Occupational categories

What is ". . .the case for 26% of the population of the WC"?

Pg 86 Thermal outflow

How reliable is the thermal ouflow figure given? Should the worst case scenario not be considered?

Pg 111 Feasibility and Business Plan availability

When will these documents become available?

Pg 112 Decommissioning

What will the costs of decommissioning and dismantling be should the project prove unsuccessful and who would bear them?

Pg 145 Meteorological analysis

The report indicates that further work is needed. Is this to be addressed in the EIA?

Pg 147 Geohydrological investigation

It is stated that further geohydrological work is required before construction. Is this information not required for the EIA and EMP?

Future desalination plants

The Directorate: Water Services has requested that future planning by Eskom should take into consideration that the City Of Cape Town may require desalination plants alongside the Cape west coast.

Fuel manufacture and transportation

It must be explained how the information from the fuel manufacture and transportation EIA will be integrated into the EIA for the PBMR.

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8.12 APPENDIX 12: SUBMISSION FROM C H GARBETT, C T GARBETT, WAT PROPS PTY, KAREE TRUST. ITUMALENG FARM CC. PROFESSIONAL AVIATION SERVICES (PTY) LTD

8.12.1 INITIAL COMMENTS

March 7th 2006

Mawatson

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Comments & Submissions in respect of the

DRAFT SCOPING REPORT for a proposed 400 MW (t) PBMR DPP

made on behalf of the following IAP's

R C H Garbett

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Wat Props Pty

Karee Trust

Itumaleng Farm cc

Professional Aviation Services (Pty) Ltd

We regret that Mawatsan imposed a deadline that places us and the various entities we represent at a distinct disadvantage as we were advised that we would have 30 days to comment from the date of receipt of the draft scoping report, which was 30 days from 14th February 2006. We appreciate the additional day granted.

We request that the applicant is approached to extend the period for comment and reserve our rights in this regard.

1. The scoping report should include a means of communicating the costs, risks and possible benefits clearly, fairly and objectively with **all communities** in South Africa in each of the official language groups (not only in English & Afrikaans) and in a manner that is clear and understandable for the average citizen with a basic level of education and average IQ.

While some I & AP's may not understand highly technical information, they should be given an equal opportunity, which is their constitutional right, to be briefed on all material aspects of the proposed PBMR, inter alia the matters specified below, which should be presented in an honest, straightforward, readily understandable format.

South African communities, whom would benefit from the 14 thousand million rand of public funds that may be wasted should the PBMR experiment, should be consulted and opinions canvassed.

1.1. Information regarding the grave dangers that are present in any untested nuclear experiment and the subsequent operation of the PBMR in the event that the PBMR experiment does not fail, including such threats as sabotage and theft of radioactive materials for use as dirty bombs or any other terrorist activities.

1.2 The escalating costs which are difficult to accurately predict (as has been amply demonstrated by the applicant who estimated in 1998 a cost of R847 million, which had grown by 1358% to 11.5 thousand million in 2002 and currently stands at around R16 thousand million rand) a current budget overrun of 1889%. Details of the consequential economic risks that are inherent in the PBMR which includes the risk that the PBMR experiment may be decommissioned and abandoned as it may not be suitable for commercial purposes. These economic risks (excluding any potential accidental damage) are currently estimated at a loss to the taxpayer of R16 thousand million rand, excluding the costs of dealing with the resultant high level waste for hundreds of thousands of years as a legacy by Eskom to future generations.

1.3 The applicant should give a detailed explanation of the rationale for ignoring the recommendations of the well respected auditing firm PriceWaterhouseCoopers (PWC) following a due diligence survey in which they concluded that "the high probability of loss fell outside an the benchmark parameters for projects of this nature." The international market potential crucial to the financial viability was regarded by PWC as uncertain and PWC RECOMMENDED THAT ESKOM WITHDRAW FROM THE PBMR project.

1.4 Eskom's CEO has stated that they will accept liability for any accidental and operational problems caused by the PBMR. Eskom needs to quantify this risk that has been assumed, especially as it is a risk that is excluded from every standard property and aviation insurance policy. Whichever way the liability ultimately falls, South African public will bear the loss, either via state owned Eskom or PBMR government majority owned or directly by government.

1.5 Explanation of how viability was assessed when the only firm order on the horizon is from Eskom itself and that is not at the cost of production of the PBMR but at the cost of the next best alternative, meaning that the Eskom orders will be subsidised by the taxpayer.

1.6 The impact on Eskom prices to consumers should the cost of using PBMR technology if it falls between failure & success i.e. that it works but not as well as PBMR hope and production costs of energy are higher than alternatives.

1.7. That there is clear transparency surrounding the various PBMR supplier companies – orders placed against delivery, cancellation fees, shareholders

1.8 The cost and future availability of imported enriched uranium make it difficult to predict the future costs of operating the PBMR. It is clear that costs of power fuelled by enriched uranium will grow progressively more expensive and renewable such as wind, solar, small hydro, hydro, geothermal which will cost zero to fuel and will only bear a relatively minor cost of maintenance.

A direct comparison of routine maintenance and operational fuel costs of PBMR vs. alternative energy sources should be undertaken.

2. The specialist studies that have been made in respect of the EIA for the 302 MW(t) PBMR DPP are not acceptable for this new application except in circumstances that are absolute insofar as no other result could reasonable be concluded and that the parameters of the specialist studies remain unchanged.

3. All previous comments and issues raised by IAP's should be taken into account in this scoping report.

4. The NO-GO option. The proponent's argument is irrational as there is no point in spending14 billion (of taxpayer's funds) on a demonstration plant that is not commercially viable.

Similarly, to wait until it is known if the PBMR DPP is viable or not, before making detailed comparisons with other technologies make no sense whatsoever.

This should more appropriately be called the NO-SENCE option.

5 Insurance. Standard property and aviation insurance policies exclude any claims for damage or destruction of property as a result of any nuclear accident. The South African public would therefore shoulder the financial burden of any accidental damage as this risk will be underwritten by the government. Insofar as the government may not be able to pay for such a risk the burden will fall on the property owners that fall within the potential danger zones. In terms of the climatic conditions the areas that could be affected would be extensive and financially of such a level that could undermine the entire economy. The proximity of the World Heritage Sites to Cape Town and Pelindaba which are both at risk should be considered and weighed carefully before embarking on this experimental. The loss of either is a risk that should not be undertaken on such a dubious experiment without absolute proof that there is no safety risk. The applicant has acknowledged that safety is not yet proven which should be sufficient reason to abandon the PBMR.

Eskom should also re affirm its undertaking that it will, as it has stated, shoulder the financial risks of the PBMR.

The worst case scenario cost should be calculated and factored into the risks of PBMR development.

6. Risk to human life and safety.

Provisions need to be in place for a worst case scenario in addition to the inherent risks to those working on site and in all other affected areas. Costs of security to be included in economic aspects of the DSR

7. A clear picture of "cradle to grave" environmental impacts of the PBMR including the building and development impacts, the fuel plant impacts, the ongoing uranium mining impacts, the enrichment impacts, the transport impacts, should be undertaken with a comparison to other technologies, with a 20, 30 40 year projected running costs versus alternatives.

