Inspection Report

Adequacy Assessment of Pollution Control Facilities for Compliance with the Environmental Norms in Industries Located within Cuncolim Industrial Estate, Cuncolim, Goa

Hon'ble High Court of Bombay at Goa

National Environmental Engineering Research Institute
Nagpur – 440 020

November 21, 2006

National Environmental Engineering Research Institute
Nehru Marg, Nagpur – 440 020

NEERI

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1.0 Preamble

1.1 Constitution of the Inspection Team

The Hon'ble High Court of Bombay at Goa, in its order of October 10, 2006 (Writ petition No. 376 of 2006), directed NEERI to inspect the Pollution control facilities installed at various industries located in Cuncolim Industrial Estate, Cuncolim in the State of Goa for their adequacy or otherwise, and to submit the inspection report to the Hon'ble Court.

Accordingly, a five member team constituted by the Director, NEERI, comprising Dr. Tapas Nandy, Dr. S.M. Tamhane, Mr. M.P. Patil, Dr. Pradyumna Pathe and Mrs Padma Rao inspected the pollution control facilities in the following industries in Cuncolim Industrial Estate:

- M/s Maa Durga Enterprises (P) Ltd.
- M/s Shri Balaji Rollings (P) Ltd.
- M/s Rukminirama Steel Rollings (P) Ltd.
- M/s Shirdi Steel Rerollers (P) Ltd.
- M/s Surise Electromelt Ltd.
- M/s Karthik Alloys Ltd.
- M/s Puja Ferro Alloys Ltd.
- M/s Nicomet Industries Ltd.
- M/s Sunrise Zinc Ltd.

The aforereferred industries were inspected from November 1 to 5, 2006, along with the following personnel from the Goa State Pollution Control Board (GSPCB):

GSPCB Personnel	Industries Inspected
Ms. Jenica Sequeira, Sc. B Mr. Sailesh Vaigankar, JEE	M/s Maa Durga Enterprises (P) Ltd.
Mr. Sailesh Vaigankar, JEE	M/s Shri Balaji Rollings (P) Ltd.
Mr. Sailesh Vaigankar, JEE	M/s Rukminirama Steel Rollings (P) Ltd.

Contd...

Mr. Sailesh Vaigankar, JEE Mr. Francisca Pereiva, Sc. Asst.	M/s Shirdi Steel Rerollers (P) Ltd.
Mr. Sailesh Vaigankar, JEE	M/s Surise Electromelt Ltd.
Ms. Jenica Sequeira, Sc. B Mr. Sailesh Vaigankar, JEE	M/s Karthik Alloys Ltd.
Ms. Jenica Sequeira, Sc. B Mr. Sailesh Vaigankar, JEE	M/s Puja Ferro Alloys Ltd.
Ms. Jenica Sequeira, Sc. B Mr. Sailesh Vaigankar, JEE	M/s Nicomet Industries Ltd.
Ms. Jenica Sequeira, Sc. B Mr. Sailesh Vaigankar, JEE Mr. Francisca Pereiva, Sc. Asst.	M/s Sunrise Zinc Ltd.

In addition, discussions were also held with the Member Secretary, GSPCB on various issues related to each of the inspected industry and with the Petitioner on various issues pertaining to the Petition filed by him in the Hon'ble High Court of Bombay at Goa.

1.2 Inspection

The details on inventory of industries were procured from the industry management in consultation with personnel from the GSPCB through a questionnaire, and field survey. The questionnaire comprised the following relevant informations, namely location, raw materials, products, process details, air emission and control, source of water supply, water requirement, wastewater generation, effluent treatment scheme, solid waste generation, future projection, etc. The details are presented in the report as well as in the Annexure I.

The aerial view of the location of industries inspected in Cuncolim Industrial Estate, including the irrigation canal is shown in Fig. 1. The report presents the industry details, observations on the status of pollution control facilities, and conclusions and recommendations of the Inspection Team.

2.0 Observations

2.1 M/s MAA Durga Enterprises (P) Ltd.

2.1.1 Present Status

M/s MAA Durga Enterprises (P) Ltd. (MDEPL) manufactures mild steel (M S) Ingots and TOR steel (CTD bars) by using induction furnace and rolling mill furnace respectively. The raw materials for the manufacture of ingots include, sponge iron, pig iron and M S scrap. The raw materials are melted in induction furnace and poured into ingot moulds for casting M S ingots. The ingots are then fed to the rolling mill furnace to cast bars and rods of desired sizes.

During the inspection period (November 1, 2006), the rated capacity of MS ingots and TOR steel (CTD bars) were 43.1 and 43.6 tonnes/d vis-à-vis the installed capacity of 90 and 87 tonnes/d, respectively.

2.1.2 Air Pollution and Control

The GSPCB consent to operate under Air Act 1981 issued to the industry was valid up to August 31, 2006.

The gases emanating out of induction furnace are partially removed from a overhead movable canopy attached to a cyclone followed by chimney through ducting and are released through the chimney. The remaining comes out as fugitive emission.

The stack height is 17 m as against CPCB norms of minimum 30 m. Stack gas emission characteristics as projected in the Table 2.1 is presently satisfying the norms laid down by GSPCB. However, instantaneous fugitive SO_2 emission concentrations near reheating furnace of rerolling mills are observed to be high as determined by the inspection team.

Table 2.1: Flue Gas Characteristics and Stack Details

Production Unit	Flue gas details			Flue gas characteristics, emission concentration and load						Stack details		
	Temp.	Velocity	Vol. flow rate	PM		SO_2		NO_X		Existing		Required
				Conc.	Load	Conc.	Load	Conc.	Load	I.D.	Ht.	Ht.
	°C	m/s	m^3/h	mg/m^3	kg/h	mg/m^3	kg/h	mg/m^3	kg/h	M	m	m
Induction furnace	99	14.7	11962	123.8	1.48	88.1	1.05	486.3	5.82	0.6	17	30
Reheating furnace	146	10	3786	-	-	3110	17.77	391.6	1.22	0.6	12	30

Remarks: GSPCB PM Emission Stds. – 150 mg/m^3.
CPCB Stack Height Regulations – Height = 14 $Q^{0.3}$, where Q is SO_2 in kg/h.

The unit has installed cyclone on furnace flue gases for dust emission control. The flue gas emission characteristics as monitored are presented in Table 2.1. The emissions meet the stipulated standards of the GSPCB.

2.1.3 Wastewater Generation, Characteristics and Management

M/s MDEPL does not have the GSPCB Consent to Operate under Section 25 of the Water Act, 1974, (as amended).

The water usage in the industry is for cooling purpose only, and the daily requirement for cooling water makeup is 20 m^3/d. There is no effluent generation from the unit. The system water, after holding in settling tanks, is cooled through cooling towers and recycled. The settling tanks are cleaned at regular intervals (usually once a month) for removal of settled solids. The solids are stored along with slag within the industry premises. The sanitary wastewater (generation of

around 0.4 m^3/d) is treated through septic tanks. There is no discharge of effluent from the industry.

To evaluate the cooling water characteristics, sample was collected from the feed tank. The cooling water being recycled conforms to the stipulated standards of the GSPCB for discharge into Inland Surface Waters and onto Land for irrigation (Table 2.2).

2.1.4 Solid Waste Generation, Characteristics and Management

The major source of solid waste generated at M/s MDEPL is steel slag from induction furnace, which amounts to about 4.5 tonnes per day. Besides this, a small quantity of cyclone dust (0.1 tonnes per day) and mill scales (0.3 tonnes per day) are also generated from air pollution control section and steel rolling mill section, respectively which are recycled back to the process due to high carbon and steel contents.

As observed during inspection, the steel slag generated by the industry is being dumped in low-lying areas and open land within their own premises.

The representative samples of steel slag were collected and subjected to detailed physico-chemical characterization and leaching tests. The results of the characterization and leaching tests are listed in Table 2.3.

As per Schedule 1 of Hazardous Wastes (Management & Handling) Amendment Rules, 2003, (HWM Rules, 2003) the slag generated from the production of iron and steel (including electric furnaces and steel rolling mills) is not listed as hazardous waste. The industry has therefore not applied for an Authorization for hazardous waste management.

The characteristics of steel slag as presented in Table 2.3 indicate that the major constituent of concern is arsenic, as the concentration (278 mg/kg) exceeds the regulatory limit for arsenic as stipulated in the Schedule 2 of HWM Rules, 2003. Hence, the steel slag generated at M/s MDEPL may be classified under hazardous wastes as per Schedule 2 of these rules. Therefore, for all practical purposes disposal methods as per HWM Rules, 2003 must be adopted.

However, the assessment of leaching potential of the steel slag as per Toxicity Characteristics Leaching Procedure Test of United States Environmental Protection Agency (USEPA), which has been adopted from the ASTM Method D 5233–92 of American Society for Testing of Materials, indicates that the steel slag has a very poor leachability. This is evident from the characteristics of TCLP leachate (Table 2.3), as none of the parameters exceed the TCLP regulatory limit, which is 100 times the Indian Standards for Drinking Water Quality (IS 10500 – 1995). Moreover, the assessment of leaching potential of the wastes as per water leaching criteria delineated by Central Pollution Control Board (CPCB), New Delhi (*Guidelines for Proper Functioning and Upkeep of Disposal Sites, Hazardous*

GPCB:Table

Table 2.2 : Physico-chemical Characteristics of Cooling Water at various Industries (Sampling Period : November 01 – 05, 2006)

Sr. No.	Parameters	Sampling Location							Effluent Discharge Standards*	
		I	II	III	IV	V	VI	VII	Into Inland Surface Water	Onto Land for Irrigation
1.	Colour, Pt. Co Units	35	30	32	36	30	33	35	**	-
2.	Temperature, ^{0}C	45	42	46	43	42	44	45	#	-
3.	pH	7.2	8.2	8.7	7.4	7.5	8.0	7.7	5.5 - 9.0	5.5 - 9.0
4.	Total Alkalinity	350	410	480	410	440	530	470	-	-
5.	SS	78	64	56	84	70	92	68	100	-
6.	TDS	546	478	1294	682	598	840	756	2100	2100
7.	COD	36.4	41.8	46.2	42.5	36.4	38.4	40.8	250	-
8.	BOD	2	3	3	3	2	2	2	30	100
9.	Chlorides	84	68	38	44	56	39	40	1000	600
10.	Sulphates	122	36	40	52	58	44	66	1000	1000
11.	Nitrate Nitrogen	0.22	0.26	0.24	0.29	0.23	0.21	0.26	10	-
12.	Calcium	64	24	26	32	20	36	52	-	-
13.	Magnesium	26.4	14.8	15.2	18.4	12.6	19.2	20.4	-	-
14.	Sodium	44	34	28	23	29	20	22	-	-
15.	Potassium	0.31	0.30	0.29	0.25	0.28	0.33	0.28	-	-
16.	Heavy Metals									
	Iron	0.204	0.320	0.222	0.278	0.314	0.296	0.278	3.0	-
	Zinc	0.198	0.246	0.208	0.118	0.143	0.232	0.176	5.0	-
	Lead	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.1	-
	Copper	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3.0	-
	Nickel	0.482	0.436	0.428	0.486	0.392	0.202	0.334	3.0	-
	Cobalt	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-	-
	Chromium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2.0	-
	Manganese	0.138	0.072	0.066	0.108	0.156	0.144	0.162	2.0	-
	Cadmium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2.0	-
	Arsenic	0.055	0.050	0.047	0.049	0.036	0.029	0.108	-	0.2

* MEF Standards.
** Removed to the maximum extent possible.
# Should not exceed 5 ^{0}C at the point of discharge of effluents.
All values are expressed in mg/L except pH, temperature and colour.
Sampling location:
- Cooling water sample from M/s Maa Durga Enterprises (P) Ltd.
- Cooling water sample from M/s Shree Balaji Rollings (P) Ltd.
- Cooling water sample from M/s Rukminirama Steel Rollings (P) Ltd.
- Cooling water sample from M/s Shirdi Steel Rerollers (P) Ltd.
- Cooling water sample from M/s Sunrise Electromelt Ltd.
- Cooling water sample from M/s Karthik Alloys Ltd.
- Cooling water sample from M/s Puja Ferro Alloys Ltd.
- Cooling water sample from M/s Sunrise Zinc Ltd.

BDL– Below Detectable Limit.

- **Cooling water from industries is being recycled.**

Table 2.3: Characteristics and Leachability of Steel Slag

Parameters	Characteristics of Steel Slag		Leachability of Steel Slag as per USEPA TCLP (USEPA Criteria)		Leachability of Steel Slag as per Water Leach Test (CPCB Criteria)	
	Conc. in Slag (mg/kg)	Regulatory Limit as per HWM Rules, 2003 (mg/kg)	Conc. in TCLP Leachate (mg/L)	TCLP Regulatory Limit (mg/L)	Conc. in Water Leachate (mg/L)	Regulatory Limit (mg/L)
Aluminium	**122**	**N.S.**	BDL	N.S.	BDL	N.S.
Arsenic	**278**	**50**	0.03	5	BDL	<1
Cadmium	22	50	0.18	1	BDL	<0.2
Cobalt	2984	5000	2.88	N.S	BDL	N.S.
Copper	3330	5000	0.09	5	BDL	<10
Chromium	290	5000	0.22	5	BDL	<0.5
Iron	**141562**	**N.S.**	78	N.S.	BDL	N.S.
Lead	899	5000	1.15	5	0.21	<2
Manganese	**17415**	**N.S.**	9.0	10	BDL	N.S.
Magnesium	**13137**	**N.S.**	0.33	N.S.	0.12	N.S.
Nickel	137	5000	0.46	N.S.	0.03	<3
Zinc	1222	20000	1.04	500	BDL	<10

BDL – Below Detectable Limit
N.S. – Not Stipulated

Waste Management Series: HAZWAMS/32/2005 – 2006) also indicates the poor leachability of steel slag, as concentration of none of the parameters exceed the stipulated limit (Table 2.3). Since the slag is generated at a temperature exceeding 1200° C, the metal impurities present in the slag are fused together and tightly bound form, and therefore not readily liberated from the slag particles or easily leached into the environment. Considering, the characteristics of the slag and leachability studies, it is recommended that industry should seek a clarification from GSPCB/CPCB, whether to designate steel slag as hazardous or non-hazardous waste.

Based on the detailed assessment of steel slag generated at M/s MDEPL, it may be concluded that the present practice of dumping of steel slag within the premises, may not result in any adverse environmental effect, especially on contamination of groundwater and surface water resources. In fact, nowhere in the world, steel slag is considered hazardous in spite of hazardous constituents because of the immobilization of toxic metals and metalloids during the high temperature operation. Steel slag is often recommended for use in the road making and for cement manufacture. It may be mentioned here, that CPCB has clarified that slag generated from copper smelter operations is non-hazardous and can be used in cement industries, filling up low lying areas, building/road construction material vide its letter (No. B-12015/33/03-AS) dated November 17, 2003 addressed to the Chairperson, Tamil Nadu Pollution Control Board, Chennai (copy enclosed – Annexure II)

Considering the present rate of generation of steel slag and the limited space available with the industry, illegal dumping of steel slag outside the premises cannot be ruled out in future. This is evident from a number of illegal slag dumps, which were observed by the inspection team within the Cuncolim Industrial Estate. It is therefore recommended that proper record of slag generation must be maintained by the industry under intimation to GSPCB. The GSPCB must evolve a proper disposal strategy in consultation with the CPCB.

