o/c

vedanta
transforming elements

sterlite copper

VL-SC/HSE/AR/2017
September 27, 2017

The Member Secretary,
Tamil Nadu Pollution Control Board,
76, Anna Salai, Guindy,
Chennai – 600 032.

Respected Sir,

Sub: Submission of Environmental Audit Statement for 2016-17 – Reg.

Please find enclosed the Environmental Audit Statement for the period April '16 to March '17 in the prescribed format, **Form – V** along with required annexure.

This is for your information and records.

Thanking You,

Yours faithfully,
For **Vedanta Limited,**

C.Murugeswaran
Vice President
Sterlite Copper, Thoothukudi.

Copy to: (i) The Joint Chief Environmental Engineer, TNPCB, Tirunelveli.
(ii) The District Environmental Engineer, TNPCB, Thoothukudi.

28 SEP 2017

Vedanta Limited
Sterlite Copper: SIPCOT Industrial Complex, Madurai Bypass Road, Thoothukudi (Tamil Nadu) - 628 002
T : +91-461 424 2591 F: +91-461 424 2829 | Website: www.vedantalimited.com

Registered Office: 1st Floor, 'C' Wing, Unit 103, Corporate Avenue, Atul Projects, Chakala, Andheri (E), Mumbai (Maharashtra) - 400 093
CIN: L13209MH1965PLC291394

FORM – V

Environmental Audit report for the financial year ending 31st March, 2017.

PART – A

i.	Name and address of the owner / occupier Of the industry, operation or process	:	P.Divakaran Associate Vice President, **Vedanta Ltd – Copper Smelter** SIPCOT industrial complex T.V. Puram P.O Thoothukudi – 628 002.
ii.	Industry category Primary-(STC Code) Secondary- (STC Code)	:	13 (a) Primary metallurgical Industry (Copper production)
iii.	Production capacity – Units	:	Copper Anode 1200 TPD Copper Cathode 875 TPD Sulphuric Acid 4200 TPD Phosphoric Acid 800 TPD Hydro fluoro Silicic Acid 25 TPD Anode Slime (Refinery) 1.75 TPD
iv.	Year of establishment	:	1995
v.	Date of the last environmental statement submitted	:	29.09.2016

PART – B

Water and raw material consumption

1) Water consumption (m^3/day)

Process	-	3356.4
Cooling	-	5080.8
Domestic	-	103.9

Name of products	Process Water consumption per unit of product output (m^3/T)	
	During the previous financial year	During the current financial year
1. Copper anodes	1.64	1.72
2. Copper Cathode	0.70	0.67
By-product		
3. Sulphuric acid	0.32	0.32
4. Phosphoric Acid	0.78	0.84

ps

2) Raw material consumption:

Name of raw Material	Name of Products	Raw material consumption per unit of product (MT)	
		During the previous financial year	During the current financial year
1. Copper concentrate	Copper Anodes	3.42	3.41
2. Lime stone		0.03	0.05
3. Quartz chips		0.11	0.11
4. Quartz fines / Silica sand		0.29	0.27
5. Rock Phosphate	Phosphoric Acid	3.45	3.41

PART – C

Pollution discharged to environment / unit of output

(Parameters as specified in the consent issued)

Pollutants		Quantity of pollutants discharged (Kg/day)	Concentration of pollutants in discharges (mg/Litre)	Percentage of variation from prescribed standards with reasons.
1. Water	TSS	6	3	Zero discharge is being practiced since inception of plant by completely recycling the effluent.
	TDS	124	75	
	Chloride	12	8	
	Sulphate	16	10	
	Arsenic	BDL	BDL	
	Cadmium	BDL	BDL	
	Copper	BDL	BDL	
	Iron	BDL	BDL	
	Nickel	BDL	BDL	
	Lead	BDL	BDL	
	Zinc	BDL	BDL	
2. Air	1. SO_2 – Hygiene Ventilation System	2253	0.75 Kg / Ton of H_2SO_4 Produced	Below CPCB Standards
	2. SO_2 – SAP Tail Gas Scrubber	179	0.12 Kg / Ton of H_2SO_4 Produced	
	3. SPM- PAP Dust Scrubber	42	64 mg/Nm3	
	4. SPM- PAP Boiler	--	--	
	5. Fluoride	33	15 mg/Nm3	

PART – D

Hazardous Wastes

(As specified under Hazardous and Other Wastes (Management and Transboundary Movement Rules, 2016)