8. It is common cause that the following are just some of the unknown aspects in respect of the PBMR DPP and answers will only be known after spending 14 billion rand and 2-7 years after the PBMR DPP is complete and operational

8.1 Safety

8.2 Viability

8.3 Power generating ability and sustainability

8.4 Ability top retain helium within the pressure boundary

8.5 Operational costs

8.6 Construction costs

8.7 Cost of power to consumers

8.8 Operational costs

8.9 Maintenance costs and maintainability

8.10 Construction costs

8.11 Plant availability and efficiency

8.12 Performance under different conditions of key mechanical components.

8.13 Reliability of power generation.

8.14. Commercial viability

The applicant should inform the public how in the light of the above the decision to proceed meets ethical criteria for the use of public funds and the potential risk to health safety and environment.

9. Emission of gaseous chemical compounds during fuel manufacture needs to be assessed on both workers and the environment. Full details of the Noxious & Offensive gas application content for permit should be provided.

10. Details of the content of all applications for permits required by the PBMR should be disclosed

11. Issues described in the DCR as "significant issues falling outside the scope of the EIA for the PBMR DPP. These issues are all relevant and we object to the applicant not dealing adequately or at all with any of these issues.

12. Details of international purchases (Past, present & future) should be detailed. Reasons why purchases and orders were placed prior to the EIA completion should be detailed.

13. Details of greenhouse gas emissions and radioactive gas emissions should be detailed. Why does ESKOM misrepresent the PBMR as a clean power to the general public.

14. Full disclosure of potential hazards to "receiving populations" should be detailed and explained fully to those "receiving populations"

15. PBMR is a private company albeit the SA government (and the public they represent) is its majority shareholder.

The applicant should justify in detail why further public funds be expended at the public expense for DME to deal with the following high level radioactive waste, NNR to assess decontamination process and finally the costs of dealing with long term waste for hundreds of thousands of years at the expense of the taxpayer and the public and not the PBMR company. (while to some extent this may be academic there is one outside shareholder being subsidised at the SA public's expense)

16. The radiological / radiation issues and the NNR evaluation must be available to IAP's during the EIA phase.

It is not acceptable that the NNR evaluation is made a condition of the ROD. IAP's will be unable to comment on these issues.

17. The radiological / radiation issues must be addressed in the EIA. The consultation between the NNR & DEAT must be open to public review & comment to ensure objectivity and public participation.

18. In view of the lack of participation of the majority of SA citizens we reject the claim in the DSR that no further study is required

19. On what basis is it deemed that the level of information and assessment that will be consulted in the final EIR should be determined by the agreement between DEAT and the NNR.

We do not accept the proposed lack of public participation in the aforementioned agreement and call for transparency.

20. We reject the exemption applied for in respect of disregarding alternative energy sources and alternative sites

21. The public should be aware of and given full details of the German PBMR accident that was the reason that Germany abandoned PBMR and is now phasing out nuclear technology.

Fuel manufacture defects present serious technical difficulties and unacceptable risks to the public and safety in general.

22. The public should be advised that the PBMR is a non commercial and only exists because government has subsidised the development to date and is willing to do so into the future irrespective of the apparent lack of viability

23. Full details of total waste by weight and volume over 40 year design life to be generated should be detailed in the EIA.

24. A document previously submitted marked annexure A – PBMR Demonstration Unit and Fuel Manufacture and Annexure D – copy of an e-mail from Wat Props to Afrosearch and Annexure E 2 pages These documents were prepared for the previous PBMR EIA however all relevant matters raised should be included in the scoping report.

25. We support and endorse all the submissions contained in the 22 page document made on behalf of Earthlife Africa (Cape Town) marked Annexure B and forms part of these submissions.

26. The attached document entitled "The economic risk to electricity consumers of the Pebble Bed Modular Reactor" is attached and forms part of these submissions in so far as the comments and recommendations are pertinent to be included in the scoping report for the PBMR. The document is marked "Annexure C."

27. Insofar as any other previous documentation in respect of either model of the PBMR DPP, which has been submitted by any of the entities that are a party to this submission, to one or more of the following entities; DEAT, DME, Eskom, the NNR, the applicants consultants, and such documents contain references to the previous PBMR EIA and or scoping report, all such comments and submissions should be included into this submission.

PLEASE NOTE: GIVEN A MORE REASONABLE TIME TO RESPOND WE WOULD BE IN A POSITION TO EXTRACT RELEVANT INFORMATION AND AVOID DUPLICATION AND TO MAKE ADDITIONAL IMPUTS – HOWEVER AT THIS STAGE WE HAVE TO MEET THE HIGHLY RESTRICTIVE DEADLINE IMPOSED AND THEREFORE REQUEST THAT YOU DILIGENTLY SEARCH

THE FILES OF THOSE ENTITIES REFERED TO IN 27 ABOVE TO ENSURE ALL ASPECTS OF PREVIOUS SUBMISSIONS ARE INCLUDED.

8.12.2 ADDITIONAL COMMENTS

Please add the following comments to the PBMR EIR/DFR

1. China is currently using Tibet as a dumping ground for their radioactive waste & nuclear testing.

Can Eskom confirm that if this action by China continues, they will not market or support the transfer of PBMR technology to China, or any other nation committing similar atrocities, or, is this practice in accordance with our Governments Corporate Governance principles?

2. Can Eskom confirm that supply to China (due to factors mentioned in point 1 above) falls within the defined exclusions at points 4.4 of the DFR *"supply PBMR systems .... in a ..socially and environmentally responsible way.....to customers only if they are politically and ethically acceptable*" and point 4.6.3 Waste management of the same report, which states "*PBMR will only supply reactors in countries that ensure that nuclear waste liability is responsibly managed*"

3. What liability might accrue to the Government of South Africa and/or Eskom and/or PBMR should the technology be sold to what may be considered at the time to be acceptable government but which looses power to a different government which implements unacceptable policies with their nuclear products? This has clearly not been considered in the reports.

4. The above point merely highlights the intrinsic dangers and irresponsibility of using and promoting Nuclear Technology which may be used for the future proliferation of nuclear weapons. There is no means of governing a countries future intention and/or ability of "*managing and dealing with nuclear waste in an acceptable manner*" nor to restrict the use of nuclear technology "*in a ..socially and environmentally responsible way*" for future generations.

The vast numbers of PBMR sales that are estimated by Eskom, demonstrates the vast regions that will be potentially affected globally, both by waste and nuclear threat.

5 What amount of capital will be invested in the PBMR Co apart from the cost of the development and intellectual rights of the PBMR experimental module?

6. The economic risk of continuing with the PBMR experiment to the South African economy is immense, whether or not it proves to be viable or not, in spite of the (false) assumption in the report that there is no cash burden on the fiscus.

6.1 There is a substantial risk that the PBMR project will fail (apparent from an independent assessment of potential commercialisation of the PBMR report) This will cost the state the loss of the PBMR development costs, particularly over the next five years, the handling and disposal of nuclear waste, the possible on going costs of PBMR support or decommissioning costs assuming the probability that PBMR Co is not around to pick up these costs, if any units are exported or sold locally.

6.2 Lost opportunity costs from other forms of energy exploitation are not considered in the report in relation to the risk capital / long term costs to fund the PBMR in the form of state subsidies of waste storage and disposal and costs/losses to Eskom in capital investments.