2.1.5 Conclusions and Recommendations

- M/s MDEPL must renew GSPCB Consent to Operate under Section 25 of the Air Act, 1981, (as amended) which stands expired as on date.

- As per the management, the industry has applied for GSPCB Consent to Operate under Section 25 of the Water Act, 1974 (as amended) on October 10, 2006. The management must ensure to acquire the same immediately from GSPCB, otherwise all industrial operations will be construed illegal under prevailing Water and Air Acts.

- The present stack height is only 17 m as against CPCB norms of minimum 30 m. Therefore, the stack height must be raised to minimum of 30 m. The

leakages from various section of the reheating furnace are to be plugged in order to improve workplace environment.

- In case, GSPCB/CPCB designates the slag as non-hazardous, it may be used for back-filling and restoration of the abandoned laterite stone quarries located in the vicinity of the Cuncolim Industrial Estate. In addition, a number of abandoned laterite mines are situated near village Quepem (about 5 km from Cuncolim Industrial Estate) spanning an area of hundreds of acres. However, a detailed environmental impact assessment needs to be carried out by the industries generating solid non-hazardous wastes in consultation with GSPCB for evaluating the feasibility of this option.

2.2 M/s Shri Balaji Rollings (P) Ltd.

2.2.1 Present Status

M/s Shri Balaji Rollings (P) Ltd. (SBRPL) is engaged in the production of MS ingots. The major raw materials for the manufacture of ingots include sponge iron, pig iron, and MS scrap. The raw materials are melted in an induction furnace and poured into ingot moulds for casting.

During the inspection period (November 5, 2006), the rated capacity of MS ingots was 58.7 tonnes/d vis-à-vis the installed capacity of 65 tonnes/d.

2.2.2 Air Pollution and Control

The GSPCB consent to operate under Air Act 1981 was valid upto October 31, 2006.

The height of stack is only 22 m and does not meet the CPCB standard of 30 m (minimum). The unit has installed cyclone on furnace flue gases for dust emission control and plans to replace it by bag filter and roof-top suction assembly. The flue gas emission characteristics, as reported in Table 2.4, meets emission standards laid down by GSPCB.

The unit has one D.G. set of 75 KW capacity, which operates only under emergency (during power failure) and runs for around 3-5 h/month.

Table 2.4: Flue Gas Characteristics and Stack Details

Production Unit	Flue gas details			Flue gas characteristics, emission concentration and load						Stack details		
	Temp.	Velocity	Vol. flow rate	PM		SO_2		NO_X		Existing		Required
				Conc.	Load	Conc.	Load	Conc.	Load	I.D.	Ht.	Ht.
	°C	m/s	m^3/h	mg/m^3	kg/h	mg/m^3	kg/h	mg/m^3	kg/h	M	m	m
Induction furnace	82	16	8697	83.5	0.7	360.7	3.2	1025	8.9	0.5	22	30

Remarks: GSPCB PM Emission Stds. – 150 mg/m^3.
CPCB Stack Height Regulations – Height = 14 $Q^{0.3}$, where Q is SO_2 in kg/h.

2.2.3 Wastewater Generation, Characteristics and Management

The unit does not have the GSPCB Consent to Operate under Section 25 of the Water Act, 1974 (as amended).

The water usage in the industry is for cooling purpose and slag cooling. Daily requirement for cooling water makeup and slag cooling is 3.0 and 0.5 m^3/d, respectively. The cooling water, after holding in settling tanks, is cooled through cooling towers and recycled. The settling tanks are cleaned at regular interval (usually once a month) for removal of settled solids. The solids are stored along with slag within the industry premises. The sanitary wastewater generation of around 1.0 m^3/d is treated through septic tanks. There is no discharge of effluent from the industry.

To evaluate the cooling water characteristics, sample was collected from the feed tank. The cooling water being recycled conforms to the stipulated standards of the GSPCB for discharge into Inland Surface Waters and onto Land for irrigation (Table 2.2).

2.2.4 Solid Waste Generation, Characteristics and Management

The major source of solid waste generated at M/s SBRPL is steel slag generated from induction furnace, which amounts to about 5 tonnes/d. Besides this, a small quantity of cyclone dust are also generated from air pollution control section which is recycled back to the induction furnace due to high carbon and iron content.

As observed during inspection, the steel slag generated by the industry is being dumped in low-lying areas and open land within their own premises.

The representative samples of steel slag were collected and subjected to detailed physico-chemical characterization and leaching tests. The results of the characterization and leaching tests are listed in Table 2.5.

As per Schedule 1 of Hazardous Wastes (Management & Handling) Amendment Rules, 2003, (HWM Rules, 2003) the slag generated from the production of iron and steel (including electric furnaces and steel rolling mills) is not listed as hazardous waste. The industry has therefore not applied for an Authorization for hazardous waste management.

The characteristics of steel slag as presented in Table 2.5 indicate that the major constituent of concern is arsenic, as the concentration (189 mg/kg) exceeds the regulatory limit for arsenic as stipulated in the Schedule 2 of HWM Rules, 2003. Hence, the steel slag generated at M/s SBRPL may be classified under hazardous wastes as per Schedule 2 of these rules. Therefore, for all practical purposes disposal methods as per HWM Rules, 2003 must be adopted.

Table 2.5: Characteristics and Leachability of Steel Slag

Parameters	Characteristics of Steel Slag		Leachability of Steel Slag as per USEPA TCLP (USEPA Criteria)		Leachability of Steel Slag as per Water Leach Test (CPCB Criteria)	
	Conc. in Slag (mg/kg)	Regulatory Limit as per HWM Rules, 2003 (mg/kg)	Conc. in TCLP Leachate (mg/L)	TCLP Regulatory Limit (mg/L)	Conc. in Water Leachate (mg/L)	Regulatory Limit (mg/L)
Aluminium	**86**	**N.S.**	BDL	N.S.	BDL	N.S.
Arsenic	**189**	**50**	0.02	5	BDL	<1
Cadmium	18	50	0.15	1	BDL	<0.2
Cobalt	2169	5000	1.79	N.S	BDL	N.S.
Copper	3815	5000	0.17	5	0.01	<10
Chromium	431	5000	0.57	5	0.03	<0.5
Iron	**162119**	**N.S.**	89	N.S.	BDL	N.S.
Lead	1128	5000	1.23	5	0.51	<2
Manganese	**16217**	**N.S.**	8.3	10	BDL	N.S.
Magnesium	**9982**	**N.S.**	0.64	N.S.	0.37	N.S.
Nickel	632	5000	0.82	N.S.	0.12	<3
Zinc	3120	20000	6.52	500	0.05	<10

BDL – Below Detectable Limit
N.S. – Not Stipulated

However, the assessment of leaching potential of the steel slag as per Toxicity Characteristics Leaching Procedure Test of United States Environmental Protection Agency (USEPA), which has been adopted from the ASTM Method D 5233–92 of American Society for Testing of Materials, indicates that the steel slag has a very poor leachability. This is evident from the characteristics of TCLP leachate (Table 2.5), as none of the parameters exceed the TCLP regulatory limit, which is 100 times the Indian Standards for Drinking Water Quality (IS 10500 – 1995). Moreover, the assessment of leaching potential of the wastes as per water leaching criteria delineated by Central Pollution Control Board (CPCB), New Delhi (Guidelines for Proper Functioning and Upkeep of Disposal Sites, Hazardous Waste Management Series: HAZWAMS/32/2005 – 2006) also indicates the poor leachability of steel slag, as concentration of none of the parameters exceed the stipulated limit (Table 2.5). Since the slag is generated at a temperature exceeding 1200° C, the metal impurities present in the slag are fused together and tightly bound form, and therefore not readily liberated from the slag particles or easily leached into the environment. Considering, the characteristics of the slag and leachability studies, it is recommended that industry should seek a clarification from GSPCB/CPCB, whether to designate steel slag as hazardous or non-hazardous waste.

Based on the detailed assessment of steel slag generated at M/s SBRPL, it may be concluded that the present practice of dumping of steel slag within the premises, may not result in any adverse environmental effect, especially on contamination of groundwater and surface water resources. In fact, nowhere in the world, steel slag is considered hazardous in spite of hazardous constituents because of the immobilization of toxic metals and metalloids during the high temperature operation. Steel slag is often recommended for use in the road making and for cement manufacture. It may be mentioned here, that CPCB has clarified that slag generated from copper smelter operations is non-hazardous and can be used in cement industries, filling up low lying areas, building/road construction material vide its letter (No. B-12015/33/03-AS) dated November 17, 2003 addressed to the Chairperson, Tamil Nadu Pollution Control Board, Chennai (copy enclosed – Annexure II)

Considering the present rate of generation of steel slag and the limited space available with the industry, illegal dumping of steel slag outside the premises cannot be ruled out in future. This is evident from a number of illegal slag dumps, which were observed by the inspection team within the Cuncolim Industrial Estate. It is therefore recommended that proper record of slag generation must be maintained by the industry under intimation to GSPCB. The GSPCB must evolve a proper disposal strategy in consultation with the CPCB.

2.2.5 Conclusions and Recommendations

- M/s SBRPL must renew GSPCB Consent to Operate under Section 25 of the Air Act, 1981, (as amended) which stands expired as on date.

- The management must ensure to acquire the GSPCB Consent to Operate under Section 25 of the Water Act, 1974 (as amended) immediately, otherwise all industrial operations will be construed illegal under prevailing Water and Air Acts.

- The present stack height is only 22 m as against CPCB norms of minimum 30 m. Therefore, the stack height must be raised to minimum of 30 m. The leakages from various section of the reheating furnace are to be plugged in order to improve workplace environment.

- In case, GSPCB/CPCB designates the slag as non-hazardous, it may be used for back-filling and restoration of the abandoned laterite stone quarries located in the vicinity of the Cuncolim Industrial Estate. In addition, a number of abandoned laterite mines are situated near village Quepem (about 5 km from Cuncolim Industrial Estate) spanning an area of hundreds of acres. However, a detailed environmental impact assessment needs to be carried out by the industries generating solid non-hazardous wastes in consultation with GSPCB for evaluating the feasibility of this option.

2.3 M/s Rukminirama Steel Rollings (P) Ltd.

2.3.1 Present Status

M/s Rukminirama Steel Rollings (P) Ltd. (RSRPL), manufactures MS ingots. The raw material include, sponge irons, pig iron and MS scrap. The raw material is melted in an induction furnace batch wise. The melted metal is poured in duplex moulds to get the cast. Runners and risers are the byproducts, which form during the ingot manufacturing, and they are recycled back into the process.

During the inspection period (November 5, 2006), the rated capacity of MS ingots was 59.8 tonnes/d vis-à-vis the installed capacity of 96 tonnes/d.

2.3.2. Air Pollution and Control

The GSPCB consent to operate under the Air Act, 1981 is valid upto March 31, 2008.

The stack height conforms to the CPCB stack height standard of minimum 30 meters.

The unit has installed movable canopy over the furnace attached to cyclone separator for arresting of particulate emission. The flue gas characteristics projected in Table 2.6 satisfy the GPSCB stipulated emission standards. However, the fugitive emission during charging are visible and required proper controlling.

Table 2.6: Flue Gas Characteristics and Stack Details

Production Unit	Flue gas details			Flue gas characteristics, emission concentration and load						Stack details		
				PM		SO_2		NO_x		Existing		Required
	Temp.	Velocity	Vol. flow rate	Conc.	Load	Conc.	Load	Conc.	Load	I.D.	Ht.	Ht.
	^0C	m/s	m^3/h	mg/m^3	kg/h	mg/m^3	kg/h	mg/m^3	kg/h	m	m	m
Induction furnace	50	8.5	5078	93.5	0.5	173	0.9	658	3.3	0.5	30	30

Remarks: GSPCB PM Emission Stds. – 150 mg/m^3.
CPCB Stack Height Regulations – Height = 14 $Q^{0.3}$, where Q is SO_2 in kg/h.

2.3.3 Wastewater Generation, Characteristics and Management

M/s RSRPL has the GSPCB consent to Operate under Section of the Water Act, 1974 (as amended). The water usage in the industry is for cooling purpose only, and the daily requirement for cooling water makeup is $12m^3/d$. There is no effluent generation from the unit. The system water, after holding in settling tanks, is cooled through cooling towers and recycled. The settling tanks are cleaned at regular intervals (usually once a month) for removal of settled solid. The solids are stored along with the slag within the industry premises. The sanitary wastewater generation of around 0.6 m^3/d is treated through septic tanks. There is no discharge of effluent from the industry.

To evaluate the cooling water characteristics, sample was collected from the feed tank. The cooling water being recycled conforms to the stipulated standards of the GSPCB for discharge into Inland Surface Waters and onto Land for irrigation (Table 2.2).

2.3.4 Solid Waste Generation, Characteristics and Management

The major source of solid waste generated at M/s Rukminirama Steel Rollings (P) Ltd. (RSRPL) is steel slag from induction furnace, which amounts to about 3 to 4 tonnes per day. Besides this, a small quantity of cyclone dust (0.05 to 0.06 tonnes/d) is also generated from the air pollution control section, which is recycled back to the induction furnace.

As observed during inspection, the steel slag generated by the industry is being dumped in low-lying areas and open land within their own premises.

The representative samples of steel slag were collected and subjected to detailed physico-chemical characterization and leaching tests. The results of the characterization and leaching tests are listed in Table 2.7.

Table 2.7: Characteristics and Leachability of Steel Slag

Parameters	Characteristics of Steel Slag		Leachability of Steel Slag as per USEPA TCLP (USEPA Criteria)		Leachability of Steel Slag as per Water Leach Test (CPCB Criteria)	
	Conc. in Slag (mg/kg)	Regulatory Limit as per HWM Rules, 2003 (mg/kg)	Conc. in TCLP Leachate (mg/L)	TCLP Regulatory Limit (mg/L)	Conc. in Water Leachate (mg/L)	Regulatory Limit (mg/L)
Aluminium	**303**	**N.S.**	0.13	N.S.	BDL	N.S.
Arsenic	**724**	**50**	0.18	5	BDL	<1
Cadmium	50	50	0.16	1	BDL	<0.2
Cobalt	39	5000	8.55	N.S	BDL	N.S.
Copper	10	5000	2.86	5	BDL	<10
Chromium	209	5000	0.19	5	BDL	<0.5
Iron	**24656**	**N.S.**	91	N.S.	BDL	N.S.
Lead	250	5000	2.5	5	0.32	<2
Manganese	**8255**	**N.S.**	4.6	10	0.02	N.S.
Magnesium	**6758**	**N.S.**	42	N.S.	0.22	N.S.
Nickel	49	5000	0.52	N.S.	0.06	<3
Zinc	560	20000	18	500	BDL	<10

BDL – Below Detectable Limit
N.S. – Not Stipulated

As per Schedule 1 of Hazardous Wastes (Management & Handling) Amendment Rules, 2003, (HWM Rules, 2003) the slag generated from the production of iron and steel (including electric furnaces and steel rolling mills) is not listed as hazardous waste. The industry has therefore not applied for an Authorization for hazardous waste management.