Hazardous Wastes	Name	Total Quantity (TPA)	
		During the previous financial year	During the current financial year
(a) From process	Oil Sludge	Nil	1.26 MT
	Spent Oil	4.90 KL**	4.22 KL**
	ESP Dust	8,329.88 MT*	8,085.44 MT*
	Spent Catalyst	0.00 MT	0.00 MT
(b) From pollution control facilities	ETP Cake	33,719.33 MT	37,050.89 MT
	Scrubber/HVS Cake	22,051.85 MT	15,645.24 MT
	ETP Slime	1,377.70 MT	1,334.36 MT
	Copper Scrap with Copper Sulphate	327.77 MT*	370.21 MT*
	DM Resin / RO plant reject	1,716.26 MT	2,409.97 MT
	Drain Desilt	136.02 MT	317.10 MT

* - Recycled back in Smelter process.
** - Recycled back in smelter for combustion

PART – E

Solid Wastes

Solid Wastes	Name	Total Quantity (MT)	
		During the previous financial year	During the current financial year
(a) From process	• Ferro sand	6,59,229.18	6,77,216
	• Gypsum	10,58,035.62	10,53,649
(b) From pollution control facility	• Lime grit	996.80	579
(c) (1) Quantity recycled or re-utilised within the unit	• Ferro Sand	-	-
	• Gypsum	-	-
	• Lime grit	-	-
(2) Sold	• Ferro Sand	7,11,891.04	6,93,667
	• Gypsum	12,10,036.52	11,21,292
	• Lime grit	1087.11	299
(3) Disposed	• Ferro Sand	(-)52,661.86*	(-)16451*
	• Gypsum	(-)1,52,000.90*	(-)67643*
	• Lime grit	(-)90.31*	280

* - Despatch quantity is more than generation quantity for the respective year.

PART – F

Please specify the characteristics (in terms of concentration and quantum) of hazardous as well as solid wastes and indicate disposal practice adopted for both these categories of wastes.

- ***Refer Annexure – I***

PART – G

Impact of pollution abatement measures taken on conservation of natural resources and on the cost of production.

Vedanta Ltd. – Sterlite Copper, Thoothukudi has implemented various pollution control measures over the past years, which have resulted in the conservation of natural resources like water & energy and improved the efficiency of Pollution control measures.

The entire process of smelting and acid production requires a huge quantity of water for various purposes. The effluent out of these processes is treated in a full-fledged Effluent Treatment Plant and is being recycled and used in the plant and Sterlite is the first metallurgical plant to run on 'Zero Liquid Discharge' basis. Moreover, we have installed R.O. plants with Mechanical Evaporator and Spray Drier facility with a capacity of 300 m^3/day for utility waste water and 1300 m^3/day for ETP treated water. This achievement of ours has saved the precious natural resource (Water) which is a rare commodity in this part of the country. As per CPCB / TNPCB directions, we have installed online monitors for treated effluent parameters viz. pH, TSS and Flow as applicable for Copper industry and the same has also been connected with Care Air Center, TNPCB, Chennai and Central Pollution Control Board for real time data monitoring.

In addition to the existing RO plants, we have provided RO-3 for treating and reusing the water collected through storm water drain in the rain water harvesting ponds and treated trade effluent along with Mechanical Vapour Recompression (MVR) for the evaporation and crystallization of RO reject. The project has been commissioned and put in operation in the month of March '17 at a cost of Rs.3,386 lakhs.

Further, as a responsible corporate, we have started consuming desalinated water even at a higher price, when compared with the price of TWAD board. This had reduced the stress on the surface water resources with reduced intake from SIPCOT.

As part of Solid Waste Management, Sterlite unit has constructed 5 cells of Secured Landfill out of which 4 cells are capped as per CPCB guidelines.

Online analysers are installed at all process stacks with Trips & Interlock mechanism. The unit is having Manual Ambient Air Quality Stations - 6 Nos along with Online Continuous Ambient Air Quality Monitoring at 7 locations in & around periphery of the plant, which are in operation with Centralized On line Display (Tamil and English Language) at the main gate of the plant, hence made the general public aware of the surrounding environment quality. In addition, we have also connected our Smelter and Sulphuric Acid Plant stack emission data with Care Air Center, TNPCB,

Chennai and Central Pollution Control Board for real time data monitoring. Further, we have installed fence line monitoring across the boundary to monitor the ambient air quality.

