	Report on Trial Run Study of Co-Processing of Iron Oxide Waste of M/s Kerala Minerals and Metals Ltd., in Sinter Plant at M/s JSW Steel Ltd., Mechari, Mettur Tk, Salem District, Tamilnadu	**South Zonal Office, Bangalore**

I **Background :**

The Hazardous Wastes (Management and Handling & Transboundary Movement) Rules, 2008, provided for a specific Section i.e. Rule 11 dedicated to utilization of Hazardous Wastes as a supplementary resource or energy recovery or after processing. In view of this CPCB has taken-up trial run for co-processing of few categories of wastes and granted regular permission for the same. The unit which is going for co-processing of wastes has to follow the guidelines on Co- processing in Cement / Power / Steel Industry.

M/s JSW Steel Ltd., Pottaneri, Mechari, Mettur Taluk Salem District having 637 acres of land in Pottaneri, at about 35 kms from Salem in Tamilnadu. M/s JSW Steel Ltd. Salem plant mainly caters to the automotive sector. It has 2 nos of 48 batteries & 1 no. of 24 batteries coke oven Plant, Iron complex consisting of 2 nos of Sinter Plant, 2 nos of Blast Furnace, 1 no. of pulverised coal injection plant and 1 no of Pig Casting Machine. Steel complex consisting of 2 Energy Optimizing Furnaces of 1 million tonne capacity which offers low tramp elements and low phosphorus, Four ladle furnaces for refining with slag metallurgy, Two automated continuous casting machines of 1 million tonne capacity for reduced central segregation, and Two cold rolling mills of 1 million tonne capacity with H/V strands for continuous rolling as per TNPCB consent and started its production during year 2004.

The unit has obtained permission from CPCB to utilise Iron Oxide (process waste) generated from Illemnite Chemical Beneficiation plant of M/s Kerala Minerals & Metals Ltd.,(KMML) Kerala as a raw material in Sinter Plant vide letter no. B-29016 (SC)/1(55-61)11/HWMD/11662-665 dated 01.03.2012 **(Annexure -1).**

In view of above, the unit obtained NOC from Tamil Nadu State Pollution Control Board (TNPCB) for conducting trail with Iron oxide of 9000 MT from M/s KMM vide letter no. T&/TNPCB/F-7379/URL/HWM/SLM/2010 dated 28.05.2012 **(Annexure-2)**. And also the unit obtained the NOC from Kerala State Pollution Control Board (KSPCB) to transport the Iron Oxide from M/s KMML, Chavara, Kollam, Kerala to M/s JSW Steel Ltd, Pottaneri, Mechari, Mettur Taluk, Salem District, Tamilnadu vide letter no. PCB/HO/KLM/ICO/08/08 dated 14.06.2012 **(Annexure – 3)** .

Accordingly, M/s JSW Steel Ltd., initiated trail run for co-processing Iron Oxide (process waste) from M/s KMML during **May 20 -24, 2014 for 5 days.** The following officials from CPCB & TNPCB have been present for assessment and monitoring:

1. Mrs. H.D.Varalaxmi, EE, CPCB
2. Mr. N Raja Gopalan ,DEE, Salem Regional Office, TNPCB
3. Mr. Saravana Kumar, AEE, Salem Regional Office, TNPCB

The unit has engaged M/s SGS India, Chennai for emission monitoring during monitoring programme (normal operation, trail run at fixed % of H.W and normal operation) for 5 days. CPCB inspection team witnessed the trail run during co-processing of Iron Oxide (process waste) as a raw material in Sinter Plant .

2. Hazardous Wastes & Handling

Generation: The TNPCB accorded permission to M/s JSW Ltd to procure 9000 tons of Iron Oxide (process waste) generated from Illemnite Chemical Beneficiation Plant of M/s Kerala Mineral & Metals Ltd., Kerala and to transport & conduct the trail run at M/s JSW Ltd.,. The details of quantity of Iron Oxide (process waste) procured is enclosed at **Annexure -4**.