The characteristics of steel slag as presented in Table 2.7 indicate that the major constituent of concern is arsenic, as the concentration (724 mg/kg) exceeds the regulatory limit for arsenic as stipulated in the Schedule 2 of HWM Rules, 2003. Hence, the steel slag generated at M/s RSRPL may be classified under hazardous wastes as per Schedule 2 of these rules. Therefore, for all practical purposes disposal methods as per HWM Rules, 2003 must be adopted.

However, the assessment of leaching potential of the steel slag as per Toxicity Characteristics Leaching Procedure Test of United States Environmental Protection Agency (USEPA), which has been adopted from the ASTM Method D 5233–92 of American Society for Testing of Materials, indicates that the steel slag has a very poor leachability. This is evident from the characteristics of TCLP leachate (Table 2.7), as none of the parameters exceed the TCLP regulatory limit, which is 100 times the Indian Standards for Drinking Water Quality (IS 10500 – 1995). Moreover, the assessment of leaching potential of the wastes as per water leaching criteria delineated by Central Pollution Control Board (CPCB), New Delhi (*Guidelines for Proper Functioning and Upkeep of Disposal Sites, Hazardous Waste Management Series: HAZWAMS/32/2005 – 2006*) also indicates the poor leachability of steel slag, as concentration of none of the parameters exceed the stipulated limit (Table 2.7). Since the slag is generated at a temperature exceeding 1200° C, the metal impurities present in the slag are fused together and tightly bound form, and therefore not readily liberated from the slag particles or easily leached into the environment. Considering, the characteristics of the slag and leachability studies, it is recommended that industry should seek a clarification from GSPCB/CPCB, whether to designate steel slag as hazardous or non-hazardous waste.

Based on the detailed assessment of steel slag generated at M/s RSRPL, it may be concluded that the present practice of dumping of steel slag within the premises, may not result in any adverse environmental effect, especially on contamination of groundwater and surface water resources. In fact, nowhere in the world, steel slag is considered hazardous in spite of hazardous constituents because of the immobilization of toxic metals and metalloids during the high temperature operation. Steel slag is often recommended for use in the road making and for cement manufacture. It may be mentioned here, that CPCB has clarified that slag generated from copper smelter operations is non-hazardous and can be used in cement industries, filling up low lying areas, building/road construction material vide its letter (No. B-12015/33/03-AS) dated November 17, 2003 addressed to the Chairperson, Tamil Nadu Pollution Control Board, Chennai (copy enclosed – Annexure II).

Considering the present rate of generation of steel slag and the limited space available with the industry, illegal dumping of steel slag outside the premises cannot be ruled out in future. This is evident from a number of illegal slag dumps, which were observed by the inspection team within the Cuncolim Industrial Estate. It is therefore recommended that proper record of slag generation must be maintained by the industry under intimation to GSPCB. The GSPCB must evolve a proper disposal strategy in consultation with the CPCB.

2.3.5 Conclusions and Recommendations

- M/s RSRPL is required to install appropriately designed and efficient system to minimize fugitive PM emissions during charging.

- In case, GSPCB/CPCB designates the slag as non-hazardous, it may be used for back-filling and restoration of the abandoned laterite stone quarries located in the vicinity of the Cuncolim Industrial Estate. In addition, a number of abandoned laterite mines are situated near village Quepem (about 5 km from Cuncolim Industrial Estate) spanning an area of hundreds of acres. However, a detailed environmental impact assessment needs to be carried out by the industries generating solid non-hazardous wastes in consultation with GSPCB for evaluating the feasibility of this option.

2.4 M/s Shirdi Steel Rerollers (P) Ltd.

2.4.1 Present Status

M/s Shirdi Steel Rerollers (P) Ltd. (SSRPL) manufactures MS angles, channels, square bars and flats. The raw material is MS ingots or billets, which are procured from other manufactures in the open market. The MS ingots or billets are fed into first zone of furnace for reheating at 100°C initially and gradually to 700°C in the second zone. The red hot metal, ejected by the mechanical ejector, is then passed over different rolls to acquire the final desired shape. Water is poured over the hot metal to quench. This water is collected through a drain, which returns to the feed water tank. The rolled metal is kept for cooling through natural draught. The cooled material is cut to required dimensions and stacked.

During the inspection period (November 4, 2006), the rated capacity of MS sections was 111.7 tonnes/d vis-à-vis the installed capacity of 180 tonnes/d.

2.4.2 Air Pollution and Control

The GSPCB consent to operate under Air Act 1981 is valid upto March 31, 2008.

The monitoring could be done only on stack attached to larger furnace (No.1) as there was no proper platform on the stack attached to smaller furnace (No. 2).

SO_2 emissions, as reported in Table 2.8, are to be regulated through dispersion in accordance with the CPCB stack height standard; the effective stack height being 40 m. Presently, the height of the stack is 32 m which is inadequate for this purpose and is required to be raised to 40 m height.

Table 2.8 : Flue Gas Characteristics and Stack Details

Production Unit	Flue gas details			Flue gas characteristics, emission concentration and load						Stack details		
				PM		SO_2		NO_x		Existing		Required
	Temp.	Velocity	Vol. flow rate	Conc.	Load	Conc.	Load	Conc.	Load	I.D.	Ht.	Ht.
	°C	m/s	m^3/h	mg/m^3	kg/h	mg/m^3	kg/h	mg/m^3	kg/h	m	m	m
Reheating furnace	120	20.1	14222	147.5	1.8	1738	20.9	-	-	0.5	32	40

Remarks: GSPCB PM Emission Stds. – 150 mg/m^3.
CPCB Stack Height Regulations – Height = 14 $Q^{0.3}$, where Q is SO_2 in kg/h.

2.4.3 Wastewater Generation, Characteristics and Management

M/s SSRPL has GSPCB consent to Operate under Section of the Water Act, 1974 (as amended). The water usage in the industry is for cooling purpose only, and the daily requirement for cooling water makeup is $3m^3/d$. The hot water, after holding in settling tanks, is cooled through cooling towers and recycled. The settling tanks are cleaned at regular intervals (usually once a month) for removal of settled solid. The solids are stored along with slag within the industry premises. The sanitary wastewater (generation of around 0.5 m^3/d) is treated through septic tanks. There is no discharge of effluent from the industry.

To evaluate the cooling water characteristics, a sample was collected from the feed tank. The cooling water being recycled conforms to the stipulated standards of the GSPCB for discharge into Inland Surface Waters and onto Land for irrigation (Table 2.2).

2.4.4 Solid Waste Generation, Characteristics and Management

Since the industry is engaged only in rolling of steel ingots to various sizes and shapes, no solid waste is generated.

2.4.5 Conclusions and Recommendations

- M/s SSRPL is required to provide proper platform on chimney attached to the smaller furnace. As per reported fuel consumption, height of stack attached to furnace no. 1 and no. 2 must be raised to 40m and 30m respectively.
- For SO_2 emissions control, flue gases are required to be treated in a properly designed alkali scrubber prior to release through chimney.
- Fugive SO_2 emissions should be controlled by adopting proper measures and devices as it adversely affects in work place environment.

2.5 M/s Sunrise Electromelt Limited

2.5.1 Present Status

M/s Sunrise Electromelt Limited (SEL) is a steel rolling mill manufacturing CTD bars, squares, angles, channels and flats. The principle raw materials, MS ingots and billets are heated in a rolling mill furnace to about 1150°C. The hot material is then passed through a series of rolls converting them into round bars, angles or flats or any other section for production. The CTD bars are manufactured by cold twisting the rolled round bars.

During the inspection period (November 5, 2006), the rated capacity of MS angle and TOR steel (CTD bars) was 109.8 tonnes/d vis-à-vis the installed capacity of 117 tonnes/d.

2.5.2. Air Pollution and Control

The GSPCB consent to operate, under Air Act 1981, is valid upto March 31, 2010.

Although stack emission characteristics (Table 2.9) meet GSPCB requirement, fugitive SO_2 emissions need to be controlled by plugging furnace leakages in order to improve conditions at work place environment.

Table 2.9 : Flue Gas Characteristics and Stack Details

Production Unit	Flue gas details			Flue gas characteristics, emission concentration and load						Stack details		
				PM		SO_2		NO_X		Existing		Required
	Temp.	Velocity	Vol. flow rate	Conc.	Load	Conc.	Load	Conc.	Load	I.D.	Ht.	Ht.
	°C	m/s	m^3/h	mg/m^3	kg/h	mg/m^3	kg/h	mg/m^3	kg/h	m	m	m
Reheating furnace	198	9.2	3769	141	15	6824	25.7	142.4	0.5	0.5	25	40

Remarks: GSPCB PM Emission Stds. – 150 mg/m^3.
CPCB Stack Height Regulations – Height = 14 $Q^{0.3}$, where Q is SO_2 in kg/h.

2.5.3 Wastewater Generation, Characteristics and Management

M/s SEL does not have the GSPCB Consent to Operate under Section 25 of the Water Act, 1974 (as amended).

The water usage in the industry is for cooling purpose only, and the daily requirement for cooling water makeup is 1 m^3/d. There is no effluent generation from the unit. The system water, after holding in settling tanks, is cooled through cooling towers and recycled. The settling tanks are cleaned at regular interval (usually once a month) for removal of settled solid. The solids are stored along with slag within the industry premises. The sanitary wastewater (generation of around 0.8m^3/d) is treated through septic tanks. There is no discharge of effluent from the industry.

To evaluate the cooling water characteristics, sample was collected from the feed tank. The cooling water being recycled conforms to the stipulated standards of the GSPCB for discharge into Inland Surface Waters and onto Land for irrigation (Table 2.2).

2.5.4 Solid Waste Generation, Characteristics and Management

Since the industry is engaged only in rolling of steel ingots to various sizes and shapes, no solid waste is generated.

2.5.5 Conclusions and Recommendations

- Stack height of chimney attached to larger reheating furnace (No.1), consuming around 5.0 kilolitre/d (KLPD) fuel oil (FO), must be increased to 40 m and that of other consuming around 3.0 KLPD to be raised to 35 m.
- All leakages in the reheating furnaces are required to be plugged to control fugitive SO_2 emissions adversely affecting workplace environment.
- Furnace oil with low sulphur content is recommended to be used in reheating furnace. Alternatively, SO_2 emissions due to consumption of high sulphur fuel are required to be controlled effectively using alkali scrubber.
- As per the management, the industry has applied for GSPCB Consent to Operate under Section 25 of the Water Act, 1974 (as amended) on October 19, 2006. The management must ensure to acquire the same immediately from GSPCB, otherwise all industrial operations will be construed illegal under prevailing Water Act.

2.6. M/s Karthik Alloys Ltd.

2.6.1 Present Status

M/s Karthik Alloys Ltd. (KAL) manufactures low and medium carbon silico manganese. The product is a raw material in the production of stainless steel. The major raw materials used are manganese ore, quartz and dolomite.

During the inspection period (November 3, 2006), the rated capacity of silico manganese was 13.8 tonnes/d vis-à-vis the installed capacity of 15 tonnes/d.

2.6.2. Air Pollution and Control

The GSPCB consent to operate, under Air Act, 1981, was valid upto August 1, 2002. As per the industry's version, application for renewal of the consent has been submitted on 05/09/2006.

Originally bag filters were used to control PM emissions from the furnace gas stream. Recently the unit has installed fume chamber replacing the existing bag filter.

The characteristics of flue gas (Table 2.10) conforms to the stipulated emission standards of GSPCB. The height of the stack is 30 m, which is in accordance with CPCB norms taking SO_2 emissions into consideration. However, there are fugitive dust emissions during feeding SAF on the charge floor, which requires effectively control. The unit has proposed to install fugitive PM emissions control system at roof top. It efficacy to arrest PM and emission should be ascertained through an in depth fugitive PM emission monitoring at charging floor of the SAF after commissioning of PM emission system is completed and the system operates under stable condition.

Table 2.10 Flue Gas Characteristics and Stack Details

Production Unit	Flue gas details			Flue gas characteristics, emission concentration and load						Stack details		
	Temp.	Velocity	Vol. flow rate	PM		SO_2		NO_x		Existing		Required
				Conc.	Load	Conc.	Load	Conc.	Load	I.D.	Ht.	Ht.
	^0C	m/s	m^3/h	mg/m^3	kg/h	mg/m^3	kg/h	mg/m^3	kg/h	m	m	m
Submerged Arc Furnace	54	6.1	44098	79.9	3.5	82	3.6	905	39.9	-	30	30

Remarks: GSPCB PM Emission Stds. – 150 mg/m^3
CPCB Stack Height Regulations – Height = 14 $Q^{0.3}$, where Q is SO_2 in kg/h.

2.6.3 Wastewater Generation, Characteristics and Management

M/s KAL does not have the GSPCB Consent to Operate under Section 25 of the Water Act, 1974, (as amended).

The water usage in the industry is for cooling purpose only, and the daily requirement for cooling water makeup is 2 m^3/d. There is no effluent generation from the unit. The system water after holding in settling tanks is cooled through cooling towers and recycled. The settling tanks are cleaned at regular interval (usually once a month) for removal of settled solid. The solids are stored along with slag within the industry premises. The sanitary wastewater (generation of around 2.4 m^3/d) is treated through septic tanks. There is no discharge of effluent from the industry.

To evaluate the cooling water characteristics, sample was collected from the feed tank. The cooling water being recycled conforms to the stipulated standards of the GSPCB for discharge into Inland Surface Waters and onto Land for irrigation (Table 2.2).

2.6.4 Solid Waste Generation, Characteristics and Management

The major source of solid waste generated at M/s KAL is manganese slag generated from the submerged arc furnace, which amounts to about 3 to 5 tonnes/d.

Presently about 10 % of the slag, rich in manganese content, is recycled back in the process and about 20 to 30 % is sold to outside agencies for reprocessing. The industry is also using about 20 to 30 % of the slag for constructing concrete platforms and road making within the plant premises. The remaining quantity of slag is being disposed off in low-lying areas within their own premises.

The representative samples of manganese slag were collected and subjected to detailed physico-chemical characterization and leaching tests. The results of the characterization and leaching tests are listed in Table 2.11.

As per Schedule 1 of Hazardous Wastes (Management & Handling) Amendment Rules, 2003, (HWM Rules, 2003) the slag generated from the primary production of non-ferrous metals (except aluminium) is not listed as hazardous waste. The industry has therefore, not applied for an Authorization for hazardous waste management.

The characteristics of manganese slag as presented in Table 2.11 indicates that the major constituent of concern is arsenic, as the concentration (273 mg/kg) exceeds the regulatory limit for arsenic as stipulated in the Schedule 2 of HWM Rules, 2003. Hence, the manganese slag generated at M/s KAL may be classified under hazardous wastes as per Schedule 2 of these rules. Therefore, for all practical purposes disposal methods as per HWM Rules, 2003 must be adopted.