In order to reduce fugitive emissions from smelting operation, the unit had voluntarily planned for installation and commissioning of Fugitive gas collection system in the year 2009 itself. In order to develop robust system we engaged world renowned agency, M/s. Worley Parson, USA to conceptualize the entire gas handling system and the same was completed by June 2010. Flue Gas De-sulphurisation System (FGDS) consists of two sections viz. Bag filter section with dry hydrated lime powder injection system and a venturi scrubber with four decks of lime spray followed with caustic spray option. In order to prepare scrubbing liquor for FGDS, we have installed a separate Milk of Lime preparation plant of 70 MT/Day capacity. The project has been commissioned and put in operation in the month of July '13 at a cost of Rs.4500 lakhs.

In addition, we have installed bag house at primary smelter as well as at secondary smelter section helped to eliminate hazardous waste generation by separating out dust particles prior to scrubber which leads to the generation of non-hazardous scrubber cake. This project has been commissioned and put into operation in September 2012 at a cost of Rs. 3500 lakhs.

Moreover, additional 4 nos. of hopper have been deployed in port operations for cargo handling to avoid spoilage and fugitive dust emission.

Further to continually improve upon the conversion process efficiency of Sulphuric Acid Plant, Sterlite had taken a mega- project for replicating the environment friendly technology (i.e.,) changing the Converter bed configuration to 3+1in the year 2005-06 & 2006-07. Old Wet ESP- V5 & V6 were replaced with new one for Sulphuric acid plant Gas Cleaning Section to improve dust collection efficiency from the off-gas stream.

The journey of perfection did not end with making the process efficiency to 99.9% but went beyond that. The emissions from the Acid Plant stacks had reduced so drastically after attainment of process efficiency of 99.9% but still to further bring down the levels and surpass the Charter of Responsibilities for Environment Protection (CREP) given by CPCB, we had installed an Alkali Tail Gas Scrubber for both the Sulphuric Acid Plants. This project also has helped us to achieve an emission level of less than 1 kg/ Ton of sulphuric acid produced.

A Closed Pneumatic dust conveying system has replaced the earlier system of taking the ESP dust, a hazardous material through tractor arrangement. This has eliminated the spillages of the hazardous material while loading or unloading and has helped in transferring the dust from ESP and WHRB to the raw material warehouse.

Five Stage scrubbing system implemented in place of three stage scrubbing for fluorine emission control in Phosphoric Acid Plant which has brought down the levels of Fluorine much below the prescribed standards. Online Hydrogen Fluoride Workplace Sensors were installed in Filter & Off-gas section of Phosphoric Acid Plant to monitor & to control the fugitive HF gas emissions levels. One new dry dust system installed; one more old wet dust system has been converted into dry dust

system. Also, we have installed online fluorine analyser in stack as well as work place to monitor the HF gas emissions levels.

Extensive concreting has been undertaken across the plant including roads in raw material handling areas (approx. 3.5 km). Further, all the unpaved roads are paved with bitumen road to reduce the dust generation due to vehicles movement.

PART – H

Additional measures / investment proposal for environmental protection including abatement of pollution, prevention of pollution.

Sterlite has planned the following Capital Expenditure for Environment upgradation in the year 2017-2018.

S. No.	Projects proposed in 2017-2018	Rs. in lakhs
1.	ETP 6 Revamping	7
2.	Scrubber vessel replacement	3
3.	Rock area upgradation	80
4.	DDS Revamping in Phosphoric Acid Plant - Phase 2	100
5.	Smelter Area Concreting (incl. primary & secondary) and Electrical Transformer area	150
6.	Concreting in Sulphuric Acid Plant (GCP 1, 2 & 3 and acid tower including blower area) and Phosphoric Acid Plant (Clarifier area & CT)	150
7.	Replacement AC sheets with Non AC sheets	150
Total		640

Any other particulars for improving the quality of the environment:

Towards improving the environment, several pollution control measures have been completed in the year 2016-2017 and the details are enclosed.

S. No.	Projects completed in 2016-2017	Rs. In lakhs
1.	RO-3 & ZLD for treated water and storm water treatment	3385.86
2.	Procurement of Port Hopper (4 nos.)	455.33
3.	Concrete floor in Slag Cleaning Furnace, Converter & RHF	142.89
4.	Mixing Chamber Duct replacement	131.92
5.	Loading station automation in Phosphoric Acid Plant	86.41
6.	Replacement AC sheets with Non AC sheets in converter aisle	77.76
7.	Lime & Pebbles Shed for internal storage in Phosphoric Acid Plant	32.85
8.	Pneumatic Conveyor for Soda Ash	30.11
9.	Water Bound Macadam (WBM) road on the Western side of SLF 4 & 5 boundary wall	28.14
10.	Replacement of Heat Exchanger in Sulphuric Acid Plant	17.64
11.	Dust suppression system at Converter Revert Screen	10.64
12.	ETP RO treated effluent Monitoring System	3.34
13.	Displaying Continuous Ambient Air Quality Monitoring data	3.25
TOTAL		**4406.14**