6.3 Should the PBMR succeed in selling the ambitious number of units, the government will have to deal with the substantial costs of the high level nuclear waste generated by the PBMR modules.

6.4 The viability of the PBMR is predicated on the conclusion of a considerable number of international sales which can not be determined or even estimated with any degree of certainty, at this stage.

The possible advantages are remote and outweighed by the hazardous, long term economic and associated environmental risks

7. The cost of assessing the location and the building a high level repository is being foisted on the state and the taxpayers. None of these costs are being borne by Eskom or the PBMR Co, now or at any future time.

<u>The viability of the PBMR therefore at all times</u>, even at the point of "commercial" assessment, <u>relies upon it remaining a state subsidised enterprise</u> and will at all times cost the taxpayer millions without considering the incalculable environmental damage for thousands of generations.

8. Eskom states in the report that " …<u>based on assumptions that capital cost reductions from design, manufacture, and construction are realised</u>" and based on the design of a larger module than the experimental PBMR, <u>it would be "possible (NB only possible) to generate power at below US$0.34/k</u>". This means that there are several hurdles to pass, before any real confidence in this project is realised, even by its proponents.

9. Supply of imported enriched uranium required for the PBMR is dwindling worldwide, there appears to have been no consideration given to the effects of significant price hikes on the future viability of the product and of the PBMR Company's ability to meet its substantial corporate responsibilities if this project is allowed to go ahead.

Please carefully reconsider this project and the full and future negative implications for South African people, our economy, our environment and the capital investment of taxpayers funds, being risked on a project that has more opportunity of failure than success, even without the enormous hidden costs that will be borne not by Eskom but by ordinary South Africans whose needs would be better and more cost effectively met by the development of renewable, safe, clean power.

8.12.3 COMMENTS ON ECONOMIC FEASIBILITY OF EXPERIMENTAL PBMR / EIR

1. The economic feasibility of the PBMR experiment does not consider the cost to the state and/or Eskom if the PBMR experiment is a complete or even a partial failure. The taxpayer and the State have the right to be given this information prior to any decision.

2. The state will have the additional burden of costs of decommissioning, costs of dealing with nuclear waste generated, funding liabilities resulting from any PBMR nuclear accidents particularly onerous with such novel and unproven technology as is employed by the PBMR,

3. The State will have to deals with the costs to the economy arising from the negative balance of payments that will arise from the PBMR failure. Still further there are the lost opportunity costs from not investing in the strongest growth market worldwide, renewable power, that will impact on job creation and economic growth without any of the hazards that nuclear poses.

4. The impact of the exchange rate movements appear not to have been assessed.

5. There is insufficient information given in the economic feasibility to assess the PBMR viability and information given is sketchy and lacks credibility.

6. The economic feasibility of the PBMR experiment must be considered on a stand alone basis. If the feasibility is based on the premise that there will be “n” PBMR’S locally and “n” exported then the Environmental Impact assessment must be considered on the same basis. There every chance that an EIA based on the anticipated PBMR sales, will not pass an EIA and/or will not be financially or technically viable, therefore the assumption that the costs of the demonstrator will be recouped is misleading.

7. The feasibility does not treat this PBMR unit as a separate issue consequently the future PBMR potential can not be assessed with any degree of accuracy until the baseline costs of the PBMR have been established and the numerous novel and untested design features have been established as successful or failures in each instance. Finally construction characteristics and durations need to be established.

8. Based on the above point 7, what value can be placed on the reports export assessments on the PBMR, except radical optimism on the part of its proponents?

9. Is the PBMR Co intended to limit the liability risk of the owners?

10. There is no repository for the high level waste that the PBMR will generate. We should not generate high level waste until we are assured that South Africa has a suitable repository as no suitable sight may exist.

11. Although currently there may be no legislation that makes a producer of nuclear technology responsible for the waste products of exported units, the following would impact on the PBMR viability and long term implications for our country. The following are just some impacts that can be anticipated, alternatively already exist:-

11.1 The legal situation may well change retrospectively as has happened in many instances globally during recent years, and undoubtedly legislation and/or political pressures which force manufacturers to assume "cradle to grave responsibilities" will, quite correctly, increase into the future. Either the PBMR/ESKOM, or the State of South Africa will be held culpable and/or financially responsible.

11.2 South Africa may well be penalised for selling nuclear technology in future decades by consumers worldwide who would boycott our export products because we have taken short terms gains at the expense of long term environmental degradation and risk to lives & health.

12 It has been widely publicised that the development of the export market for the PBMR will include China, which is viewed as an important market for this product. Whether or not the anticipated sales could be realised it is indeed disturbing, in the light of existing events, namely.

12.1 China is currently guilty of gross mistreatment of the nation of Tibet by abusing the Tibetan people and their land, which is used by china as nuclear dumping ground for radioactive waste.

12.2 That Eskom would even consider selling and/or collaborating with China on any nuclear products while China is illegally occupying Tibet and is in gross violation of human rights, is reprehensible and in contradiction of ESKOMS stated corporate governance position in the survey.

13. The sale of nuclear technology is viewed by the majority of citizens globally as morally reprehensible, particularly as it is planned by ESKOM to sell PBMR nuclear technology to economically strapped third world countries that may be unwilling and/or unable to deal with radioactive waste in an acceptable manner.

14. Sales predicated on destinations such as China and Third World countries do not fall within the letter or spirit of even the most basic Corporate Governance principles, to which ESKOM publicly claims to subscribe.

15. The economic feasibility figures should be revised or ESKOM should provide a factual statement on their true position on such vital issues as which countries will be targeted as potential customers of this dangerous technology.

16. The report on the economic viability of the PBMR was inadequate and left insufficient time to adequately assess the document. Please consider increased time to comment.

Christine T. Garbett Robert C. H. Garbett

8.12.4 FURTHER COMMENTS

Sooner or later a fool will prove greater even than the proof in a fool proof system" Dr. Edward Teller

a) The West German government closed down their experimental PBMR (THTR-300) (which was also offered as accident proof) because they found the design unsafe. Why the same or similar technology is considered safe for the South African Public? (The PBMR is based on the same West German design that in May 86 (9days after Chernobyl) resulted in accidental radiation releases as far as 2 kms following the accident.)

b) What amount has the minister set as security by NECSA for potential liability claims in respect of the PBMR and the associated nuclear fuel manufacture process?

c) Why have most residents not received or been briefed on current and future emergency plans at NECSA?

d) Other problems in West Germany include radiation induced "Bolt head" failures in the reactors gas channels. What steps have been taken by NECSA to prevent similar failures?

e) The amount of "high level waste by weight" is higher than other types of nuclear reactors. This means that there will be a much higher impact in terms of numbers of vehicles on the roads with the inherent risks of accidents and sabotage. Comments?

f) What amount has been set aside for the cost of storage and disposal of the 2.5 million fuel elements that will be created during the 40 year cycle of the PBMR?

g) For what future period beyond the 40 year life will these costs be projected into the current costs?

h) We understand that there will be no containment building for the PBMR? If not what will provide the community with a last line of defense in the event of a radiological release following an accident?

i) Without a containment building the reactors wide open to a terrorist attack. Comment?

j) How many defects have been found in the manufacturing process of the graphite covered uranium fuel balls? AND Is it possible that theses defects could lead to ignition of the graphite?

k) What is the industry norm in respect of the production of perfect v/s imperfect fuel pebbles (production 370,00 per reactor/ one released every 30 seconds)

l) What are the estimated cumulative radioactive emissions from Pelindaba from all existing sources and the MAXIMUM estimates from the PBMR processes?

m) The nuclear industry is subsidised internationally to the tune of billions of dollars a year (excluding much of its financial responsibilities for the present and future disposal of toxic nuclear waste, the cost in human lives and suffering from nuclear disasters?)

n) Why should this scenario be any different in South Africa and why should the South African taxpayer subsidise an industry that is fraught with dangers that could be better spent in clean renewable energy that will be safe, create more jobs and give our economy medium and long term advantages.

o) What is the "emergency zone" for the PBMR? As the most likely accident will result in burning graphite, radioactivity will be released via smoke and flames - the smoke could drift over several kilometres - have all these effected communities been warned of the potential disaster and where would these people be housed in the event of evacuation.