However, the assessment of leaching potential of the manganese slag as per Toxicity Characteristics Leaching Procedure Test of United States Environmental Protection Agency (USEPA), which has been adopted from the ASTM Method D 5233–92 of American Society for Testing of Materials, indicates that the manganese slag has a very poor leachability. This is evident from the characteristics of TCLP leachate (Table 2.11), as none of the parameters exceed the TCLP regulatory limit, which is 100 times the Indian Standards for Drinking Water Quality (IS 10500 – 1995). Moreover, the assessment of leaching potential of the wastes as per water leaching criteria delineated by Central Pollution Control Board (CPCB), New Delhi (*Guidelines for Proper Functioning and Upkeep of Disposal Sites, Hazardous Waste Management Series: HAZWAMS/32/2005 – 2006*) also indicates the poor leachability of manganese slag, as concentration of none of the parameters exceed the stipulated limit (Table 2.11). Since the slag is generated at a temperature exceeding 1000°C, the metal impurities present in the slag are fused together and tightly bound form, and therefore not readily liberated from the slag particles or easily leached into the environment. Considering, the characteristics of the slag and leachability studies, it is recommended that industry should seek a clarification from

Table 2.11: Characteristics and Leachability of Manganese Slag

Parameters	Characteristics of Slag		Leachability of Slag as per USEPA TCLP (USEPA Criteria)		Leachability of Slag as per Water Leach Test (CPCB Criteria)	
	Conc. in Slag (mg/kg)	Regulatory Limit as per HWM Rules, 2003 (mg/kg)	Conc. in TCLP Leachate (mg/L)	TCLP Regulatory Limit (mg/L)	Conc. in Water Leachate (mg/L)	TCLP Regulatory Limit (mg/L)
Aluminium	**302**	**N.S.**	0.09	N.S.	BDL	N.S.
Arsenic	**273**	**50**	0.09	5	BDL	<1
Cadmium	17	50	0.08	1	BDL	<0.2
Cobalt	3871	5000	5.4	N.S	BDL	N.S.
Copper	3961	5000	4.8	5	BDL	<10
Chromium	58	5000	0.11	5	BDL	<0.5
Iron	**30812**	**N.S.**	35	N.S.	BDL	N.S.
Lead	982	5000	1.99	5	0.28	<2
Manganese	**36614**	**N.S.**	**39.4**	**10**	0.57	N.S.
Magnesium	**24709**	**N.S.**	35.9	N.S.	0.63	N.S.
Nickel	156	5000	0.45	N.S.	0.04	<3
Zinc	1440	20000	11.0	500	BDL	<10

BDL – Below Detectable Limit
N.S. – Not Stipulated

GSPCB/CPCB, whether to designate manganese slag as hazardous or non-hazardous waste.

Based on the detailed assessment of manganese slag generated at M/s KAL, it may be concluded that the present practice of dumping of manganese slag within the premises, may not result in any adverse environmental effect, especially on contamination of groundwater and surface water resources.

Considering the present rate of generation of manganese slag and the limited space available with the industry, illegal dumping of manganese slag outside the premises cannot be ruled out in future. This is evident from a number of illegal slag dumps, which were observed by the inspection team within the Cuncolim Industrial Estate. It is therefore recommended that proper record of slag generation must be maintained by the industry under intimation to GSPCB. The GSPCB must evolve a proper disposal strategy in consultation with the CPCB.

2.6.5 Conclusions and Recommendations

- The industry is operating without the GSPCB Consent to Operate under Section 25 of the Water Act, 1974 (as ammended). The management must immediately apply for the GPCB consent and acquire the same.

- The unit has proposed to install fugitive PM emissions control system at roof top. Its efficacy to arrest PM and emissions should be ascertained through an in depth fugitive PM emission monitoring at charging floor of the SAF after commissioning of PM emission system is completed and the system operates under stable condition.

- In case, GSPCB/CPCB designates the manganese slag as non-hazardous, it may be used for back-filling and restoration of the abandoned laterite stone quarries located in the vicinity of the Cuncolim Industrial Estate. In addition, a number of abandoned laterite mines are situated near village Quepem (about 5 km from Cuncolim Industrial Estate) spanning an area of hundreds of acres. However, a detailed environmental impact assessment needs to be carried out by the industries generating solid non-hazardous wastes in consultation with GSPCB for evaluating the feasibility of this option.

2.7 M/s Puja Ferro Alloys Ltd.

2.7.1 Present Status

M/s Puja Ferro Alloys Ltd. (PFAL) manufactures high carbon silicon manganese. The raw materials are manganese ore, quartz and dolomite. The unit has a furnace from where the material is tapped, and separated from slag.

During the inspection period (November 3, 2006), the rated capacity of silico manganese was 18.15 tonnes/d vis-à-vis the installed capacity of 22 tonnes/d.

2.7.2 Air Pollution and Control

The GSPCB Consent to Operate under Air Act, 1981 is valid upto February 27, 2008.

M/s PFAL uses fuel coke which has sulphur content less than 2 %. The height of the existing stack attached to the furnace is 29 m.

The unit has recently installed four exhaust fans above charge floor on the four sides of SAF and the exhaust is connected to cyclone to arrest fugitive PM emissions on charge floor. The unit has installed bag filter with two bag houses containing 320 bags each on furnace flue gas to control PM emissions. In addition, the unit has recently installed an electronic cut-off system for their furnace to the APC unit. Stack emission characteristics reported in Table 2.12 reveal that the unit is conforming to the emission norms laid down by GSPCB.

Table 2.12 : Flue Gas Characteristics and Stack Details

Production Unit	Flue gas details			Flue gas characteristics, emission concentration and load						Stack details		
	Temp.	Velocity	Vol. flow rate	PM		SO_2		NO_x		Existing		Required
				Conc.	Load	Conc.	Load	Conc.	Load	I.D.	Ht.	Ht.
	°C	m/s	m^3/h	mg/m^3	kg/h	mg/m^3	kg/h	mg/m^3	kg/h	m	m	m
Submerged Arc Furnace	62	18.0	59724	43.2	2.6	111.7	6.7	806.3	48.2	-	29	40

Remarks: GSPCB PM Emission Stds. – 150 mg/m^3.
CPCB Stack Height Regulations – Height = 14 $Q^{0.3}$, where Q is SO_2 in kg/h.

2.7.3 Wastewater Generation, Characteristics and Management

M/s PFAL has the GSPCB consent to Operate under Section of the Water Act, 1974 (as amended) and is valid upto February 27, 2008.

The water usage in the industry is for cooling purpose and for slag granulation. The daily requirement for cooling water makeup and slag granulation is 5 and 7 m^3/d, respectively. There is no effluent generation from the unit. The water, after holding in settling tanks, is cooled through cooling towers and recycled. The settling tanks are cleaned at regular intervals (usually once a month) for removal of settled solid. The solids are stored along with slag within the industry premises. The sanitary wastewater (generation of around 2.8 m^3/d) is treated through septic tanks. There is no discharge of effluent from the industry.

To evaluate the cooling water characteristics, sample was collected from the feed tank. The cooling water being recycled conforms to the stipulated standards of the

GSPCB for discharge into Inland Surface Waters and onto Land for irrigation (Table 2.2).

2.7.4 Solid Waste Generation, Characteristics and Management

The major source of solid waste generated at M/s Puja Ferro Alloys Ltd. (PFAL) is manganese slag generated from the submerged arc furnace, which amounts to about 25 tonnes/d.

Presently, the entire quantity of slag generated by M/s PFAL is being disposed off on open land within the plant premises.

The representative samples of manganese slag were collected and subjected to detailed physico-chemical characterization and leaching tests. The results of the characterization and leaching tests are listed in Table 2.13.

As per Schedule 1 of Hazardous Wastes (Management & Handling) Amendment Rules, 2003, (HWM Rules, 2003) the slag generated from the primary production of non-ferrous metals (except aluminium) is not listed as hazardous waste. The industry has therefore, not applied for an Authorization for hazardous waste management.

The characteristics of manganese slag as presented in Table 2.13 indicates that the major constituent of concern is arsenic, as the concentration (515 mg/kg) exceeds the regulatory limit for arsenic as stipulated in the Schedule 2 of HWM Rules, 2003. Hence, the manganese slag generated at M/s PFAL may be classified under hazardous wastes as per Schedule 2 of these rules. Therefore, for all practical purposes disposal methods as per HWM Rules, 2003 must be adopted.

However, the assessment of leaching potential of the manganese slag as per Toxicity Characteristics Leaching Procedure Test of United States Environmental Protection Agency (USEPA), which has been adopted from the ASTM Method D 5233–92 of American Society for Testing of Materials, indicates that the manganese slag has a very poor leachability. This is evident from the characteristics of TCLP leachate (Table 2.15), as none of the parameters exceed the TCLP regulatory limit, which is 100 times the Indian Standards for Drinking Water Quality (IS 10500 – 1995). Moreover, the assessment of leaching potential of the wastes as per water leaching criteria delineated by Central Pollution Control Board (CPCB), New Delhi (*Guidelines for Proper Functioning and Upkeep of Disposal Sites, Hazardous Waste Management Series: HAZWAMS/32/2005 – 2006*) also indicates the poor leachability of manganese slag, as concentration of none of the parameters exceed the stipulated limit (Table 2.13). Since the slag is generated at a temperature exceeding 1000°C, the metal impurities present in the slag are fused together and tightly bound form, and therefore not readily liberated from the slag particles or easily leached into the environment. Considering, the characteristics of the slag and leachability

Table 2.13 Characteristics and Leachability of Manganese Slag

Parameters	Characteristics of Slag		Leachability of Slag as per USEPA TCLP (USEPA Criteria)		Leachability of Slag as per Water Leach Test (CPCB Criteria)	
	Conc. in Slag (mg/kg)	Regulatory Limit as per HWM Rules, 2003 (mg/kg)	Conc. in TCLP Leachate (mg/L)	TCLP Regulatory Limit (mg/L)	Conc. in Water Leachate (mg/L)	TCLP Regulatory Limit (mg/L)
Aluminium	**58**	**N.S.**	0.18	N.S.	BDL	N.S.
Arsenic	**515**	**50**	0.12	5	BDL	<1
Cadmium	3.2	50	0.16	1	BDL	<0.2
Cobalt	16	5000	12.5	N.S	0.06	N.S.
Copper	48	5000	**44**	**5**	BDL	<10
Chromium	611	5000	0.21	5	BDL	<0.5
Iron	**1221**	**N.S.**	68	N.S.	BDL	N.S.
Lead	176	5000	2.88	5	0.29	<2
Manganese	**150281**	**N.S.**	**48.7**	10	0.45	N.S.
Magnesium	**59590**	**N.S.**	48.3	N.S.	0.58	N.S.
Nickel	18	5000	0.68	N.S.	0.06	<3
Zinc	156	20000	27.3	500	BDL	<10

BDL – Below Detectable Limit
N.S. – Not Stipulated

studies, it is recommended that industry should seek a clarification from GSPCB/CPCB, whether to designate manganese slag as hazardous or non-hazardous waste.

Based on the detailed assessment of manganese slag generated at M/s PFAL, it may be concluded that the present practice of dumping of manganese slag within the premises, may not result in any adverse environmental effect, especially on contamination of groundwater and surface water resources.

Considering the present rate of generation of manganese slag and the limited space available with the industry, illegal dumping of manganese slag outside the premises cannot be ruled out in future. This is evident from a number of illegal slag dumps, which were observed by the inspection team within the Cuncolim Industrial Estate. It is therefore recommended that proper record of slag generation must be maintained by the industry under intimation to GSPCB. The GSPCB must evolve a proper disposal strategy in consultation with the CPCB.

2.7.5 Conclusions and Recommendations

- Although stack emissions are within permissible limits, the stack heights should be increased from the existing height of 29 m to 40 m. In depth fugitive emission studies should be conducted to ensure safe work place environment on shop floor.

- In case, GSPCB/CPCB designates the manganese slag as non-hazardous, it may be used for back-filling and restoration of the abandoned laterite stone quarries located in the vicinity of the Cuncolim Industrial Estate. In addition, a number of abandoned laterite mines are situated near village Quepem (about 5 km from Cuncolim Industrial Estate) spanning an area of hundreds of acres. However, a detailed environmental impact assessment needs to be carried out by the industries generating solid non-hazardous wastes in consultation with GSPCB for evaluating the feasibility of this option.

2.8 M/s Nicomet Industries Limited (NIL)

2.8.1 Present Status

M/s Nicomet Industries Limited (NIL) extracts cobalt and copper, and their compounds from imported cobalt ore using hydro-metallurgical route. The industry commenced commercial production in 1997, and today it's the largest manufacturer of Cobalt in India. The company has indigenously developed its own process to extract cobalt and copper.

The cobalt ores, the principle raw materials, are mostly in the form of oxide, sulphide, hydroxide and carbonate. The process involves leaching the raw material with sulphuric acid and SO_2 followed by solvent extraction of iron free

leached solution for recovery of pure cobalt and copper streams. The solvent extraction process basically involves neutralization, extraction, scrubbing and stripping.

Three major streams are generated from the solvent extraction plant, which are sent for further processing. First stream of cobalt sulphate solution is treated for electrolytic deposition of cobalt metal, which is subsequently processed for conversion to other cobalt salts or evaporated to make cobalt sulphate crystals. Second stream of copper sulphate solution is treated for electrolytic deposition of copper metal or crystallized out as copper sulphate crystals. Third stream of sodium sulphate solution is evaporated to get sodium sulphate crystals.

During the inspection period (November 2-5, 2006), the processing of original cobalt ore was not being practiced. In addition, the impurity removal circuit and the copper extraction circuit were also not in operation. The following sections were in operation:

- Reprocessing of the process residue in leaching section.
- Cobalt sulphate refining circuit for refining of the existing solution.
- Cobalt sulphate crystalisation section for the production of $CoSO_4$ crystals.

During the inspection period, the rated capacity of cobalt sulphate crystal production was in the range, 0.5-1.0 tonnes/d vis-à-vis the installed capacity of 1.66 tonnes/d. Since, the copper extraction circuit with an installed capacity of 1.0 tonnes/d was under maintenance, there was no production of copper metal during the inspection period.

2.8.2 Air Pollution and Control

Since, the industry was not in operation at installed capacity, the stack emission could not be monitored as the monitoring is required to be done when the industry starts operation at full capacity, and attains a stable condition. However during the visit to various sections, high SO_2 emissions of fugitive nature were observed, particularly in leaching and cell-house sections, which was adversely affecting the workplace environment. The industry must take effective steps to control fugitive emissions.

2.8.3 Wastewater Generation, Characteristics and Management

During the inspection period, the industry was not processing original cobalt ore, and only the cobalt sulphate refining unit was in operation. However, the quantity of effluent generation at installed operating capacity is 100 m^3/d. This effluent, under normal conditions of operation is treated in a double effect evaporation system for crystallisation of sodium sulphate. However, during the inspection period, the double effect evaporation system was dismantled and the system was not in place. As per the industry management, a new facility is being planned for

installation, comprising three-effect evaporation system for a design flow of 150 m^3/d. As the existing facility was not in place, the adequacy assessment of the evaporation system could not be monitored during the inspection period.