ANNEXURE: I

HAZARDOUS WASTES

The Hazardous wastes that are generated in our Tuticorin Complex are the Spent Catalyst, Spent Oil and Oil Sludge, ESP/GC dust, ETP cake, HVS Cake , ETP slime, Copper scrap with copper sulphate and R.O. reject.

Spent Catalyst:

Spent catalyst is bagged in polythene bags, stuffed in drums and disposed in Secured Landfill Facility.

Spent Oil & Oil Sludge:

The spent Oil is collected in drums and Recycled back in smelter process for combustion and Oil Sludge is collected in drums and sold to authorised parties

ESP / GC DUST:

ESP & Gas cooler dust are collected from the off gases coming out of the smelter. The entire quantity of dust is recycled back into the system.

ETP Cake:

The sludge generated from reaction of lime and ferric sulphate with the effluent generated in various stages of the process is collected in the sludge holding tank of ETP. This sludge is pumped to the filter press (a part of the effluent treatment plant). The sludge is filtered, the filtrate (clear water) is pumped back into the reaction tank and the resultant cake with about 50 – 60 % solids is mechanically transferred to the Secured Landfill Facility for disposal.

SCRUBBER CAKE

Hygiene Ventilation Systems are being operated in Smelter to treat secondary gases coming from ISA/RHF, Ferro Sand cleaning furnace, and Converter and Anode furnaces. The bleed off from these Hygiene Ventilation Systems is pumped to ETP-1 having sludge thickening system. The thickened sludge is taken to the filter press. The sludge (Scrubber Cake) is filtered, the filtrate (clear water) is pumped back into the reaction tank. The resultant cake is disposed to Secured landfill facility / further beneficial uses.

ETP slime

ETP slime are the impurities from the anode. It is generated from the Refinery ETP which is stored in drums & sold for authorized recyclers.

Copper scrap with copper sulphate

Non ferrous scrap is generated from Copper Refinery which will be sold to authorized recyclers approved by CPCB.

R.O. Reject

During resin change in water purification and RO plant rejection, waste will be generated and it contains some toxic metals which is Stored in Secured Landfill facility in a designated area through tractor.

SOLID WASTES

The Solid wastes that are generated in our Thoothukudi Complex are the Ferro Sand, Gypsum, Tail Gas Scrubber (TGS) Cake and Lime Grit.

Ferro Sand

The Copper Concentrate containing about 30% Copper is mixed with limestone and silica. This feed is smelted in the ISA Smelt Furnace with the help of Lance. The products obtained after Smelting are Matte (60% Copper) and Ferro Sand (Fe_2SiO_4 - Fayalite)

These are tapped from the smelting furnace into a Rotary Holding Furnace where the two are separated i.e., Matte and Ferro Sand. Ferro Sand is directly tapped into the granulation system where it is granulated by water. It is an inert material and is transferred by truck to the storage yard. We are selling ferro sand for shot blasting, road building activities and for land filling.

Gypsum

Gypsum is being produced in dry form as a part of our Phosphoric Acid Plant operation. Closed pipe conveyor transfers gypsum to the Gypsum Pond. We are selling the Gypsum to Cement Industries, Gypsum Board industries etc. Our present dispatch quantity is higher than the generation quantity.

Lime Grit

Our ETP and Hygiene Ventilation system require Milk of Lime (MOL) for neutralisation. The same is prepared from Imported Quick Lime. During the MOL preparation, sediment will be generated which is called Lime grit. Mostly it will be a part of unburnt lime stone and silica. This lime grit is recycled back into ISA furnace as well as sold to market.

Tail Gas Scrubber (TGS) cake

The residual SO_2 gas from Sulphuric Acid Plant is sent to stack after treatment through TGS. In the process of treatment, Sodium Sulphite and bi-sulphite are formed during alkali scrubbing, which is further treated with milk of lime to precipitate them as solids. The final cake formed in TGS is calcium sulphite and sulphates.