8.12.5 APPEAL AGAINST THE 302 MW(T) PBMR EIA

Annexure A

1 The process of authorisation was seriously flawed. This appeal document does not cover all issues surrounding the proposed experimental PBMR that are questionable but merely highlights certain issues and is not intended to limit this appeal to the matters raised herein.

1.1 The Minister issued the ROD without giving proper consideration to several crucial issues that impact adversely on every person and investor in South Africa.

1.2 The EIR did not adequately address several vital issues in respect of the contemplated PBMR experiment.

1.3 The report on the economic viability of the PBMR was inadequate and left insufficient time to adequately assess the document.

1.4 Public participation in the EIA was extremely limited and in particular biased against those members of the public who did not have access to a computer and/or were illiterate and /or lacked the education to easily understand the serious adverse implications of the PBMR to their lives or their rights.

1.5 Low level radiation effects on health were not investigated.

1.6 The applicant has stated that "The South African design (configuration) while untested, will look into proving both the safety and the techno-economics of the overall concept". To conduct a nuclear experiment, which on the applicants own version is not known to be safe, within a few thousand metres of Cape Town, is irresponsible in the extreme. If Eskom wish to pursue the PBMR experiment we believe that it is the constitutional right of all interested and affected parties that Eskom should evacuate the entire effected areas surrounding both Koeburg and Pelindaba that may potentially be affected on a worst case scenario basis, with appropriate financial compensation for those affected parties, and further to put up financial guarantees for the property that may be affected on a worst case scenario basis, prior to commissioning the PBMR experiment.

1.7 Security, adverse short and long term financial and practical implications in respect of dealing with high level waste, were either not addressed adequately or at all in the EIR. There is no licensed long term high level radioactive waste repository anywhere in the world. The cost to date of the Yucca Mountain repository in the USA is in the region of 56 billion Rand. There is no repository for the high level waste that the PBMR will generate. The applicant should not generate high level waste until we are assured that South Africa has a suitable repository as no suitable sight may exist. The cost of a South African repository would be paid from public funds which is unacceptable.

1.8 Any accidental, terrorist or criminal damage arising from the PBMR or the materials used or the radioactive waste, that potentially could run into billions of rand, costs of long term storage of high level radioactive waste, risks of future litigation emerging from countries that the PBMR environmental damage caused by the PBMR and the hazardous radioactive waste that is produced, will be borne by the taxpaying public who has not been widely consulted and is largely unaware of the risks. Liabilities arising from a PBMR nuclear accidents are particularly difficult to quantify with such novel and unproven technologies as are employed by the PBMR.

1.9 The EIR did not consider that Lanseria Airport hangars billions of rand of aircraft. It falls well within the area surrounding Pelindaba that would be affected in the event of the graphite nuclear fuel casing being ignited as a result of an accidental or deliberate act. Aviation and household insurance policies exclude nuclear damage. There has been no consultation regarding the liability of the State as the PBMR Company will clearly not have the funding to meet such liabilities. There has been no consultation in this regard with property owners in the potentially effected areas.

1.10 The costs of PBMR nuclear power neither adequately address the costs of damage to the environment in the event of an accident or act of sabotage, nor the escalating costs of de-commissioning and future liabilities.

1.11 Economic feasibility of the PBMR experiment must be considered on a stand alone basis. If the feasibility is based on the premise that there will be "n" PBMR'S locally and "n" exported then the Environmental Impact assessment must be considered on the same basis. There every chance that an EIA based on the anticipated PBMR sales, will not pass an EIA and/or will not be financially or technically viable. Therefore the premise that the costs of the demonstrator will be recouped is misleading and false and should be considered a loss for the purposes of this experiment.

1.12 The economic feasibility did not treat this PBMR unit as a separate issue consequently the future PBMR potential can not be assessed with any degree of accuracy until the baseline costs of the PBMR have been established and the numerous novel and untested design features have been established as successful or failures in each instance. Finally construction characteristics and durations need to be established.

1.13 Based on the above no value could be given to the export assessments of the PBMR without which the project is optimistically worthless.

1.14 The economic viability did not provide sufficient information to adequately assess the PBMR viability, information given was sketchy, impacts of exchange rate fluctuations did not appear to have been assessed. Generally the report lacked credibility.

2. Unacceptable environmental impacts were not taken into account by DEAT in authorising the PBMR application.

2.1 All HTR's built to date have used HEU, more than 90% U235, which is a serious proliferation risk. NECSA plans to use 7-8% enriched uranium, which is a very different type of fuel and never previously used. The effects of this has still to be determined, what risks does this pose for workers and the general public during the experimental phase has not been covered in the EIA/EIR

2.2 The manufacture of graphite fuel has serious technical problems in that almost every single graphite fuel sphere manufactured will be partially defective. This poses serious hazards both at Pelindaba during the manufacture and at Koeburg during the operation. These risks are not acceptable to the general public and even the applicant is on record as stating that the safety of the PBMR is unproven.

2.3 Costs to cover the long term storage of radioactive waste and contaminated materials can not be calculated, let alone be provided for by the applicant. The public have the right to refuse to fund storage of radioactive and toxic waste produced by the PBMR experiment. At least during the known period of radioactive contamination (250,00 years), storage costs of the waste produced by the PBMR must be provided for by the applicant.

2.4 Alternatives were not adequately or independently assessed in respect of the benefits of utilising the entire estimated PBMR budget, plus the sale of the current technology claimed to be the most advanced in the world, compared to a similar investment in renewable power, including scale of employment potential, savings in taxpayers funds from reduced toxic pollution management costs weighted with potential liability damage, negative impacts on tourism. Further there are the lost opportunity costs from not investing in the strongest growth market in energy worldwide, namely renewable power, that will impact on job creation and economic growth without any of the hazards that nuclear poses.

2.5 PBMR Company is unable, both technologically and financially, to comply with the King Commission requirements on "cradle to grave responsibilities", a prerequisite of good corporate governance. The radioactive waste will remain hazardous for hundreds of thousands of years, there is no method available for its safe disposal and the cost of merely caretaking the problem for such a period is literally incalculable. The applicant proposes to pass the problem to this and all future generations.

2.6 The economic risk of continuing with the PBMR experiment to the South African economy is immense, whether or not it proves to be viable or not, in spite of the (false) assumption in the report that there is no cash burden on the fiscus. There is a substantial risk that the PBMR project will fail (apparent from an independent assessment of potential commercialisation of the PBMR report) This will cost the state the loss of future PBMR development costs, particularly over the next five years, handling and disposal of nuclear waste, decommissioning costs based on the probability that the applicant is not financially capable of sustaining these costs.