Transportation: The unit has obtained NOC from KSPCB to transport the 9000 tons of Iron Oxide from M/s KMML, Kerala to M/s JSW Ltd., Salem, Tamilnadu as per Rule 20 (3) of Hazardous Waste (Management Handling 7 Transboundary Movement Rules 2008.

The hazardous waste for co-processing need to be handled in an environmentally safe manner avoiding the possibilities of contaminating the nearby environment and eliminate the chances of accidents. It was informed that the Iron Oxide having 65 % moisture from M/s KMML was being transported by truck (covered with HDPE sheet to avoid any spillage during transportation) about 470 km from Chavara, Kollam, Kerala to M/s JSW during May 2013. The Iron oxide was transported for co-processing with required Form - 13, Hazardous Waste Manifest. *The unit informed that the transportation cost incurred per ton of iron oxide having 65 % moisture content is Rs. 1400 and Rs 400 paid towards M/s KMML as a lifting charge.*

Storage: The total quantities of Iron Oxide brought from M/s KMML was stored in closed shed which is constructed near the raw material (iron ore fine) storage yard. The available storage shed is adequate to accommodate the 2800 tonnes of Iron Oxide with 65 % moisture content. *During inspection the unit has stored around 1919 tonnes of Iron Oxide in the shed.*

Preparation: The unit has made concrete plat form in 100 m^2 to facilitate mixing of Iron Oxide with Iron Ore fine. The Iron Oxide of 37 tonnes and the iron ore fine of about 313 tonnes was shifted by truck to concrete plat form and mixed by using tipper bucket. After uniform mixing the mixed raw material was charged in sinter plant-1 raw material conveyor belt to stock in silo. The blended iron ore along with other raw material viz. coke fine, lime stone fine and blast furnace return fine etc., were feed to sinter plant to maintain ratio of about 5 %. The weigh bridge slip pertains to Iron oxide waste and Iron Ore fine is enclosed at **Annexure – 5**.

Characteristic of sludge: The characteristic of Iron Oxide and the blended with Iron Ore fine (stacked for Sinter plant -1 feed) are given below:

Characteristics	**Iron Oxide**		**Blended (Iron Oxide & Iron Ore fine)**
Total Moisture %	9.4 %	-	-
LOI %	3.08 %	-	-
Fe (T)	-	54.69%	54.34 5
FeO	-	10.12 %	9.92%
Fe_2O_3	88.86%	66.95%	66.69%
SiO_2	1.24 %	5.58 %	5.68 %
Al_2O_3	1.42%	2.82%	2.70%
CI	1.53 %	0.012 %	0.09 %
CaO	Nill	11.10 %	11.42 %
MgO	0.96 %	2.06 %	2.07 %
TiO_2	1.62%	0.019%	0.21%
MnO	0.48 %	0.16 %	0.17 %
P_2O_5	0.02%	-	-
ZnO	0.04%	0.006%	0.01%
SO_3	0.48%	-	-
Na_2O	-	0.08%	0.08 %
K_2O	-	0.08 %	0.05 %

3. Sinter plant - Process involved in which Hazardous waste used as a supplementary raw material

The iron ore fines, coke fines, lime stone fines and other raw material fines dusts which cannot be used in the Blast furnace are processed in the plant at a temperature 1200 ^{o}C , by burning fuel. Sintering is process of agglomeration of fines by incipient fusion in to porous lumps called Sinter which is an input for Blast furnace.

The Sinter plant is an assembly of pallets with gates moving with the help of sprocket wheel and chain table. The hearth layer passes through an ignition hood where it gets ignited by burning furnace oil/Blast furnace gas. Wind boxes are provided below the sinter bed for suction of air to effect uniform burning of sinter bed along the cross section. The suction is maintained by fans. The strand is provided with necessary sealing to prevent air leakage between pallets and the machine.

The hot sinter cake are broken by a sinter breaker and passed through sinter cooler strand where the hot sinter is subjected to cold air below. This cold sinter is crushed in roll crusher and screened in three stages.