SPENT OIL & OIL SLUDGE COMPOSITIONS

Parameter	SPENT OIL	OIL SLUDGE
Specific Gravity	>0.9 g/cc	>1.25 g/cc
% Solids	< 2 %	< 5 %
Flash point	>100°c	>66°C
Calorific Value (Cal / g)	7500-9000	10000
Reactivity	Flammable	Highly Flammable
Explosivity	NA	NA
Biodegradability	NA	NA

ESP DUST COMPOSITION

Parameter	Range
Copper (%)	24
Iron (%)	27
Silica (%)	3
Lime(%)	0.5
Sulphur (%)	20
Arsenic (%)	0.04 – 0.12
Bismuth(ppm)	<15
Cadmium (ppm)	<5
Chromium (ppm)	<15
Cobalt (ppm)	<10
Nickel (ppm)	<10
Lead (ppm)	<10
Antimony (ppm)	<20
Zinc (ppm)	<1100

ETP CAKE COMPOSITION

Parameter	Range
Iron (%)	4.5 – 6.2
Arsenic (%)	0.8 – 1.5
Copper (ppm)	1300 - 2100
Bismuth (ppm)	65 - 185
Cadmium (ppm)	<15
Chromium (ppm)	<15
Cobalt (ppm)	<20
Nickel (ppm)	<15
Lead (ppm)	20 - 50
Antimony (ppm)	< 20
Zinc (ppm)	1100 – 2500

SCRUBBER CAKE COMPOSITION

Parameter	Range
Iron (%)	0.05
Arsenic (ppm)	30 - 40
Copper (ppm)	10 - 20
Bismuth (ppm)	BDL
Cadmium (ppm)	BDL
Chromium (ppm)	BDL
Cobalt (ppm)	BDL
Nickel (ppm)	BDL
Lead (ppm)	BDL
Antimony (ppm)	BDL
Zinc (ppm)	1.0 – 2.0

ETP SLIME (WITH LOW PRECIOUS METALS) COMPOSITION

Parameter	Range (%)
Nickel	10 – 17
Arsenic	0.2 – 0.75
Ca	18 – 23
S	11 – 14
Sb	0.02 – 0.07
Bi	BDL
Fe	0.2 – 0.9
Co	0.02 – 0.05
Mg	0.5 – 0.8
Na	0.05 – 0.09
Pb	BDL
K	1 – 1.5
Moisture	35 – 45

COPPER SCRAP – DO POWDER COMPOSITION

Parameter	Range
Copper (%)	50 – 75
Sulphur (%)	30 – 40
Other Elements (%)	5 – 10

SPENT CATALYST COMPOSITION

Parameter	Range
V_2O_5 (%)	6 - 7 %
K_2O	9 - 12 %
Na_2O	1 - 2 %

Composition of Ferro Sand

Parameter	Ferro Sand
1. Copper (%)	0.4 – 0.5
2. Iron (%)	40 - 45
3. Sulphur (%)	0.5 – 1.5
4. Silica (%)	28 – 35
5. Lime - CaO (%)	3.0 – 5.0
6. Arsenic (ppm)	100 - 150
7. Bismuth (ppm)	2 - 5
8. Cadmium (ppm)	5 – 8
9. Chromium (ppm)	0.5 – 1.0
10. Cobalt (ppm)	100 – 200
11. Nickel (ppm)	25 – 50
12. Antimony (ppm)	2 – 5
13. Selenium (ppm)	1 – 2
14. Zinc (ppm)	500 – 1500

BDL - Below Detectable Limit

CHARACTERISTICS OF GYPSUM

Parameter	Result
Total P_2O_5	0.36%
Water Soluble P_2O_5	0.005%
Sulphate as SO_3^-	42.12%
CaO	32.96%
Silica	1.32%
Al_2O_3	0.0567%
MgO	0.0132%
Water of Crystallization	19.9% at 250'c
Uncombined moisture	10.33%
pH of 1% solution	4.30
Fe_2O_3	0.0107%
Chloride	0.03%
Na_2O	0.05%
K_2O	0.03%
Fluoride	0.28%
As	BDL
Pb	BDL
Cd	BDL
Zn	BDL
Cu	BDL
Radium	BDL

LIME GRIT

Parameter	Result.
CaO	45.0%
Sulphate as SO_3	0.2%
Silica	40%
MgO	0.5%
Iron	0.2%
Arsenic	BDL
Copper	BDL
Bismuth	BDL
Cadmium	BDL
Chromium	BDL
Cobalt	BDL
Nickel	BDL
Lead	BDL
Zinc	BDL

pp
C.Murugeswaran
Vice President, Sterlite Copper