2.7 The manufacturers of the gas turbine have not provided the guarantees that it is reported that the applicant was requesting. This may have unknown safety implications for the PBMR operation and was not investigated.

2.8 Points 4.4 of the DFR stated that they undertook to ***"supply PBMR systems .... in a ..socially and environmentally responsible way.....to customers only if they are politically and ethically acceptable"*** *and at* point 4.6.3 Waste management of the same report, undertook that ***"PBMR will only supply reactors in countries that ensure that nuclear waste liability is responsibly managed"*** *The aforegoing* merely highlights the intrinsic dangers and irresponsibility of using and promoting Nuclear Technology which may be used for the future proliferation of nuclear weapons. There is no means of governing a countries future intention and/or ability of "*managing and dealing with nuclear waste in an acceptable manner*" nor to restrict the use of nuclear technology "*in a ..socially and environmentally responsible way*" for this, let alone for future generations. The aforegoing merely highlights the intrinsic dangers and irresponsibility of using and promoting Nuclear Technology which may be used for the future proliferation of nuclear weapons.

There is no means of governing a countries future intention and/or ability of "*managing and dealing with nuclear waste in an acceptable manner*" nor to restrict the use of nuclear technology "*in a ..socially and environmentally responsible way*" for future generations.

2.9 Liability might accrue to the Government of South Africa and/or Eskom and/or PBMR should the technology be sold to what may be considered at the time to be acceptable government but which looses power to a different government which implements unacceptable policies with their nuclear products? This aspect has clearly not been considered in the reports. The vast numbers of PBMR sales that are projected by Eskom, demonstrates the vast regions that will be potentially affected globally, both by waste and nuclear threat.

2.10 Target markets for the PBMR appear to be those countries that can either ill afford to deal responsibly with nuclear waste or have a record of abuse. For example, China has for some time used Tibet as a dumping ground for their radioactive waste and nuclear testing. If this action by China continues the South African public needs assurances that the PBMR company will not market or support the transfer of PBMR technology to China, or any other nation committing similar atrocities, or, if not, our Governments should state that this practice in accordance with acceptable governance principles?

2.11 PBMR Nuclear power is incorrectly referred to as being a clean power as this ignores the "cradle to grave" principle. The Nuclear Industry does not even have the technology to deal with the resultant pollution safely. The processes used in developing nuclear power from the mining of Uranium to the development of the nuclear plants can not render PBMR technology or any other Nuclear Power "clean". This terminology is not only inaccurate but also deliberately misleading to the public, particularly when it is used on the basis that Nuclear positively combats Global Warming.

2.12 The cost of assessing the location and the building a high level repository is being foisted on the State and its taxpayers. None of these costs are being borne by the applicant, now or at any future time. <u>Therefore the viability of the PBMR relies upon it remaining a state subsidised enterprise</u> which is unacceptable.

8.13 APPENDIX 13 INDIVIDUAL SUBMISSIONS

8.13.1 OPPOSITION TO THE PROPOSED PBMR DPP.

The following submissions were received stating their opposition to the proposed PBMR DPP.

a) Itumaleng Farm cc

I the undersigned

Christine T Garbett on behalf of

Itumaleng Farm cc

Hereby support the submission made by Earthlife Africa on the DRAFT SCOPING REPORT for the 400 MW Pebble Bed Modular Reactor

10th March 2006

b) Wat Props Pty Ltd

I the undersigned

Christine T Garbett on behalf of

Wat Props Pty Ltd

Hereby support the submission made by Earthlife Africa on the DRAFT SCOPING REPORT for the 400 MW Pebble Bed Modular Reactor

10th March 2006

c) The Karee Trust

I the undersigned

Christine T Garbett on behalf of

The Karee Trust

Hereby support the submission made by Earthlife Africa on the DRAFT SCOPING REPORT for the 400 MW Pebble Bed Modular Reactor

10th March 2006

d) Professional Aviation Services (Pty) Ltd

I the undersigned

Christine T Garbett on behalf of

Professional Aviation Services (Pty) Ltd

Hereby support the submission made by Earthlife Africa on the DRAFT SCOPING REPORT for the 400 MW Pebble Bed Modular Reactor

10th March 2006

e) Christine T Garbett, Robert C H Garbett

We the undersigned

Christine T Garbett

Robert C H Garbett

Hereby support the submission made by Earthlife Africa on the DRAFT SCOPING REPORT for the 400 MW Pebble Bed Modular Reactor

10th March 2006

f) Sally Andrew, Bowen Boshier

From: Bowen and Sally [sally@mail.ngo.za]

Sent: Saturday, March 11, 2006 12:43 PM

To: Mehreen Khan Mawatsan

Subject: Re: Communication to IAPs regarding availability of Scoping Report (Jan 2006)

Please note the following for your records:

We reject the pebble bed on economic, environmental and social grounds. We believe energy should be

renewable, non-toxic and in the hands of the people.

We support the submission made by Earth Life Africa.

Sally Andrew, Bowen Boshier.

8.13.2 SUPPORT FOR THE PROPOSED PBMR DPP.

a) Vilieria Community Association and the Ward committee of ward 53

From: AHJ Verrips [hr@iiskzn.co.za]
Sent: 03 March 2006 11:09
To: pbmr@mawatsan.co.za
Subject: PEBBLEBED POWER

The Vilieria Community Association and the Ward committee of ward 53 has no problems with the PBMI PROJECT and hopes that it will go ahead and be on line as soon as possible.

Thank you for keeping me updated.

Villieria greetings,

Aart Verrips

8.14 APPENDIX 15: DEAT – NNR CO-OPERATIVE AGREEMENT

COOPERATIVE AGREEMENT IN RESPECT OF THE MONITORING AND CONTROL OF RADIOACTIVE MATERIAL OR EXPOSURE TO IONISING RADIATION

In terms of the provisions of section 6 of the National Nuclear Regulator Act (Act No. 47 of 1999) and Regulation No. 709 of 24 May 2002

Between the

NATIONAL NUCLEAR REGULATOR

And the

DEPARTMENT OF ENVIRONMENTAL AFFAIRS AND TOURISM

2

COOPERATIVE AGREEMENT IN RESPECT OF THE MONITORING AND CONTROL OF RADIOACTIVE MATERIAL OR EXPOSURE TO IONISING RADIATION

In terms of the provisions of section 6 of the National Nuclear Regulator Act (Act No. 47 of 1999) and Regulation No. 709 of 24 May 2002 Between

The National Nuclear Regulator

And

Department of Environmental Affairs and Tourism

(hereinafter referred to as parties)

PREAMBLE

Whereas: The National Nuclear Regulator (hereinafter referred to as the NNR) has responsibilities with regard to the regulation of radiation hazards in terms of the National Nuclear Regulator Act (Act no 47 of 1999);

And whereas: The Department of Environmental Affairs and Tourism also has responsibilities with regard to the regulation environmental management associated with radiation hazards in terms of the National Environmental Management Act (Act no 107 of 1998) and the Environment Conservation Act (Act 73 of 1989);

And whereas: The parties acknowledge and respect each others autonomy and statutory responsibilities whilst recognizing the National Nuclear Regulator as the lead authority in the regulation of radiation hazards with a view to protecting persons, property and the environment against nuclear damage;

And whereas: The National Nuclear Regulator and the Department of Environmental Affairs and Tourism (hereafter referred to as DEAT) have concluded an agreement in terms of the requirements for co-operative governance as provided for in terms of the provision of section 6 of the National Nuclear Regulator Act, section 35 of the National Environmental Management Act and section 41 of the Constitution of the Republic of South Africa.