4. Trail Process

The hazardous waste i.e Iron Oxide (37 tonnes) blended with Iron Ore fine (313 tonnes) is transferred to feed which is stocked in silos for feeding to Sinter plant along with other raw material ((390 tonnes) viz Coke fine, lime stone fine, blast furnace return fine. Relevant photos are given at **Annexure -A.** The operating temperature of the Sinter Plant was found in the range of 1050 -1100^{o} C

5. Raw material & Cost Saving

As like other wastes, the Iron Oxide is not having required calorific value to consider as energy substitute in the co-processing. The Iron Oxide contains average Fe_2O_3 of 88.5%, which is consider to be good substitute for Iron Ore fine to about 5%. The substituting with Iron Oxide the unit has saved 5% of the Iron Ore fine by weight.

Quantity of Iron Oxide utilized	: 5 % i.e 37 TPD
Direct saving of Iron Ore fine	: 37 TPD
Cost of Iron Ore fine	: Rs. 6700/tone
Total cost saving	: 6700 * 37 = Rs. 2,47,900 per day*

Note: * - *excluding the packaging, transportation, preparation and handling costs.*

As per the information provided by the unit , the cost incurred for lifting, packing, transportation of Iron Oxide with 65% moisture content is Rs. 1800/ton, actual cost towards procurement of Iron Oxide excluding moisture is Rs.5142/tonne.

The net cost of saving is : Rs. 6700 – 5142 = Rs 1558/tonne
Or Rs 1558 * 37 tonne = Rs.57646 / day

The Raw material consumption and Sinter production are as follows:

S.No.	Raw material	Pre trial (Ave)	Trial (Ave)	Post-trial (Ave)
1.	Iron Ore Fine (TPD)	352.97	310.00	352.97
2.	Coke (Breeze) Fine (TPD)	28.76	30.00	28.76
3.	Lime Stone Fine (TPD)	43.06	43.00	43.06
4.	Lime powder (TPD)	24.34	24.00	24.34
5.	Blast Furnace return Fine (TPD)	188.89	200.00	188.89
6.	Dolomite fine (TPD)	26.68	27.50	26.68
7.	Other process wastes (TPD)	59.38	59.00	59.38
8.	Return fine (TPD)	133.00	136.00	133.00
9.	Water addition (TPD)	58.16	61.34	58.16
10.	Iron Oxide (TPD)	-	36.06	-
	Total Input (TPD)	**918.22**	**926.9**	**918.22**
	Percentage of Iron Oxide use	-	3.88%*	
	Out Put			
	Sinter production (TPD)	618.00	620.00	618.00
	Return fines (TPD)	133.00	137.00	133.00
	Loss of Ignition (TPD)	109.06	110.00	109.06
	Water loss (TPD)	58.16	60.00	58.16

Note : *If exclude the Moisture and return fine the percentage of Iron Oxide is works about 4.9 %

6. Emission Control & Monitoring

The unit has provided ESP to control the particulate matter followed with a stack. The stack height is 45 M and 1.6 Meter dia. The CPCB team witnessed the co-processing of sludge in the kiln. The unit has engaged M/s SGS India, Chennai to carry out as per Guideline for normal operation; trail run at fixed % of H.W and normal operation for 5 days. **The summary of the emissions monitoring results as per protocol of monitoring for source and ambient is enclosed at Annexure -6**. From Source emission monitoring report, it is observed that, in two instances of trail run particulate matters exceeds the prescribed limit (150 mg/Nm^3) of TNPCB. Acid mist also found high in 3 instances of trail run and HCl concentration was also found very high in throughout the trail run.

7. Conclusion

- M/s JSW Steel Ltd., has conducted trail run for utilisation of Iron Oxide process waste as a supplementary resource during May 20 -24, 2014 in the Sinter Plant 1 of 607 TPD Sinter production.

- The unit has maintained the Iron Oxide feed at an average of 4-5% by weight in Sinter plant along with other Raw material Iron Ore fine, Lime Stone fine, Coke Fine and Blast furnace return fine.