No adequate facility exists within the industrial premises for storage of waste filter cake generated from the industry. The filter cake was stored within the industry premises on land and covered with impervious sheets. The existing practice of storing the filter cake, which falls under hazardous wastes category is unscientific, and may lead to soil and groundwater contamination through seepage and subsequent migration of pollutants. As monitored, the sample of the stagnant water collected at the filter cake storage site had pH value of 4.2, with high concentration of TDS (56275 mg/l), sulphates (29784 mg/l), zinc (25 mg/l), led (4.05 mg/l), copper (900 mg/l), nickel (700 mg/l), cobalt (634 mg/l), manganese (76.5 mg/l), cadmium (7.2 mg/l) and arsenic (3.48 mg/l) (Table 2.14).

An irrigation canal is 100 m away from the industry premises (Figure 1). As observed during monitoring, the flow in the irrigation canal was observed at a point adjacent to the premises of the industry with no flow in the upstream of the canal. It appeared that seepage water was finding its way into the canal from the industry as the canal water monitored up to 3 km downstream, indicated pH of 4.2 (Table 2.15). The pH of seepage water was also 4.2. This is indicative of the fact that the water flowing in the canal is water seeping from the filter cake storage yard.

The natural storm water drain existing on the southern side of the industry premises has a downward slope towards the industry premises. During monsoon this results in storm water flowing across the industry premises. The leaching of waste filter cake from the storage yard flows along with the storm water. This must be diverted immediately so that storm water from outside should not flow through the industry's premises as is the prevailing situation.

2.8.4 Solid Waste Generation, Characteristics and Management

The major source of solid waste generated at M/s NIL is the filter cake from the ore leaching operations, which amounts to about 10 –12 tonnes/d.

The representative samples of waste filter cake during inspection, and subjected to detailed physico-chemical characterization and leaching tests. The results of the characterization and leaching tests are documented in Table 2.16.

As per Hazardous Wastes (Management & Handling) Amendment Rules, 2003, the process residues generated from the primary production of non-ferrous metals is classified as hazardous wastes (Schedule I, Process S. No. 7, Waste stream No. 7.2). Moreover, the levels of arsenic, and cadmium (Table 2.16) also exceed the regulatory limit prescribed under Schedule 2 of these rules. Hence, the filter cake generated at M/s NIL, is classified as hazardous wastes as per Schedule 1

GPCB Table

Table 2.14 : Physico-chemical Characteristics of Water from Sludge Storage Area within Premises of M/s Nicomet Industries Ltd. (Sampling Period : November 02, 2006)

Sr. No.	Parameters	Water from Sludge Dump Area	Effluent Discharge Standards*	
			Into Inland Surface Waters	Onto Land for Irrigation
1.	Colour, Pt.Co.Units	970	**	**
2.	Temperature, ^{0}C	34	#	-
3.	**pH**	**4.3**	**5.5 - 9.0**	**5.5 - 9.0**
4.	Total acidity	50	-	-
5.	SS	42	100	-
6.	**TDS**	**56275**	**2100**	**2100**
7.	COD	78	250	-
8.	BOD	4	30	100
9.	Chlorides	310	1000	600
10.	**Sulphates**	**29784**	**1000**	**1000**
11.	Nitrate Nitrogen	3.0	10	-
12.	Sodium	4200	-	-
13.	Potassium	475	-	-
14.	Percent Sodium	91.7	-	**60**
15.	Heavy Metals			
	Iron	0.710	3.0	-
	Zinc	**25**	**5.0**	-
	Lead	**4.1**	**0.1**	-
	Copper	**900**	**3.0**	-
	Nickel	**700**	**3.0**	-
	Cobalt	**634**	-	-
	Chromium	0.26	2.0	-
	Manganese	**76.5**	**2.0**	-
	Cadmium	**7.2**	**2.0**	-
	Arsenic	**3.5**	**0.2**	**0.2**

* MEF Standards.
** Reduced to the maximum extent possible.
# Should not exceed 5 ^{0}C at the point of discharge of effluents.
All values expressed in mg/L except pH, temperature and colour.
BDL– Below Detectable Limit.

- **Water collected from sludge dump area does not conform to the Standards of the MEF for discharge into Inland Surface Waters with respect to the parameters pH, TDS, sulphates, and heavy metals except iron and chromium.**
- **Water collected from sludge dump area does not conform to the Standards of the MEF for discharge onto Land for irrigation with respect to pH, TDS, sulphate, percent sodium and arsenic parameters.**

D:\IPCS\Table

Table 2.15 : Physico-chemical Characteristics of Water from Irrigation Canal (Sampling Period : November 02 – 04, 2006)

Sr. No.	Parameters	Sampling Location					Standards* for Irrigation Water
		I	II	III	IV	V	
1.	Turbidity, NTU	25	40	35	40	30	-
2.	Temperature, ^{0}C	34	34	34	34	34	-
3.	**pH**	**4.2**	**4.2**	**4.2**	**4.2**	**4.2**	**5.5 - 9.0**
4.	Total Acidity	230	250	240	250	240	-
5.	SS	10	12	18	14	19	-
6.	**TDS**	**3878**	**3940**	**3996**	**3982**	**3974**	**2100**
7.	COD	72.8	74.6	78.8	78.8	72.6	-
8.	BOD	4.2	4.5	6.0	5.8	5.7	100
9.	Chlorides	73.8	110.4	119.5	118.6	118.2	600
10.	**Sulphates**	**2198**	**2206**	**2240**	**2232**	**2236**	**1000**
11.	Nitrate Nitrogen	0.268	1.016	1.013	1.015	1.012	-
12.	Total Hardness	450	480	460	470	440	-
13.	Calcium Hardness	220	240	225	230	220	-
14.	Calcium	88	96	90	92	88	-
15.	Magnesium	55.2	57.6	56.5	57.6	52.8	-
16.	Sodium	598	618	630	636	622	-
17.	Potassium	38.2	39.6	39.6	40.2	39.0	-
18.	**Percent Sodium**	**72.3**	**71.7**	**72.8**	**72.6**	**73.4**	**60**
19.	Heavy Metals						
	Iron	0.578	0.588	0.617	0.620	0.614	-
	Zinc	4.532	4.596	5.244	5.248	5.241	-
	Lead	0.201	0.209	0.216	0.220	0.214	-
	Copper	2.480	2.564	2.650	2.657	2.646	-
	Nickel	3.896	3.994	4.056	4.092	4.022	-
	Cobalt	4.476	4.508	4.576	4.582	4.532	-
	Chromium	BDL	BDL	BDL	BDL	BDL	-
	Manganese	6.624	6.650	6.628	6.648	6.594	-
	Cadmium	0.099	0.110	0.114	0.115	0.112	-
	Arsenic	0.194	**0.209**	**0.279**	**0.276**	**0.270**	**0.2**

* MEF Standards.
All values are expressed in mg/L except pH, temperature and turbidity.
Sampling location:
- Water sample at a distance of 250 meters upstream of M/s Nicomet Industries Ltd.
- Water sample at a distance of 50 meters upstream of M/s Nicomet Industries Ltd.
- Water sample of seepage water into canal.
- Water sample at a distance of 500 meters downstream of M/s Nicomet Industries Ltd.
- Water sample at a distance of 3.0 kilometers downstream of M/s Nicomet Industries Ltd.

BDL– Below Detectable Limit.

- **Irrigation canal water samples do not conform to the stipulated standards of the MEF Standards for discharge onto Land for Irrigation with respect to parameters pH, TDS, sulphates, percent sodium and arsenic.**

Table 2.16: Characteristics and Leachability of Waste Filter Cake

Parameters	Characteristics of Waste Filter Cake		Leachability of Waste Filter Cake as per USEPA TCLP (USEPA Criteria)		Leachability of Waste Filter Cake as per Water Leach Test (CPCB Criteria)	
	Conc. in Cake (mg/kg)	Regulatory Limit as per HWM Rules, 2003 (mg/kg)	Conc. in TCLP Leachate (mg/L)	TCLP Regulatory Limit (mg/L)	Conc. in Water Leachate (mg/L)	CPCB Regulatory Limit (mg/L)
Aluminium	**341**	**N.S.**	0.25	**N.S.**	0.07	**N.S.**
Arsenic	**820**	**50**	0.47	**5**	BDL	**<1**
Cadmium	**198**	**50**	**1.80**	**1**	**7.6**	**<0.2**
Cobalt	3994	5000	**22.5**	**N.S**	**85**	**N.S.**
Copper	3300	5000	**24**	**5**	**60**	**<10**
Chromium	175	5000	0.33	**5**	BDL	**<0.5**
Iron	**55600**	**N.S.**	**92**	**N.S.**	BDL	**N.S.**
Lead	765	5000	**3.14**	**5**	0.41	**<2**
Manganese	**825**	**N.S.**	**40**	**10**	**22**	**N.S.**
Magnesium	**1303**	**N.S.**	**47**	**N.S.**	**20.4**	**N.S.**
Nickel	2396	5000	1.58	**N.S.**	**13.4**	**<3**
Zinc	151	20000	4.2	**500**	3.16	**<10**

BDL – Below Detectable Limit
N.S. – Not Stipulated

and 2 of these Rules. As per the HWM Rules, 2003 the industry has obtained Authorization for collection, reception and storage of hazardous waste in June 2005 from GSPCB (No.10/200/05-PCB/820 dated 07-07-2005). As per the conditions of the authorization, the industry is required to store the waste in a secured landfill facility till a centralized hazardous wastes treatment, storage and disposal facility (HWTSDF) is established for the State of Goa. Such secured landfill; is however, not existing within the factory premises.

The assessment of leaching potential of the waste filter cake as per TCLP Test, as described earlier, indicates that the waste filter cake is amenable to leaching of cadmium, cobalt, copper, lead, manganese and magnesium in significant quantities. This is evident from the characteristics of TCLP leachate (Table 2.16), as concentration of cadmium, copper and manganese exceed the TCLP regulatory limit. Moreover, the assessment of leaching potential of the wastes as per water leaching criteria delineated by Central Pollution Control Board (CPCB), New Delhi also indicate the high leachability of waste filter cake, as concentration of cadmium, copper and nickel exceed the limit stipulated by CPCB (Table 2.16).

As informed by the industry, the filter cake generated till May 2006 was disposed off on open land in two large heaps within the plant premises. As per the instructions of the regulatory agencies, namely GSPCB and CPCB, the wastes generated after May 2006 have been collected by the industry in plastic bags and stacked in a concrete platform shed covered with tarpaulin. Neither any bottom liner for preventing the seepage of leachate to the subsurface nor a drainage system for the waste dumps for arresting the surface run-off generated during monsoon season have been provided as observed by the inspection team.

Based on the detailed assessment of characteristics of waste filter cake and leachability studies it may be concluded that the present practice of disposal of waste filter cake on open land is not an environmentally sound practice. The present practice of disposal of waste filter cake on open land also violates the conditions prescribed in Authorization for hazardous wastes management issued by GSPCB. The present practice of disposal of waste filter cake at M/s NIL would lead to the infiltration of rainwater and surface runoff into the partially covered dumps, during heavy monsoon period resulting in leaching of hazardous constituents from the dumps. The flow/seepage of leachate and surface runoff containing hazardous constituents is bound to contaminate the groundwater and surface water resources in the area.

2.8.5 Conclusions and Recommendations

- The industry was not inspected for adequacy of the pollution control facilities, as the unit was not processing the original cobalt ore, and instead was reprocessing the process residue. In addition, the impurity removal circuit and the copper extraction circuit were also not in operation. Also the evaporation facility, which is necessary for management of the liquid effluent generated

from cobalt extraction circuit, was not in place. Therefore, the conclusions drawn and recommendations made are partial as delineated hereunder:

- As committed by the industry management, the three-stage evaporation system must be commissioned by the end of November 2006. It is therefore recommended that the plant must be allowed to operate only after installation of the evaporation facility.

- The industry must be allowed for continuous operations only after the next inspection by NEERI in association with GSPCB is conducted, to establish that all compliances are met.

- The sludge storage facility within the industry premises must be scientifically designed. Since, the existing practice of storing waste filter cake on land with only impervious cover on top is not scientific keeping in view the possibility of soil and ground water contamination. The existing facility must be provided with proper roof top and cement platform with facility for leachate collection to prevent surface and groundwater contamination including soil contamination as the sludges fall under hazardous waste category as per MEF Guidelines.

- It is necessary to periodically monitor the ground water quality and soil status around the waste filter cake storage yard, and therefore test wells must be provided for regular monitoring of groundwater quality in and around the filter cake storage yard.

- Considering the present status of disposal of waste filter cake and contamination of irrigation canal in the vicinity of the industry, it is strongly recommended for immediate containment of the existing dumps as a short term measure, so as to minimize the generation and seepage of leachate and surface runoffs from these dumps.

- It must be ensured that the existing openings in the compound wall along the periphery of the plot where the filter cake is stored must be sealed to prevent the seepage from the sludge dumps along with surface overflow during monsoon, finding way into the natural storm water drains finally meeting the surface water body.

- As a short term measure, it is necessary dispose off the filter cake in a scientifically designed captive secured landfill until the permanent landfill site is identified and commissioned by the state. Since a centralized HWTSDF is yet to be established in the State of Goa, the M/s SZL should develop a captive secured landfill facility either within their own premises or at a suitable location within the Cuncolim Industrial Estate. The captive SLF must be designed, constructed and operated as per the guidelines and criteria delineated by CPCB. The industry must initiate the action for immediate implementation of these measures.

- As a long-term measure, the entire quantity of waste filter cake accumulated at M/s NIL must be disposed off in a secured landfill facility. Since the water leachability tests as per CPCB criteria indicated leaching of cadmium, copper and nickel in the concentrations exceeding the prescribed limit, the wastes accumulated at M/s NIL is not suitable for direct disposal to secured landfill facility. The waste therefore needs to be pretreated (such as solidification/stabilization) prior to its disposal in secured landfill facility.

- As per the industry management, the preliminary report prepared by M/s Ramky Infraconsulting (P) Ltd. on the proposed captive TSDF based on earlier NEERI Report (2006) has been received on November 4, 2006. The industry management must ensure that Government approval of the preliminary TDSF design is acquired within 45 days of the receipt of the report, and commissioned within six months.

- The industry must submit a time schedule for implementation of both the measures, to the GSPCB, with necessary documentary evidences.

- Adequate measures must be taken to arrest flow of the seepage water of low pH laden with heavy metals immediately into the canal.

- In order to assess the extent of contamination of groundwater, soil and surface water resources due to the past and present waste management practices by M/s NIL, a detailed study needs to be carried out. The cost of remediation of surface water, groundwater and soil to be delineated by the proposed study, may be recovered from the Industry.

- The opening of the existing storm water drain of the industrial plot on the Southern side must be blocked, since the downward slope of the plot area is towards North. In addition, the natural storm water drain must be dredged to provide proper slope for free flow of storm water through this drain during monsoon. If necessary, land filling may be carried out to increase the height of bund area between the canal and the compound wall of the industry. These will prevent access of storm water within the industry premises during monsoon.

- The stack height must be increased from the existing height of 15 m to the CPCB limits of minimum height of 30.