Now therefore the parties record the following-

SCOPE

This agreement provides for the working relationship with regards to issues Environmental impact between the Department of Environmental Affairs and Tourism and the National Nuclear Regulator with regard to:

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i. ensuring the effective monitoring and control of the nuclear hazard;
ii. co-coordinating the exercise of such functions;
iii. minimizing the duplication of such functions and procedures regarding the exercise or such functions; and
iv. promoting consistency in the exercise of such functions

ARTICLE I

Time period for implementation of this agreement

The parties agree that this agreement must be implemented on the date of signature hereof.

ARTICLE II

Coordination of functions with respect of the monitoring and control of radioactive material or exposure to ionising radiation

Specific Activity	Lead responsibility	Support Responsibility	Mechanisms & procedure for cooperation
Develop legislation, safety standards and regulatory practice including conditions of authorisation (where applicable) and guidelines.	NNR develop according to the NNRA	DEAT to provide input	The NNR must involve the DEAT to participate in the development process.
	DEAT develop according to the NEMA, ECA	The NNR to provide input to radiation matters	The DEAT must involve the NNR to participate in the development process.
Issue nuclear authorisations and authorization change requests in terms of NNRA	NNR	DEAT	The NNR must notify the DEAT in writing of authorizations and status
The issuing of Environmental Impact Assessment authorisations for construction and operation, where applicable, of nuclear installation in terms of the NEMA or ECA	DEAT	NNR	Through a mechanism and process as established by DEAT and the NNR
Investigate accidents, incidents and other occurrences which impacts on the public	NNR	DEAT	Joint investigations must be conducted
Conduct inspections and audits related to nuclear authorisations	NNR	DEAT	NNR communicates findings to DEAT.

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Conduct inspections and audits related to authorisations issued in terms of NEMA and ECA	DEAT	NNR	DEAT will communicate any radiation anomalies identified during their general inspections to the NNR for action
Review routine reports (Occupational Hygiene and Occupational Medicine)	NNR	DEAT	The NNR provides DEAT with the results.
Conduct regulatory research and development	NNR	DEAT	The NNR would invite participation from DEAT and elicit support from DEAT processes
Enforce legislation	NNR	DEAT	Offences and non-compliances must be communicated to both parties. NNR take the necessary action after consultation between the parties, should the offence relate to the NNRA, or where the offence relates to the NNRA and the NEMA and/or ECA.
	DEAT	NNR	Offences and non-compliances must be communicated to both parties. DEAT take the necessary action after consultation between the parties, should the offence relate only to NEMA / ECA.

ARTICLE III

Measures to resolve non-compliances with this agreement

In the event of either of the parties failing to comply with any provision of this agreement every effort must be made to ensure compliance thereof. Where the parties are unable to reach agreement on compliance after referral to the Joint Coordinating Committee referred to in section V, the details of such non-compliance must separately be referred to the respective Ministers for determination.

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ARTICLE IV

Resolution of disputes in respect of the interpretation or application of this agreement

The parties agree that, in the event of any dispute relating to the interpretation or application of any provision contained in this agreement, every effort must be made to resolve such dispute between the parties. Where the parties are unable to resolve the dispute after referral to the Joint Coordinating Committee, the details of such dispute must separately be referred to the respective Ministers for determination.

ARTICLE V

Mechanisms and procedures for co-operation between the parties

In order to implement the provisions of this agreement, the parties agree to the following:

i. A joint coordinating committee must be established, and must be chaired by the Chief Executive Officer of the NNR.

Membership of this committee must consist of an equal number of representatives from each party and the Deputy Director General Environmental Quality & Protection must head the DEAT representation.

ii. The joint coordinating committee must meet at least bi-annually.

iii. The joint coordinating committee is responsible for the establishment of working groups, where the need arises, to conduct the tasks identified by the committee to comply with this agreement.

ARTICLE VI

Safety Standards

The standards established in terms of section 36 of the National Nuclear Regulator Act must be applicable to all relevant provisions of the implementation of regulation, monitoring and control of radiation hazards falling within the responsibility of the parties. Where the regulation contemplated in section 36 does not address the safety standards relating to responsibilities of DEAT, the parties may agree that a recommendation be made to the Minister to have the regulation amended accordingly.

ARTICLE VII

Coordination of monitoring and enforcement functions

The coordination of monitoring and enforcement functions shall be carried out as indicated in article II.

ARTICLE VIII

Record of delegation

No delegations has been made in terms of section 238 of the constitution.

ARTICLE IX

Expert Assistance and support

As and when required the parties agree to provide expert assistance to each other. The NNR would provide radiation expert assistance and support to the DEAT. The DEAT would provide expert assistance and support in respect of Environmental Impact Assessment procedures to the NNR.

ARTICLE X

Sharing of Relevant information

Relevant information must be shared by the quickest means of communication supported in writing by the parties.

Means of communication including but is not restricted to:

- Telephone
- E-mail
- Fax
- Ordinary mail
- Working groups and
- Joint Co-ordinating Committee

ARTICLE XI

Coordination of Responses to incidents/accidents

The coordination of responses to incidents/accidents shall be carried out as outlined in article II.

ARTICLE XII

Amendments to co-operative agreements

This agreement constitutes the entire agreement between the parties and any amendment thereto must only be effective when reduced to writing after agreement by the Joint Coordinating Committee and signed by both parties.

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THUS DONE AND SIGNED AT CENTURION On This 13TH Day

Of JUNE 2006.

For NATIONAL NUCLEAR REGULATOR

M Magugumela
Chief Executive Officer

WITNESSES

1.

2.

THUS DONE AND SIGNED AT PRETORIA On This 15th Day

Of June 2006.

J. Yawith.

For DEPARTMENT OF ENVIRONMENTAL
AFFAIRS AND TOURISM

J Yawith
Deputy Director General: Environmental Quality and Protection

WITNESSES

1.

2.