- The unit could able to save 37 TPD of Iron Ore fine by substituting Iron Oxide process waste. The net cost of saving of Iron Ore fine @ Rs. 1558 /T is around Rs. 57646 per day, which is including the cost of transportation and packing etc.

- The unit has handled the materials with a help of truck to carry the material to platform for blending, the Iron Oxide (37 tonne) and Iron Ore fine (313 tonnes) are mixed with the help of tipper bucket and fed to raw material silo. The other raw materials viz coke fine, lime stone fine, blast furnace fine were stored in other silo and fed at the rate of 390 TPD to sinter plant.

- The unit shall develop and maintain the sprinkler system to arrest fugitive emission at raw material storage yard, Iron Oxide storage yard and charging point to arrest fugitive emission. Also to construct wind barrier around material handling area to arrest the carryover dusts.

- As per protocol of Trial run for co- processing of Hazardous waste – Part –A for source emission monitoring the unit required to be monitor 4 samples/day w.r.t Particulate, SO_2, HCL, CO, Nox, HF, 2 samples/day w.r.t HC, VOC, PAH and I sample/day w.r.t. TOC, Heavy metals, Dioxin &furan and Cyanide. However the unit was not prepared for proper monitoring as per protocol, after intervention of CPCB officials, the unit asked M/s SGS India to carryout source monitoring as per protocol which indicates the negligence of unit.

- As per CPCB, Standard Procedure for Ambient Air Quality Monitoring, the filter paper for particulate matter is required to be change in 8 hrs, and other gaseous pollutant, the absorbents are required to be change every 4hrs. However the unit was not prepared for the same and monitoring for 24 hrs, by using one filter paper/24 hr and by changing absorbent once in a day for gaseous pollutant. This was observed by the team during trail run on 21.05.2014 and asked to follow Standard Procedures of CPCB for Ambient air Quality Monitoring.

- From Source emission monitoring report, it is observed that, in two instances of trail run particulate matters exceeds the prescribed limit (150 mg/Nm3) of TNPCB. Acid mist also found high in 3 instances of trail run and HCl concentration was also found very high in throughout the trail run.

Signature of Inspection team :

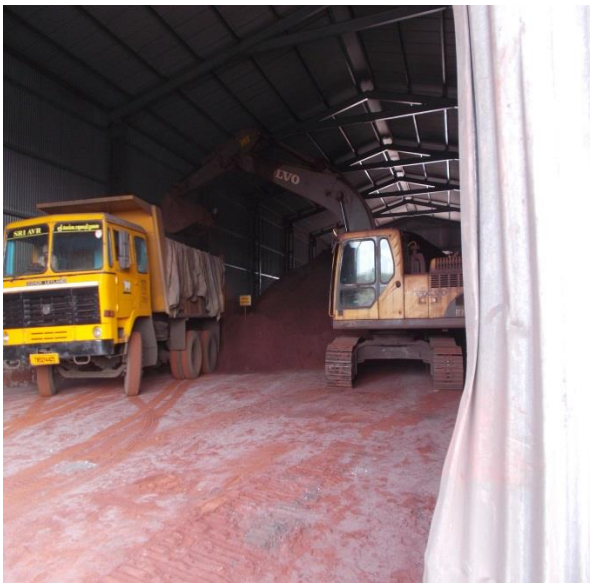
(H.D. Varalaxmi)
EE

Annexure A

Photographs taken during Co- processing Trail Run at M/s JSW Steel Ltd.