2.9. M/s Sunrise Zinc Ltd.

2.9.1 Present Status

M/s Sunrise Zinc Ltd. (SZL) extracts zinc and copper using secondary sources as raw materials, namely zinc ash & skimmings, copper dross and brass dross. The

industry commenced commercial production in 1996. The industry uses solvent extraction technology for recovery of electrolytic zinc and electrolytic copper.

The process involves pulverizing the raw materials and leaching with sulphuric acid followed by solvent extraction of iron free leached solution for recovery of zinc and copper streams. The solvent extraction process basically involves neutralization, extraction, scrubbing and stripping. This is followed by zinc and copper electromining separately.

During the inspection period (November 3-5, 2006), the rated capacity of electrolytic zinc and copper cathodes was 2.060 - 2.350 and 0.085 - 0.210 tonnes/d vis-à-vis the installed capacities of 12.5 and 2.0 tonnes/d, respectively.

2.9.2 Air Pollution and Control

The GSPCB Consent to Operate under Air Act for the industry is valid upto November 30, 2007.

The industry has installed bag filter systems for air pollution control. The bag filters contains 36 (non woven polyester) bags followed by draft fan connected to chimney for dispersal. The chimney height is 18 m as against the CPCB norm of 30 m. The results of stack emission monitoring, as reported in the Table 2.17, indicates that the emissions are within the limits prescribed by GSPCB. However, during the visit through leaching/ cell house section as well as melting section, high fugitive SO_2 emissions were observed.

Table 2.17: Flue Gas Characteristics and Stack Details

Production Unit	Flue gas details			Flue gas characteristics, emission concentration and load						Stack details		
				PM		SO_2		NO_x		Existing		Required
	Temp.	Velocity	Vol. flow rate	Conc.	Load	Conc.	Load	Conc.	Load	I.D.	Ht.	Ht.
	^0C	m/s	m^3/h	mg/m^3	kg/h	mg/m^3	kg/h	mg/m^3	kg/h	m	m	m
Melting furnace	49	4.11	3547	27.4	0.1	32.9	0.1	77.8	0.3	0.6	18	30

Remarks: GSPCB PM Emission Stds. – 150 mg/m^3
CPCB Stack Height Regulations – Height = 14 $Q^{0.3}$, where Q is SO_2 in kg/hr

2.9.3 Wastewater Generation, Characteristics and Management

The sources of liquid effluent generation are the zinc and copper extraction circuits. The extract raffinate generated is treated through the following unit operations and processes:

- Neutralization
- Hydro-oxidation
- Filtration using bag filter
- Adsorption in activated carbon column.

The quantity of treated effluent generation is 4 m^3/d, and is treated under batch operation. The treated effluent is used for gardening purpose within the industrial premises.

Performance evaluation of the treatment facility was carried out by sampling at various stages of treatment, and characterization. The performance of the treatment facility along with the stipulated standards of the GSPCB for discharge of effluent into Inland Surface Waters and onto Land for Irrigation are presented in Table 2.18.

The treated effluent from the treatment facility conforms to the stipulated standards of the GSPCB for discharge of effluent onto land for irrigation. The treated effluent is reused for gardening within the industrial premises, and no effluent is discharged from the industry.

The waste filter cake generated during the leaching process is partially disposed in captive landfill based on the report submitted by Regional Research Laboratory, Bhopal, and the remaining stored under a shed within the industrial premises.

In addition, filter cake has been dumped in the adjacent plot. This practice of dumping the filter cake on land, which falls under hazardous waste category is unscientific, and may lead to soil and ground water contamination through seepage and subsequent migration of pollutants.

2.9.4 Solid Waste Generation, Characteristics and Management

The major source of solid waste generated at M/s Sunrise Zinc Ltd. (SZL) is the filter cake generated from the leaching operations, which amounts to about 6 tonnes/d.

The representative samples of waste filter cake were collected during the inspection, and subjected to detailed physico-chemical characterization and leaching tests. The results of the characterization and leaching tests are listed in Table 2.19.

As per Hazardous Wastes (Management & Handling) Amendment Rules, 2003, the residue generated from the secondary production of zinc from zinc ash and skimming is classified as hazardous wastes (Schedule I, Process S. No. 6, Waste stream No. 6.3). Moreover, the levels of aluminum (42 mg/kg) arsenic (423 mg/kg), cadmium (72 mg/kg), copper (7446 mg/kg), lead (16252 mg/kg), iron (14079 mg/kg) and zinc (20563 mg/kg) also exceed the regulatory limit prescribe under Schedule 2 of these rules (Table 2.19). Hence, the filter cake generated at M/s SZL is classified as hazardous wastes as per Schedule 1 and 2 of these rules.

Table 2.18 : Physico-chemical Characteristics of Wastewater at various Stages of Treatment from Effluent Treatment Plant, M/s Sunrise Zinc (Sampling Period : November 01 – 05, 2006)

Sr. No.	Parameters	Raw Waste water	Effluent from Neutralization Unit	Effluent from Activated Carbon Column	Effluent Discharge Standards*	
					Into Inland Surface Water	Onto Land for Irrigation
1.	Colour, Pt.Co.Units	50	20	5	**	-
2.	Temperature, ^{0}C	36	35	33	#	-
3.	pH	1.5	7.0	6.6	5.5-9.0	5.5 – 9.0
4.	Total Alkalinity	-	250	146	-	-
5.	SS	76	64	48	100	-
6.	TDS	2542	1326	1314	2100	2100
7.	COD	542	308	232	250	-
8.	BOD	110	50	10	30	100
9.	Chloride	498	203	184	1000	600
10.	Sulphates	5184	1398	650	1000	1000
11.	Nitrate Nitrogen	2.82	1.24	0.98	10	-
12.	Calcium	912	132	124	-	-
13.	Magnesium	326	74	67	-	-
14.	Sodium	224	192	184	-	-
15.	Potassium	3.7	2.2	1.9	-	-
16.	Percent Sodium	16.28	39.47	40.04	-	60
17.	Heavy Metals					
	Iron	0.705	0.009	BDL	3.0	-
	Zinc	4.32	0.872	0.466	5.0	-
	Lead	0.178	0.136	0.056	0.1	-
	Copper	2.574	0.033	0.018	3.0	-
	Nickel	3.586	0.560	0.258	3.0	-
	Cobalt	BDL	BDL	BDL	-	-
	Chromium	0.006	0.002	BDL	2.0	-
	Manganese	1.316	0.682	0.344	2.0	-
	Cadmium	BDL	BDL	BDL	2.0	-
	Arsenic	0.038	0.020	0.009	0.2	0.2

* MEF Standards.
** Removed to the maximum extent possible.
# Should not exceed 5 ^{0}C at the point of discharge of effluents.
All values are expressed in mg/L except pH, temperature and colour.
BDL– Below Detectable Limit.

- **Treated effluent from activated carbon column conform to the stipulated Standards for discharge into Inland Surface Waters and onto Land for Irrigation.**

Table 2.19 : Characteristics and Leachability of Waste Filter Cake

Parameters	Characteristics of Waste Filter Cake		Leachability of Waste Filter Cake as per USEPA TCLP (USEPA Criteria)		Leachability of Waste Filter Cake as per Water Leach Test (CPCB Criteria)	
	Conc. in Cake (mg/kg)	Regulatory Limit as per HWM Rules, 2003 (mg/kg)	Conc. in TCLP Leachate (mg/L)	TCLP Regulatory Limit (mg/L)	Conc. in Water Leachate (mg/L)	CPCB Regulatory Limit (mg/L)
Aluminium	**41**	**N.S.**	0.28	**N.S.**	0.14	**N.S.**
Arsenic	**423**	**50**	0.50	**5**	0.08	**<1**
Cadmium	**72**	**50**	0.33	**1**	**1.53**	**<0.2**
Cobalt	105	**5000**	**13.5**	**N.S**	1.51	**N.S.**
Copper	**7446**	**5000**	**31.3**	**5**	0.66	**<10**
Chromium	477	5000	0.40	**5**	0.012	**<0.5**
Iron	**14079**	**N.S.**	86	**N.S.**	BDL	**N.S.**
Lead	**16252**	**5000**	**6.79**	**5**	**2.49**	**<2**
Manganese	**13615**	**N.S.**	**61**	**10**	**222**	**N.S.**
Magnesium	**10779**	**N.S.**	**58**	**N.S.**	**168**	**N.S.**
Nickel	402	5000	1.72	**N.S.**	**2.57**	**<3**
Zinc	**20563**	**20000**	55.2	**500**	**186**	**<10**

BDL – Below Detectable Limit
N.S. – Not Stipulated

As per the HWM Rules, 2003 the industry has obtained Authorization for collection, reception and storage of hazardous waste from GSPCB (No.10/200/05-PCB/820 dated 07-07-2005). As per the conditions of the authorization the industry is required to store the waste in a secured landfill facility (SLF) till a centralized hazardous wastes treatment, storage and disposal facility (HWTSDF) is established for the State of Goa.

As informed by the industry management, a captive secured landfill facility was established by the industry in 1999 for the disposal of filter cake at a site adjacent to the existing manufacturing facility. However during inspection, the SLF was found to be closed, as its designed capacity was full. Based on the records available with the industry and as observed by the inspection team, the SLF was improperly designed, constructed and operated. This was evident from the present status of the SLF, as huge quantities of filter cake were observed to be dumped in plastic bags over the closed SLF. The cap (tarpaulin liner and top soil cover) of the SLF was observed to be damaged due to the dumping of waste filter cake. Moreover, the leachate collection sump was exposed to the atmosphere and below the height of dumped wastes, making it vulnerable to intrusion of rainwater and leachates from the adjacent dumps. The past waste disposal practice adopted at M/s SZL was not an environmentally sound practice. Presently, the industry is storing the waste filter in a shed, which is covered from the top.

As observed, huge quantity of waste filter cake, similar to that of M/s SZL has been dumped on open land at an adjacent plot, and the dumps were covered with soil. The samples of the dumped wastes were collected by the inspection team to verify its source. The waste sample was subjected to detailed characterization and leachability studies as described earlier. The results of the characterization and leaching tests on the sample collected from the dump site in the backyard of M/s SZL are presented in Table 2.20.

Based on the comparison of the characteristics of the waste collected from the dump site and their leachates (Table 2.20) with that of the characteristics of the waste filter cake generated at M/s SZL (Table 2.19), it is concluded that the wastes dumped at the adjacent plot is of M/s SZL. The unscientific disposal of hazardous wastes may lead to contamination of soil, groundwater and surface water resources in the area.

2.9.5 Conclusions and Recommendations

- Melting crucible must be properly covered with flexible hood system (while charging zinc sheet) connected to blower with sufficient negative draft so that fugitive SO_2 emissions must be minimized in melting section.

Table 2.20 : Characteristics and Leachability of Waste Collected from Dump Site at backyard

Parameters	Characteristics of Steel Slag		Leachability of Steel Slag as per USEPA TCLP (USEPA Criteria)		Leachability of Steel Slag as per Water Leach Test (CPCB Criteria)	
	Conc. in Slag (mg/kg)	Regulatory Limit as per HWM Rules, 2003 (mg/kg)	Conc. in TCLP Leachate (mg/L)	TCLP Regulatory Limit (mg/L)	Conc. in Water Leachate (mg/L)	CPCB Regulatory Limit (mg/L)
Aluminium	**173**	**N.S.**	0.28	N.S.	0.35	N.S.
Arsenic	**403**	**50**	0.52	5	0.26	<1
Cadmium	**58**	**50**	0.30	1	**0.62**	**<0.2**
Cobalt	91	5000	**19.7**	**N.S**	1.40	N.S.
Copper	**19281**	**5000**	**39.2**	**5**	0.83	<10
Chromium	179	5000	0.35	5	0.02	<0.5
Iron	**60316**	**N.S.**	112	N.S.	BDL	N.S.
Lead	**11898**	**5000**	**6.01**	**5**	**2.64**	**<2**
Manganese	**22577**	**N.S.**	**91**	**10**	**275**	**N.S.**
Magnesium	**17468**	**N.S.**	**76**	**N.S.**	**437**	**N.S.**
Nickel	265	5000	1.15	N.S.	**1.20**	**<3**
Zinc	19446	20000	54.3	500	**197**	**<10**

BDL – Below Detectable Limit
N.S. – Not Stipulated

- Fugitive SO_2 emissions from flexible roof top (suction) hood system in the leaching section and that in the cell house must be controlled using properly designed alkali scrubber.

- The stack height must be increased from the existing height of 18 m to the CPCB limits of 30 m (minimum).
- The present practice of dumping filter cake on land is unscientific keeping in view the possibility of groundwater and soil contamination. It must therefore be ensured that such disposal practices are discontinued forthwith.

- It is necessary to periodically monitor the ground water quality and soil status around the sludge storage yard, and therefore test wells must be provided for regular monitoring of groundwater quality in and around the filter cake storage yard.

- Considering the past and the present status of disposal of waste filter cake, inspection team strongly recommends immediate retrieval and containment of the entire quantity of wastes illegally dumped outside the plant premises by M/s SZL, as an immediate short-tem measure. The inspection team also recommends that the entire quantity of wastes accumulated at M/s SZL (including the waste disposed off in the existing landfill) and the waste dumped outside the plant premises must be collected and disposed off in a state-of-the-art secured landfill facility. Since the water leachability tests as per CPCB criteria indicated leaching of cadmium, lead and zinc in the concentrations exceeding the prescribed limit, the wastes accumulated at M/s SZL is not suitable for direct disposal to secured landfill facility. The waste therefore needs to be pretreated (such as solidification/stabilization) prior to its disposal in secured landfill facility.

- As the short term measure, it is necessary to dispose off the filter cake in a scientifically designed captive secured landfill until the permanent landfill site is identified and commissioned by the state. Since a centralized HWTSDF is yet to be established in the State of Goa, the M/s SZL should develop a captive secured landfill facility either within their own premises or at a suitable location within the Cuncolim Industrial Estate. The captive SLF must be designed, constructed and operated as per the guidelines and criteria delineated by CPCB. The industry must initiate the action for immediate implementation of these measures.

- As a long-term measure, the entire quantity of waste filter cake accumulated at M/s NIL must be disposed off in a secured landfill facility. Since the water leachability tests as per CPCB criteria indicated leaching of cadmium, copper and nickel in the concentrations exceeding the prescribed limit, the wastes accumulated at M/s NIL is not suitable for direct disposal to secured landfill facility. The waste therefore needs to be pretreated (such as solidification/stabilization) prior to its disposal in secured landfill facility.

- As per the industry management, the preliminary report prepared by M/s Ramky Infraconsulting (P) Ltd. on the proposed captive TSDF based on NEERI Report has been received on November 1, 2006. The industry management must ensure that Government approval of the preliminary TDSF design is acquired within 45 days of the receipt of the report, and commissioned within six months.

- In order to assess the extent of contamination of groundwater, soil and surface water resources due to the past and present waste management practices M/s SZL, a detailed study needs to be carried out. The cost of remediation of groundwater, soil and surface water to be delineated by the proposed study, may be recovered from the Industry.

- Industry must submit a time schedule for implementation of both the measures, to the GSPCB, with necessary documentary evidences.