8.15 CURRICULUM VITAE OF CONSULTANTS

8.15.1 MR OTTO F GRAUPNER

a) Personal Particulars

Date of birth :	26 May 1947
Nationality :	South African Citizen
Specialisation :	Environmental Management
Years experience:	35 years in Conservation, Environmental Planning and Management

b) Academic qualifications

BSc, University of Pretoria, 1969

BSc Hons, Wildlife Management, University of Pretoria, 1972

MDP, Unisa, 1985

AEP, Unisa, 1987

c) Specialist Courses:

- Advanced Negotiations
- Concentric Management
- Strategic Management and Lateral Thinking
- Conflict Resolution
- Advanced Presentation Skills
- Quality/Environmental Auditing

d) Employment record

1969 - 1970:	Smithsonian Institute, Washington, DC, as Field Officer
1970 - 1975:	Transvaal Nature Conservation, Research Officer on Wildlife Management and Game Farming
1976 – 1982:	Central Government, Assistant Director: Environmental Planning and Management
1982 – 1997:	Eskom, Corporate Environmental Manager
1998 – 2002:	Poltech (Pty) Ltd, Environmental Manager & Specialist Consultant

2003 onwards: GeoScientific and Exploration Services cc. Associate Member

e) Specialsition

35 years of experience in the fields of environmental planning and management in the natural, industrial and health sections in both government, para-statals and the private sector. Particular fields of environmental expertise related to:

- Formulation and implementation of Environmental Impact Assessments and Management Plans (Basic Assessments, EIAs, EMPs and EMPRs)
- Design and formulation of environmental data banks
- Formulation and implementation of Environmental Management Systems (ISO 14001)
- Design and implementation of Environmental Auditing Systems, Environmental Policy formulation and implementation, Environmental Performance Indicator Development
- Annual Environmental Report compilation
- Environmental Due Diligence and Risk Assessments

f) Project experience

<u>Utility Environment</u>

- Project Manager: Environmental Impact Assessments for Demonstration Module for the Eskom Pebble Bed Modular Reactor (PBMR), Fuel Manufacturing and associated transport of nuclear materials (1999 – 2002)
- Project Leader: Establishment of Flexible Coal Transport Systems for Eskom Power Stations (1995 – 1997). This study involved engineering, financial, environmental, socio-economic and public consultation components.
- Establishment of a Groundwater monitoring system for Eskom Power Stations (1985 – 1990)
- Siting of Dry Ash Disposal Facilities for 5 Eskom Power Stations (1983 – 1988)
- Identification, assessment and acquisition of potential future nuclear power station sites (1982 – 1990)
- Development and implementation of a Environmental Management Plan for the Palmiet Pumped Storage Scheme (1982 – 1985)
- Siting of the Tutuka, Letabo, Matimba and Majuba Power Station and associated facilities (1983 – 1985)

Project Management and Environmental Assessment for various Eskom power lines. The more noted ones are stated below, namely:

- Routes for the 400kV power lines to link the identified nuclear sites to the national grid. This also involved the identification and environmental qualification of substation sites.
- The delineation and environmental assessment for the 2 X 275 kV power lines from Matimba Power Station (Ellisras) to Johannesburg and associated high voltage substation sites that covered a distance of some 250 km.
- The delineation of route corridors for the 2 X 400 kV power lines from Tutuka Power station (Standerton) to the electricity market in Durban, Kwa Zulu Natal that stretched over a distance of about 300 km. This assessment included the associated high voltage sub station sites.
- The Identification and assessment of a 132 kV powerline and substations for Bison board factory in Piet Retief. The line covered a distance of about 70 km.
- The transmission and distribution lines and associated sub stations also involved the use of new tower designs that allowed more cost effective and faster construction and also considered bird (Raptor) friendly designs

<u>Corporate Field</u>

Corporate Environmental Manager (Eskom): - Establishment and Maintenance of Environmental Functions (1987 – 1997) incorporating the following:

- Environmental Policy
- Environmental Management Systems & Accountabilities
- Environmental Auditing Systems
- Environmental Performance Indicators
- Environmental Annual Reports
- Environmental Marketing and Communication Plans
- Environmental Financial Investment Portfolio

<u>Transport</u>

Assistant Project Manager: N4 Toll Road: Maputo Corridor (1998 – 2001), Provision of Environmental Input into the Construction, Operation and Maintenance of the Toll Road and associated facilities.

<u>Urban Environment</u>

- Formulation of a Scoping Report and an Environmental Management Plan for a proposed Residential and Agri-Industrial Development for Chinese Investor in the Vereeniging Area (1998).
- Environmental Scoping Report for the relocation of Aerosud Workshop and offices to Pierre van Ryneveld Park, Centurion (2202/3).
- Exemption applications and Basic Assessments for various residential developments in the Gauteng province (2002 to current)

Industrial Environment

- Environmental Risk Assessment of the Acid Storage Tanks, Loading Facilities and Acid Plant of the Ergo Plant for Kynochem and Anglogold Division (1999 - 2000).
- Environmental Due Diligence Assessment and Letter of Conformance for a Pharmaceutical Manufacturing Plant in Cape Town. for Braite/FCC (2000).
- Phase 1 Environmental Due Diligence Audits of the Nigerian Bottling Company for Jacobs-Gibb (United Kingdom) 2001.
- Environmental Risk Assessment and the formulation of a Waste Management Plan for the NF_6 Plant at Pelindaba (2002).
- Environmental Assessment for a Medical Waste Incinerator for Clin-X, Boksburg, (2001)
- Environmental Assessment for a Medical Waste Incinerator for Aid Safe Waste, Dunswart, Benoni (2001).
- Co-author for the Amendment of the EMPR for a Chrome Smelter at Driekop, Steelpoort for ASA Metals (2002).
- Environmental Audit of the Anglo Platinum Refining Plant at Rustenburg (2002).
- Environmental Assessment, Due diligence Assessments, Environmental Management Plans and Permitting for the re-commissioning and operation of the Palmiet Ferrochrome Smelter, for Mogate Alloys, Krugerdorp (2003 to current).

g) Associated activities

- External Examiner for MBA, MBL graduate and post graduate students specialising in Environmental Management (Stellenbosch, Pretoria University & Pretoria Technicon – 1990 – 1997).
- Founder member of the Industrial Environmental Forum (1990 – 1995).
- Member of Environmental Committee of SACOB (1988 – 1987).

8.15.2 MR. WILLEM A LOMBAARD

a) Personal particulars

Date of birth:	14 September 1961
Nationality:	South African Citizen
Specialisation:	Impact of airborne and settled chemicals of Humans, and the environment
Years experience:	Occupational (Industrial) Hygiene Environmental Impact Assessment – 15 years

b) Academic qualifications

B.Sc., Potchefstroom University, 1982

M.Sc. Potchefstroom University, 1985

Mr. W Lombaard completed his M.Sc. thesis under the guidance of Dr. J Killblock of the then Chamber of Mines Industrial Hygiene Laboratory. The title of the above thesis was as follows, namely: Assessment of the Risk to health of foundry workers posed by silica dust, metal fumes and noise.

c) Specialist Courses

- Isokinetic emission monitoring – Pretoria Technicon
- Certificate of Competence – British Examination Board for Occupational Hygienists

d) Employment record

1983 – 1985:	Chamber of Mines, post graduate student.
1985 – 1987:	National Service
1987 – 1990:	Eskom, Officer: Risk Management – Engineering department
1990–1999:	Poltech (Pty) Ltd, Snr. Consultant (Occupational Hygiene; Environmental Management), General Manager and Board Chairman

e) Specialisation

Mr Lombaard has applied his formal scientific education to obtain a broad experience of the impact of mining and industry on the health of humans and the environment.

As a consultant Mr Lombaard had exposure to a broad field of activities in the field of health risk assessment and environmental impact. Health Risk Assessment work include consultation to small companies, as well as large corporations with regards to the mitigation of excessive risks inclusive of noise, airborne contaminants, heat stress, illumination, ventilation and ergonomics.