Storage of Raw material in open yard without sprinkler system to arrest the fugitive emissions

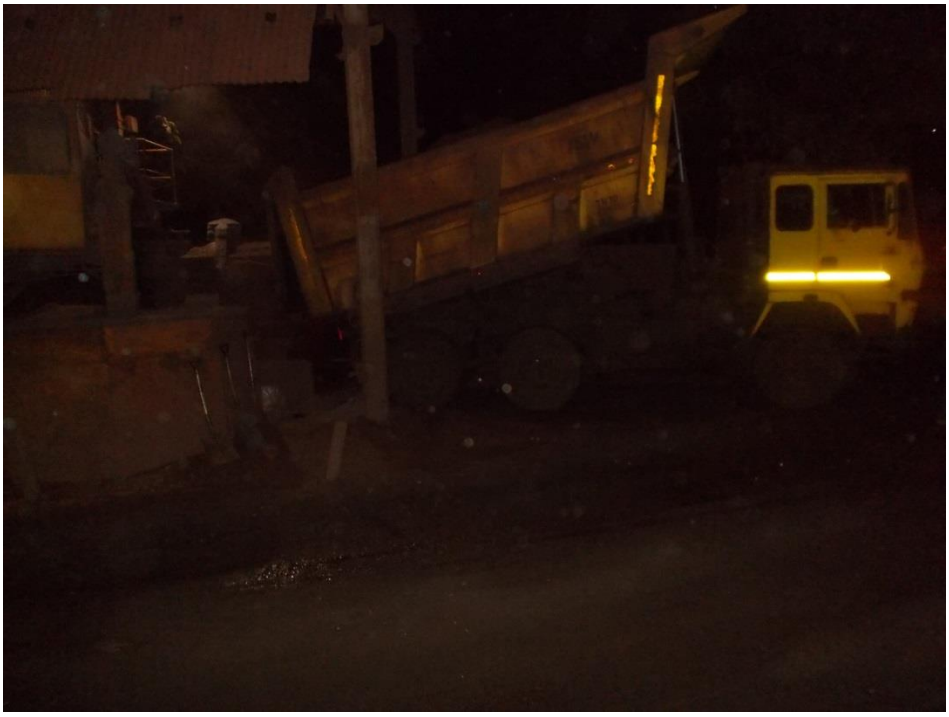
Storage of Iron Oxide in Shed

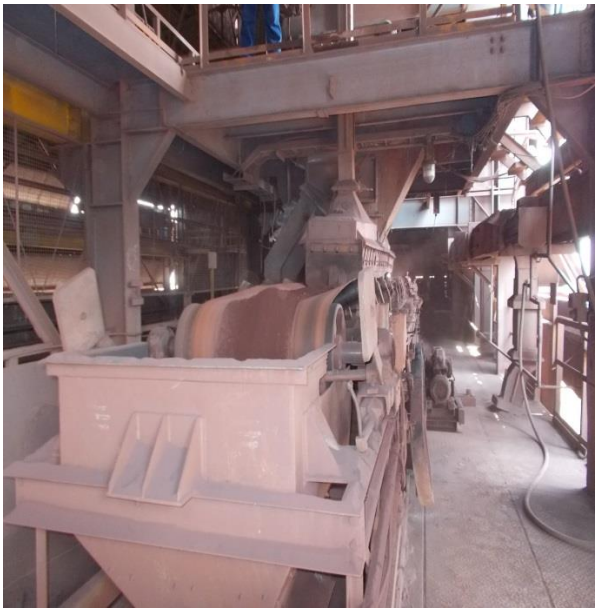


Carrying of Iron Oxide for blending

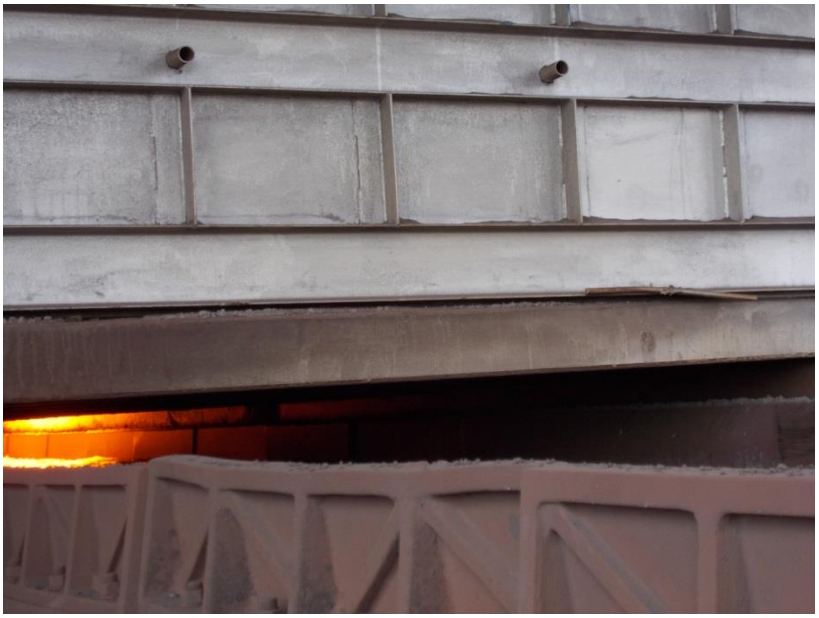
Plat form made for blending

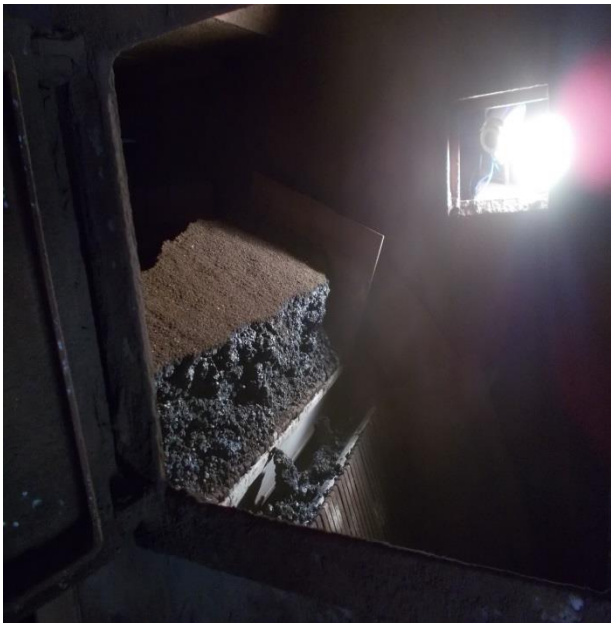