- It must be ensured that the existing openings in the compound wall along the periphery of the plot where the filter cake is stored must be sealed to prevent the seepage from the sludge dumps along with surface overflow during monsoon, finding way into the natural storm water drains finally meeting the surface water body.

3.0 Status of Ambient Air Quality around Cuncolim Industrial Estate, Cuncolim, Goa

Ambient air quality around Cuncolim Industrial Estate, Cuncolim, Goa was monitored in terms of suspended particulate matter (SPM), sulphur dioxide (SO_2) and oxides of nitrogen (NOx) at three identified sites. The first site was selected in upwind direction near the Western Beverages Ltd. on the eastern boundary of industrial estate to estimate background concentration of the pollutants (SPM, SO_2, NOx) .The other two sites selected were in the downwind direction namely near Reliance Fuel Storage Depot and near Trimurty Industries on the western boundary of Cuncolim Industrial Estate.

Table 3.1 reveals that ambient air quality (AAQ) at these identified sites is well within the AAQ standards prescribed by the Central Pollution Control Board (CPCB), Delhi, as well as GSPCB, Goa.

Table 3.1 : Status of Ambient Air Quality around Cuncolim Industrial Estate

Sr.No.	Sampling location/Bearing	Concentration Air Pollutant (µg/m^3)			CPCB Standard (µg/m^3)		
		SPM	SO_2	NOx	SPM	SO_2	NOx
AQ-1	Near western Beverages boundary of Industrial estate Upwind Direction	52	BDL	7	500	500	150
AQ-2	Near Reliance(Fuel storage) on Eastern boundary of industrial estate(Downwind Direction)	23	5	13	500	500	150
AQ-3	Near Trimurty on Eastern boundary of Industrial Estate (Downwind Direction)	57	18	16	500	500	150

4.0 Quality of Surface Water and Ground Water

The irrigation canal is located at a minimum distance of 100 m from M/s NIL and at a maximum distance of 1000 m from M/s SSRPL, M/s KAL and M/s PFAL. The physico-chemical characteristics of canal water samples do not conform to the stipulated standards by the Ministry of Environment and Forests (MoEF) for discharge onto land for irrigation with respect to the parameters such as pH, TDS, sulphates, arsenic and percent sodium (Table 2.14).

In addition, the concentration of heavy metals, namely zinc, copper, nickel, cobalt and manganese (Table 2.14) are also high as compared to the GIDC water being used by M/s NIL (Table 4.1).

Assessment of groundwater quality in Cuncolim Industrial Estate was carried out through sampling of bore wells located within the inspected industrial premises except for M/s NIL where no bore well exists as per the management. The bore well water is being used by the industries for process and cooling purposes only. The physico-chemical characteristics of water samples collected conform to the permissible limits of the Drinking Water Standards (IS 10500:1991) except for the parameters, arsenic at M/s Puja Ferro Alloys Ltd. and M/s Sunrise Zinc Ltd. (Table 4.2). The increase in arsenic concentration may be due to seepage from the waste filter cake dumping yard, the disposal of which has been practices unscientifically.

Assessment of ground water quality within 2 km radius of the Industrial Estate was conducted through sampling of open dug wells from residential houses. The physico-chemical characteristics of water samples collected conform to the permissible limits of the Drinking Water Standards (IS.10500:1991) (Table 4.3).

5.0 Overall Conclusions and Recommendations

- Industries which do not have valid consents under Air and Water Acts must procure the same with immediate effect. This requirement is to be one of the essential pre-requisite for reopening the industries for operation.

Table 4.1 : Physico-chemical Characteristics of Water supplied by Goa Industrial Development Corporation (GIDC) to Industries

Sr. No.	Parameters	Sampling Location		Permissible Drinking Water Standards*
		I	II	
		Nov. 3, 2006	Nov. 2, 2006	
1.	Turbidity, NTU	< 5	< 5	5
2.	pH	7.6	7.7	6.5 - 8.5
3.	Total Alkalinity	186	175	600
4.	SS	2	1	-
5.	TDS	56	60	2000
6.	COD	6.4	6.4	-
7.	BOD	BDL	BDL	-
8.	Chlorides	37.4	36.9	1000
9.	Sulphates	24.4	24.9	400
10.	Nitrate Nitrogen	0.022	0.024	100
11.	Total Hardness	20	24	600
12.	Calcium Hardness	10	12	-
13.	Calcium	4.0	4.8	200
14.	Magnesium	2.4	2.8	100
15.	Sodium	16.46	16.82	-
16.	Potassium	0.156	0.168	-
17.	Heavy Metals			
	Iron	0.056	0.059	1.0
	Zinc	0.018	0.016	15
	Lead	BDL	BDL	0.05
	Copper	BDL	BDL	1.5
	Nickel	BDL	BDL	-
	Cobalt	BDL	BDL	-
	Chromium	BDL	BDL	0.05
	Manganese	0.004	0.003	0.3
	Cadmium	BDL	BDL	0.01
	Arsenic	BDL	BDL	0.05

*** Bureau of Indian Standards (BIS) : 10500 : 1991.**
All values are expressed in mg/L except turbidity and pH.
Sampling locations :
– GIDC water sample from M/s Sunrise Zinc Ltd.
– GIDC water sample from M/s Nicomet Industries Ltd.
BDL – Below Detectable Limit.

- **Water supplied by Goa Industrial Development Corporation (GIDC) to Cuncolim Industrial Estate conforms to the Permissible Drinking Water Standards with respect to the aforereferred parameters.**

Table 4.2 : Physico-chemical Characteristics of Bore Well Water Samples from Industries Inspected at Cuncolim Industrial Estate, Cuncolim, Goa
(Sampling Period : November 01 – 05, 2006)

Sr. No.	Parameters	Bore Well									Permissible Drinking Water Standards*
		I	II	III	IV	V	VI	VII	VIII	IX	
1.	Turbidity, NTU	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	10
2.	pH	7.2	7.0	7.3	7.4	7.2	7.2	7.2	6.9	6.8	6.5 - 8.5
3.	Total Alkalinity	240	230	250	270	240	230	240	220	210	600
4.	SS	8	5	2	3	4	5	3	2	5	-
5.	TDS	350	326	236	292	186	172	164	430	724	2000
6.	Chlorides	74	70	56	18	38	74	22	110	136	1000
7.	Sulphates	90	94	16	18	32	49	28	52	266	400
8.	Nitrate Nitrogen	0.17	0.15	0.16	0.20	0.12	0.14	0.10	0.17	0.22	100
9.	Total Hardness	220	210	130	80	110	90	130	180	410	600
10.	Calcium Hardness	170	160	50	30	50	70	80	100	230	-
11.	Calcium	68	64	20	12	20	28	32	40	92	200
12.	Magnesium	12.0	12.0	19.2	12.0	14.4	4.8	12.0	16.8	43.2	100
13.	Sodium	35.2	36.2	29.4	10.2	16.5	38.4	10.8	56.6	68.5	-
14.	Potassium	0.27	0.25	0.20	0.19	0.21	0.26	0.19	0.56	0.68	-
15.	Heavy Metals										
	Iron	0.134	0.125	0.202	0.101	0.186	0.186	0.102	0.205	0.380	1.0
	Zinc	0.123	0.104	0.180	0.063	0.013	0.078	0.990	0.261	0.433	15
	Lead	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05
	Copper	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.5
	Nickel	0.426	0.398	0.398	0.437	0.342	0.102	0.272	0.396	0.219	-
	Cobalt	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-
	Chromium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05
	Manganese	0.082	0.094	0.028	0.026	0.092	0.032	0.085	0.108	0.197	0.3
	Cadmium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.01
	Arsenic	0.048	0.041	0.040	0.035	0.034	0.016	0.017	0.058	0.078	0.05

*** Bureau of Indian Standards (BIS) : 10500 : 1991.**
All values are expressed in mg/L except turbidity and pH.
Sampling location:

- Bore well No. 1 water sample within premises of M/s Maa Durga Enterprises (P) Ltd.
- Bore well No. 2 water sample within premises of M/s Maa Durga Enterprises (P) Ltd.
- Bore well water sample within premises of M/s Shree Balaji Rollings (P) Ltd.
- Bore well water sample within premises of M/s Rukminirama Steel Rollings (P) Ltd.
- Bore well water sample within premises of M/s Shirdi Steel Rerollers (P) Ltd.
- Bore well water sample within premises of M/s Sunrise Electromelt Ltd.
- Bore well water sample within premises of M/s Karthik Alloys Ltd.
- Bore well water sample within premises of M/s Puja Ferro Alloys Ltd.
- Bore well water sample within premises of M/s Sunrise Zinc Ltd.

BDL – Below Detectable Limit

- **Bore well water from M/s Puja Ferro Alloys and M/s Sunrise Zinc do not conform to the permissible limits of the Drinking Water Standards with respect to arsenic parameter.**

Table 4.3 : Physico-chemical Characteristics of Water Samples from Open Dug Wells within 2 km radius of Cuncolim Industrial Estate, Cuncolim, Goa (Sampling Period : November 02 – 05, 2006)

Sr. No.	Parameters	Open Dug Well				Permissible Drinking Water Standards*
		I	II	III	IV	
1.	Turbidity, NTU	< 5	< 5	< 5	< 5	10
2.	pH	6.1	6.2	6.5	6.3	6.5 - 8.5
3.	Total Alkalinity	100	140	150	120	600
4.	SS	4	8	5	3	-
5.	TDS	386	518	676	798	2000
6.	Chlorides	74	314	706	158	1000
7.	Sulphates	156	358	395	252	400
8.	Nitrate Nitrogen	0.878	0.585	0.951	1.825	100
9.	Total Hardness	40	190	48	110	600
10.	Calcium Hardness	10	70	15	50	-
11.	Calcium	4	28	6	20	200
12.	Magnesium	7.2	28.8	7.9	14.4	100
13.	Sodium	38.4	156.2	248.6	78.4	-
14.	Potassium	0.528	1.246	2.120	0.884	-
15.	Heavy Metals					
	Iron	0.034	0.064	0.286	0.242	1.0
	Zinc	0.189	0.196	0.003	0.302	15.0
	Lead	BDL	BDL	BDL	BDL	0.05
	Copper	BDL	BDL	BDL	BDL	1.5
	Nickel	0.096	0.023	0.058	0.038	-
	Cobalt	BDL	BDL	BDL	0.429	-
	Chromium	BDL	BDL	BDL	BDL	0.05
	Manganese	0.036	0.135	0.059	0.256	0.3
	Cadmium	BDL	BDL	BDL	BDL	0.01
	Arsenic	0.034	0.022	0.014	0.046	0.05

*** Bureau of Indian Standards (BIS) : 10500 : 1991.**
All values are expressed in mg/L except turbidity and pH.
Sampling location:

- Open dug well water sample at Akamol, 500 m East of M/s Nicomet Industries Ltd.
- Open dug well water sample from house of Mr.Paulina Rodigven,Belathemb.
- Open dug well water sample of from house of Mr.Sayad Mirza, Takaband.
- Open dug well water sample from farm house adjacent to irrigation canal, 300 m North of M/s Nicomet Industries Ltd.

BDL – Below Detectable Limit.

- **Water quality from open dug wells conform to the permissible limits of the Drinking Water Standards with respect to the aforereferred parameter.**

- The chimneys of M/s Maa Durga Enterprises Limited, M/s Shri Balaji Rolling (P) Ltd., M/s Shirdi Steel Rerollers (P) Ltd., M/s Sunrise Electromelt Ltd., M/s Puja Ferro Alloys Ltd., and M/s Sunrise Zinc Ltd are to be raised to the designated heights.

- The stack emission characteristics of all industries were within the stipulated standards of the GSPCB, though industries by and large, require to install fugitive emission control devices.

- The ambient air quality around Cuncolim Industrial Estate, measured at three sites (one in the upwind and the two in the downwind directions) were within the AAQ Standards stipulated by the GSPCB and that prescribed by the CPCB.

- Based on the detailed assessment of steel and manganese slags generated, it may be concluded that the present practice of dumping the slags within the premises, may not result in any adverse environmental effect, especially on contamination of groundwater and surface water resources. In fact, nowhere in the world, steel and manganese slags are considered hazardous in spite of hazardous constituents because of the immobilization of toxic metals and metalloids during the high temperature operation. Steel and manganese slags are often recommended for use in the road making and for cement manufacture. It may be mentioned here, that CPCB has clarified that slag generated from copper smelter operations is non-hazardous and can be used in cement industries, filling up low lying areas, building/road construction material vide its letter (No. B-12015/33/03-AS) dated November 17, 2003 addressed to the Chairperson, Tamil Nadu Pollution Control Board, Chennai (copy enclosed – Annexure II)

- Considering the present rate of generation of steel and manganese slags and the limited space available with the industries, illegal dumping of slags outside the premises cannot be ruled out in future. This is evident from a number of illegal slag dumps, which were observed by the inspection team within the Cuncolim Industrial Estate. It is therefore recommended that proper record of slag generation must be maintained by the industries under intimation to GSPCB. The GSPCB must evolve a proper disposal strategy in consultation with the CPCB.

- In case, GSPCB/CPCB designates the iron and manganese slags as non-hazardous, it may be used for back-filling and restoration of the abandoned laterite stone quarries located in the vicinity of the Cuncolim Industrial Estate. In addition, a number of abandoned laterite mines are situated near village Quepem (about 5 km from Cuncolim Industrial Estate) spanning an area of hundreds of acres. However, a detailed environmental impact assessment needs to be carried out by the industries generating solid non-hazardous wastes in consultation with GSPCB for evaluating the feasibility of this option.

- At M/s NIL the fugitive SO_2 emissions from flexible roof top (suction) hood system in the leaching section and that in the cell house must be controlled using properly designed alkali scrubber.

- The stack height must be increased from the existing height of 15 m to the height of 30 m.

- As committed by the M/s NIL, the three-stage evaporation system must be commissioned by the end of November 2006. It is therefore recommended that the plant must be allowed to operate only after installation of the evaporation facility.

- M/s NIL must be allowed for continuous operation only after the next inspection by NEERI in association with the GSPCB, to establish that all compliances are met.

- The sludge storage facility within M/s NIL premises must be scientifically designed. The existing practice of storing filter cake on land with only impervious cover on top is not scientific, keeping in view the possibility of soil and ground water contamination. The existing facility must be provided with proper roof top and cement platform with facility for leachate collection to prevent surface and groundwater contamination including soil contamination as the sludges fall under hazardous waste category as per the MEF Guidelines. It is recommended that the plant should be allowed to operate only after installation of the storage facility.

- It is necessary to periodically monitor the ground water quality and soil status around the sludge storage yard of M/s NIL. Therefore, test wells must be provided for regular monitoring of groundwater quality in and around the filter cake storage yard.

- It is necessary to dispose off the filter cake in a scientifically designed captive secured landfill until the permanent landfill site is identified and commissioned by the state.

- Adequate measures must be taken to arrest flow of the seepage water of low pH laden with heavy metals immediately in to the canal.

- It must be ensured that the existing openings in the compound wall along the periphery of the plot where the filter cake is stored must be sealed to prevent the seepage from the sludge dumps along with surface overflow during monsoon, finding way into the natural storm water drains finally meeting the surface water body.