Mr Lombaard has also developed his skills in the field of environmental impact management especially with reference to noise and air pollution. His experience in these areas include environmental and source monitoring, impact description, impact modelling, health risk assessment and the development of appropriate mitigating measures.

f) Project experience

<u>Industrial and Mining Environment</u>

Occupational Health Risk Assessment and mitigation for the following prominent clients on a continual basis:

- Impala Platinum (Pty) Ltd
- ·BMW (SA) (Pty) Ltd
- DaimlerChrysler (SA) (Pty) Ltd
- Nissan (SA) (Pty) Ltd
- Hoechs ((Pty) Ltd
- Foskor Ltd (Pty) Ltd (Phosphate Mine)
- Omnia (Pty) Ltd (Fertiliser Manufacturer)
- Mondi (Pty) Ltd
- Columbus Stainless
- Iscor
- Iscor Mining
- Richardsbay Coal Terminal
- Anglo Coal
- Western Deep Mines
- Scaw Metals
- Texaco Panama Angola

Environmental audits, development of environmental management systems (ISO 14000), environmental health risk assessment and impact mitigation related consulting to the following companies:

- All of above mentioned
- Impala Platinum (Pty) Ltd
- Columbus Stainless
- African Products (Pty) Ltd
- Sasol Synthetic Fuel
- Sasol Chemicals
- Colgate Palmolive

Environmental Impact Assessment

Over and above technical inputs to several Environmental Impact Assessments (EIA) and Project Risk Management, in the past, Willem has managed and co-ordinated the following EIA's:

- Acrylonitrile Plant for Sasol Chemicals
- Braamhoek Pumped Storage Scheme for Eskom
- Boardmill in Mpumalanga for Tafibra Ltd
- Expansion of Palletising Plant for Samancor Manganese
- N4 Toll Road, Maputo Corridor
- Pebble Bed Modular Reactor (PBMR), and associated Fuel Manufacturing Plant – Leader of the EIA Team.

g) Education

Mr. Lombaard has acted as a guest lecturer for the University of Technology of Pretoria. This involved short courses, as well as a full course for third year B.Tech Students on Air Pollution Assessment and Management.

Mr. Lombaard was appointed as a moderator for two B. Honns students at the Potchefstroom University.

h) Associated activities

- Past president (two terms) of the Occupational Hygiene Association of South Africa (OHASA).
- Examination Board Member of the Institute for Occupational Hygiene of Southern Africa (IOHSA).
- Served on a Technical Committee to the Minister of Labour. Purpose of technical committee: to advice the minister on the education, training and registration of Occupational Health/Safety Professionals in South Africa.

- Served for five years as an Executive Committee Member of the African Chapter of Safari Club International.
- Is a dedicated hunter in terms of the Firearms Control Act. As such Mr. Lombaard breeds and trains German Shorthaired Pointers for bird and big game hunting.

8.15.3 DR DAVID DE WAAL

a) Personal particulars

Date of birth: 9 October 1957

Nationality: South African Citizen

Specialisation: Public participation, Social impact assessment and institutional conflict management.

Years experience: 24 years

b) Academic qualifications

BA Social Sciences/Law: Stellenbosch University, 1982

Ba, Hons. Stellenbosch University, 1983

MA. Communiy Development: Stellenbosch University, 1987

M A Development Administration (Community Development). Based upon a study of development amongst the! Kung Bushmen (specifically the Barakwena and !Vasekela)

Dlitt. et Phil. University of South Africa, 1992

Title: Strategic management of development: Mhala – A case study - focused on the participative mechanisms to strategically manage change and diversity in the development arena.

c) Employment record

1993 to date Afrosearch (Pty) Ltd and Mawatsan (Pty) Ltd

Pretoria, South Africa

Position: Director

1995 to date Foundation for People Centred Development.

Position: Director

1991 – 1993 INDEX (Pty) Ltd

Midrand, South Africa

Position: Managing Director.

Responsibilities: Index merged with Afrosearch in 1993

1988 – 1991 LHA Management Consultants

Position: Senior consultant

1986 – 1988 South African Development Trust Corporation

Position: Senior community development officer – seconded to the Department of Development Aid

d) Specialisation

Dr de Waal has focussed his professional carer on the developmental and environmental fields, including the management and implementation of public participation processes. He has extensive capacity building and support experience at local government, national government as well as international levels. He is an experienced social impact assessor and sits and facilitator.

e) Select recent project experience

Facilitation and Public Consultation

- Lead author of the public participation guidelines for the new EIA regulations
- Author of the public participation guidelines for the new EIA regulations for Gauteng
- Facilitation of the workshop process on the progress, future and implementation of the Commission for Unity and Reconciliation in Rwanda
- Facilitated public meetings for the Development Of An Environmental Management Plan (EMP) For Gautrain.
- Public participation for the formulation of an Environmental Management Framework (EMF) For The Modderfontein/Kayalami Corridor
- Public participation process as part of the Environmental Impact Assessment for the development of the Burnstone Gold Mine near Balfour
- Public participation process as part of the Environmental Impact Assessment for the development of the Leeuwkop Mine near Rustenburg
- Public participation process as part of the Environmental Impact Assessment for the of residential housing near Modderfontein, Gauteng
- Public participation for the research project: Investigation of the borehole disposal of disused sealed radioactive sources

- Public participation process as part of the Environmental Impact Assessment for the upgrading of the road system in the Menlyn node, Pretoria
- Public participation for the Environmental Impact Assessment To Develop An Environmental Management Programme For Coal Mines In The Proposed Western Complex Project
- Public Participation Process for the Iscor Vanderbijlpark Steel Water Use Licence Application Process
- Public Participation process for the upgrading of the Coke Ovens at Iscor Vanderbijlpark Steel
- Public Participation Process for the Mittal Steel Vanderbijlpark Steel sinter planr upgrades.
- Public Participation Process for the Environmental Impact Assessment for proposed Pebble Bed Nuclear Modular Reactor and the transportation of nuclear materials

Social Impact Assessment

- Social Impact Assessment and Social Mobilisation Potential for the proposed downscaling/closure of the Beeshoek Mine and simultaneous development of the Kathu Mine
- Social Impact Assessment for the Environmental Impact Assessment for the proposed Pebble Bed Modular Reactor at Koeberg and the transportation of nuclear material from Durban to Pelindaba
- Social Impact Assessment for the Environmental Impact Assessment for the N4 Platinum Highway (Botswana Toll Road)
- Preliminary Social Impact Assessment of the Hatherley Domestic Landfill Site
- Social Impact Assessment for the Rooderant Mine in the Northwest Province

Training and Development

- Training on Supporting the Development of Consumer Services at Local Government Level
- Training on Water Services Sector Legislative Frameworks from a support and Regulatory Perspective
- Development of outcomes based training material in Communication skills and Management skills and Basic Bookkeeping
- Catchment – based Integrated Water Resources Management Training
- Certificate course on Policy Development for Freestate Councillors and key officials – Department of Water Affairs and Provincial Government

- Certificate course on Policy Development for Councillors and key officials – Department of Water Affairs and Northern Province Provincial Government

f) Education

Dr de Waal regularly acts as guest lecturer for the Universities of Pretoria and Johannesburg in the fields of social impact assessment and public participation processes.

g) Associated activities

- Member of the ISO 14001 advisory Board of the SABS
- Member of the International Association of Impact Assessment
- Member of South Africa –Rwanda association

8.16 APPENDIX 14: NATIONAL INTEGRATED RESOURCE PLAN (NIRP)