Mixing of Iron Oxide & Iron Ore fine





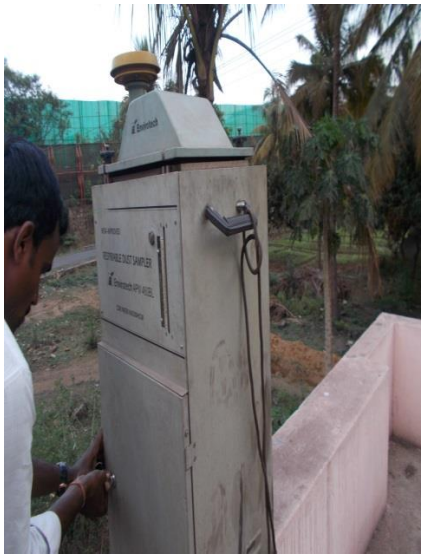
Feeding of Blended raw material into Sinter Plant 1

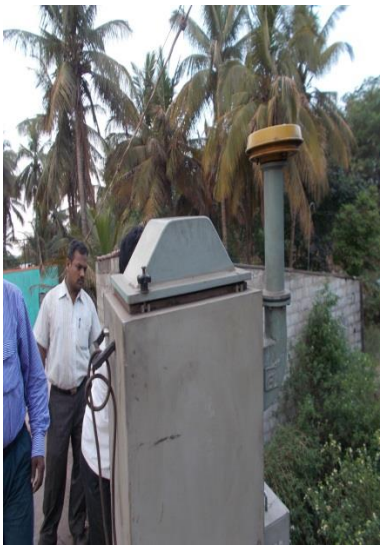




Sinter Plant -1 where Iron Oxide was utilised as supplementary raw material

Source emission monitoring at stack attached t Sinter plant -1





Ambient Air Quality Monitoring at 3 Stations during trail run