- The opening of the existing storm water drain of the industrial plot on the Southern side must be sealed, since the downward slope of the plot area is

towards North. In addition, the natural storm water drain must be dredged to provide proper slope for free flow of storm water through this drain during monsoon. If necessary, land filling may be carried out to increase the height of bund area between the canal and the compound wall of the industry. These will prevent access of storm water within the industry premises during monsoon.

- Considering the present status of disposal of waste filter cake and contamination of groundwater and surface water resources in the vicinity of the industry, inspection team strongly recommends immediate containment of the existing dumps as a short term measure, so as to prevent /minimize the generation and seepage of leachate and surface runoffs from these dumps. As a long-term measure, the entire quantity of waste filter cake accumulated at M/s NIL should be disposed off in a secured landfill facility. Since the water leachability tests as per the CPCB criteria indicated leaching of cadmium, copper and nickel in the concentrations exceeding the prescribed limits, the wastes accumulated at M/s NIL is not suitable for direct disposal to secured landfill facility. The waste therefore needs to be pretreated (such as solidification/stabilization) prior to its disposal in secured landfill facility.

- In order to assess the extent of contamination of groundwater, soil and surface water resources due to the past and present waste management practices by M/s NIL, a detailed study needs to be carried out by GSPCB. The cost of remediation of surface water, groundwater and soil to be delineated by the proposed study, may be recovered from the Industry.

- In M/s SZL, the melting crucible must be properly covered with flexible hood system (while charging zinc sheet) connected to blower with sufficient negative draft so that fugitive SO_2 emissions would be minimized in melting section.

- Fugitive SO_2 emissions from flexible roof top (suction) hood system in the leaching section and that in the cell house must be controlled using properly designed alkali scrubber.

- The stack height must be increased from the existing height of 18 m to the height of 30 m.

- The present practice of dumping filter cake on land is not scientific keeping in view the possibility of groundwater and soil contamination. It must, therefore, be ensured that such disposal practices are discontinued forthwith.

- It is necessary to periodically monitor the ground water quality and soil status around the sludge storage yard of M/s SZL. Therefore, test wells must be provided for regular monitoring of groundwater quality in and around the filter cake storage yard.

- It is necessary to dispose off the filter cake in a scientifically designed captive secured landfill until a permanent landfill site is identified and commissioned by the state.

- It must be ensured that the existing openings in the compound wall adjacent to the filter cake storage shed must be sealed to prevent the seepage from the sludge dumps along with surface overflow during monsoon, finding way into the natural storm water drains finally meeting the surface water body.

- Based on the detailed assessment of waste management practice at M/s SZL, it is concluded that the past and present practices of disposal of waste filter cake cannot be considered as an environmentally sound practice. The past and present practices of disposal of waste filter cake also violates the conditions prescribed in Authorization for hazardous wastes management issued by the GSPCB.

- Considering the past and the present status of disposal of waste filter cake, inspection team strongly recommends immediate retrieval and containment of the entire quantity of wastes illegally dumped outside the plant premises by M/s SZL, as a immediate and short-term measure. The inspection team also recommends that the entire quantity of wastes accumulated at M/s SZL (including the waste disposed off in the existing landfill) and the waste illegally dumped outside the plant premises must be collected and disposed off in a state-of-the-art secured landfill facility. Since the water leachability tests as per the CPCB criteria indicated leaching of cadmium, lead and zinc in the concentrations exceeding the prescribed limit, the wastes accumulated at M/s SZL is not suitable for direct disposal to secured landfill facility. The waste therefore needs to be pretreated (such as solidification/stabilization) prior to its disposal in secured landfill facility.

- M/s SZL shall dispose all its hazardous wastes to the secured landfill facility described above for disposal of hazardous wastes generated by M/s NIL and M/s SZL.

- In order to assess the extent of contamination of groundwater, soil and surface water resources due to the past and present waste management practices of M/s SZL, a detailed study needs to be carried out. The cost of remediation of surface water, groundwater and soil to be delineated by the proposed study, may be recovered from the Industry.

- All the nine industries must submit time schedules for implementation of all the measures recommended by the Inspection Team with stipulated time frame to the GSPCB who, in turn, will ensure effective implementation.

Annexure I - Inventory of Industries Inspected in Cuncolim Industrial Estate, Cuncolim, Goa

Sr. No.	Item	Industry								
		MDEPL	SBRPL	RRSRPL	SSRPL	SREL	KAL	PFAL	NIL	SZL
1.	Full address	L-1, Cuncolim Industrial Estate, Cuncolim, Goa - 403 703	M-14,15, Cuncolim Industrial Estate, Cuncolim, Goa - 403 703	L-17, Cuncolim Industrial Estate, Cuncolim, Goa - 403 703	L-8, Cuncolim Industrial Estate, Cuncolim, Goa - 403 703	M 3-4, Cuncolim Industrial Estate, Cuncolim, Goa - 403 703	L-6/7, Cuncolim Industrial Estate, Cuncolim, Goa - 403 703	L-4, Cuncolim Industrial Estate, Cuncolim, Goa - 403 703	L/15/19/20, Cuncolim Industrial Estate, Cuncolim, Goa - 403 703	L-2/3, Cuncolim Industrial Estate, Cuncolim, Goa - 403 703
2.	Status of industry									
	• Govt./Public/ Private Sector	Private	Private	Private	Private	Private	Private	Private	Private	Private
	• Large/Medium/ Small Scale	Small	Small	Medium	Small	Medium	Medium	Medium	Medium	Medium
3.	Type of industry	Steel	Steel	Steel	Steel	Steel	Ferro Alloy	Ferro Alloy	Chemical	Secondary production of zinc
4.	Category of industry									
	• Red/Orange/ Green	Red	Red	Red	Red	Red	Red	Red	Red	Red
5.	Surface water body near industry	Irrigation canal	Irrigation canal	Irrigation canal	Irrigation canal	Irrigation canal	Irrigation canal	Irrigation canal	Irrigation canal	Irrigation canal
	• Distance from industry	800 m from canal	700 m from canal	400 m from canal	1000 m from canal	400 m from canal	1000 m from canal	1000 m from canal	100 m from canal	900 m from canal
6.	Raw materials requirement at installed capacity									
	• Name & quantity (t/d)	Sponge iron: 60	Sponge iron : 70	Sponge Iron: 60	M S ingots & billets : 190	M S ingots : 123	Manganese ore : 30	Manganese ore : 50	Cobalt ore : 25	Zinc ash and skimmings : 20.3
		Pig iron : 15	Pig iron : 70	Pig iron : 16	-	-	Dolomite/quartz : 10	Dolomite/quartz : 3	Sulphuric acid : 20	Copper dross and residue : 5.7
		M S scrap : 25	M S scrap : 70	M S scrap : 40	-	-	-	Coke : 15	Caustic lye : 9.1	Brass dross : 12.5
		-	-	-	-	-	-	-	Soda ash : 2	-
		-	-	-	-	-	-	-	SO_2 (liquefied gas) : 2.5	-
		-	-	-	-	-	-	-	Hydrochloric acid : 3	-

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7.	Product(s) at installed capacity									
	• Name & quantity (t/d)	M S ingots : 90	M S ingots : 65	M S ingots : 96	Hot roll M S structural steel : 180	M S rolled structural steel: 117	Silico manganese (medium & low carbon) : 15	Silico manganese (high carbon) : 22	Cobolt metal & salt : 1.66	Electrolytic zinc : 12.5
		TOR steel : 87	Runner/riser : 1.5	Runner/riser : 96	-	-	-	-	Copper : 1.0	Electrolytic copper : 2.0
		-	-	-	-	-	-	-	-	Copper granules : 5.0
		-	-	-	-	-	-	-	-	Brass granules : 5.0
		-	-	-	-	-	-	-	-	Ordinary brand zinc : 10.2
8.	Energy consumption kWh/d	23000-25000	80000-85000	80000-83333	13000-13500	12000-12500	80000-73330	75000-80000	30000-35000	15300-17500
9.	Source of water supply	Goa Industrial Development Corp.	Goa Industrial Development Corp.	Bore well	Goa Industrial Development Corp.	Bore well	Bore well	Goa Industrial Development Corp.	Goa Industrial Development Corp.	Goa Industrial Development Corp.
	No. of bore wells	Two	One	One	One	One	One	One	Nil	One
	No. of bore wells operational	Two	Nil	One	Nil	One	One	One	NA	One
10.	Water requirement									
	• Cooling water makeup	20 m^3/d	3 m^3/d	12 m^3/d	3 m^3/d	1 m^3/d	2 m^3/d	5 m^3/d	-	-
	• Slag granulation	-	-	-	-	-	-	7 m^3/d	-	-
	• Slag cooling	-	0.5 m^3/d	-	-	-	-	-	-	-
	• Boiler feed	-	-	-	-	-	-	-	60 m^3/d	-
	• Process	-	-	-	-	-	-	-	12 m^3/d	12 m^3/d
	• Sanitary/ drinking purpose	0.5 m^3/d	1.2 m^3/d	4.2 m^3/d	2 m^3/d	2.5 m^3/d	3 m^3/d	6 m^3/d	45 m^3/d	4 m^3/d
	Total	20.5 m^3/d	4.7 m^3/d	16.2 m^3/d	5 m^3/d	3.5 m^3/d	5 m^3/d	18 m^3/d	117m^3/d	16 m^3/d
11.	Wastewater generation									
	• Process	Nil	Nil	Nil	Nil	Nil	Nil	Nil	100 m^3/d (Cobalt extraction unit)	4 m^3/d (scrub feed bleed)
	• Sanitary	0.4 m^3/d	1.0 m^3/d	0.6 m^3/d	0.5 m^3/d	0.8 m^3/d	2.4 m^3/d	2.8 m^3/d	40 m^3/d	3 m^3/d
	Total	0.4 m^3/d	1.0 m^3/d	0.6 m^3/d	0.5 m^3/d	0.8 m^3/d	2.4 m^3/d	2.8 m^3/d	140 m^3/d	7 m^3/d

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12.	Wastewater treatment facilities									
	• Cooling water	Settling tanks	Settling tanks	Settling tanks	Settling tanks	Settling tanks	Settling tanks	Settling tanks	-	-
	• Sanitary	Septic tanks	Septic tanks	Septic tanks	Septic tanks	Septic tanks	Septic tanks	Septic tanks	Septic tanks	Septic tanks
	• Process	NA	NA	NA	NA	NA	NA	NA	Two stage evaporation for recovery of sodium sulphate	ETP
13.	Total effluent discharge	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	4 m^3/d
14.	Treated effluent disposal point	NA	NA	NA	NA	NA	NA	NA	NA	Reused for gardening
15.	GPCB consent for water	Application filed for consent on October 12, 2006	No consent	Valid upto March 31, 2008 Industrial – Nil Sanitary – Nil	Valid upto March 31, 2007 Industrial – Nil Sanitary – 0.5 m^3/d	Application filed for consent on October 19, 2006	No consent	Valid upto February 27, 2008 Industrial – Nil Sanitary – 5 m^3/d	Valid upto April 30, 2007 Industrial – 11 m^3/d Sanitary – 20 m^3/d	Valid upto Nov. 30, 2007 Industrial – 7 m^3/d Sanitary – 4 m^3/d
16.	Effluent recycle/reuse									
	• Purpose	Recycling of cooling water	Recycling of cooling water	Recycling of cooling water	Recycling of cooling water	Recycling of cooling water	Recycling of cooling water	Recycling of cooling water	Recycling of condensate from evaporator	Treated effluent reused for gardening
	• Quantum	200 m^3 (continuous)	80 m^3/d	10 m^3/d	8 m^3 (continuous)	10 m^3 (continuous)	60 m^3 (continuous)	100 m^3 (continuous)	160 m^3/d	4 m^3/d
17.	Intermediate waste product	Mill scale (0.3-0.35 t/d)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
18.	Solid waste generation									
	• Type	Slag/ Cyclone dust	Slag	Slag	Mill scale	Mill scale	Slag	Slag	Filter cake	Filter cake
	• Quantum	4.5 t/d /100 kg/d	5 t/d	40 t/d	3 t/d	0.5 t/d	3-5 t/d	25 t/d	12 t/d	6.6 t/d
	• Mode of disposal/ utilization	Partially used for land filling and remaining stored within industry premises	Stored within industry premises	Stored within industry premises	Sold to pig iron manufacture	Sold to pig iron manufacture	- 10% for reprocessing - 20-30% sold to foundries - 20-30% mixed with concrete for land filling within industry premises - 30-40% stored within industry premises	Partially used for land filling remaining stored within industry premises	Stored within industry premises	Partially disposed in captive land fill and remaining stored within industry premises and dumped on adjacent land

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19.	Hazardous waste	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Filter cake (12 t/d)	Filter cake (6.6 t/d)
20.	GPCB consent for air	Valid upto August 31, 2006 Stack ht. (existing): Induction furnace – 17 m Reheating furnace – 12 m	Valid upto October 31, 2006 Stack ht. (existing): Induction furnace – 22 m	Valid upto March 31, 2008 Stack ht. (existing): Induction furnace – 30 m	Valid upto March 31, 2008 Stack ht. (existing): Reheating furnace – 32 m	Valid upto March 31, 2010 Stack ht. (existing): Reheating furnace – 25 m	Application filed for consent on September 5, 2006 Stack ht. (existing): Submerged arc furnace – 30 m	Valid upto February 27, 2008 Stack ht. (existing): Submerged arc furnace – 29 m	Valid upto April 30, 2007 Stack ht. (existing): 15 m	Valid upto Nov. 30, 2007 Stack ht. (existing): Melting furnace – 18 m
21.	Future projections, if any	Nil	Rolling mill of 96 t/d (applied for consent to install)	Nil	Nil	Nil	Rolling mill of 65 t/d (applied for consent to install)	Nil	Production of anhydrous sodium sulphate crystals	Nil

t/d: tonnes/day

Annexure - II

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
(पर्यावरण एवं वन मंत्रालय, भारत सरकार)
(MINISTRY OF ENVIRONMENT & FORESTS, GOVT. OF INDIA)

No.B-12015/33/03-AS/

November 17, 2003

To

The Chairperson
Tamil Nadu Pollution Control Board
100 Anna Salai
Chennai – 600 032.

Sub: Clarification on copper smelter slag.

Sir,

Placed below is copy of letter dated October 28, 2003 from M/s. Sterlite Industries India Ltd., Tuticorin, Tamil Nadu regarding the captioned subject. The matter has been examined and following is submitted for consideration.

The slag is generated in the primary copper smelter at temperature more than 1300°C and at that temperature whatever toxic compounds, organic as well as incorganic get mineralised and a solid mass of slag is produced in the process. This slag is highly stabilised solid waste and non-leachable in terms of toxic heavy metals etc. This is also corroborated by National Metallurgical Laboratory, Jamshedpur who have conducted TCLP test on the slag and found to be non-leachable. The slag is non-hazardous and can be used in cement industries, filling up low lying area, building/road construction material etc.

Yours faithfully,

(B. Sengupta)
Member Secretary

Encl: As above.

NVR

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