Parivesh
A Newsletter from Central Pollution Control Board

Technologies for Pollution Control Industry

MINING INDUSTRIES

Aluminium Industry

The manufacture of aluminium involves two important stages (i) refining bauxite to aluminium oxide (alumina) by the Bayer process and (ii) reducing alumina in Hall-Heroult electrolytic cells to the aluminium metal.

In Bayer process the bauxite material is crushed and digested in a heated caustic solution. The solution is then filtered to remove insoluble residue (red mud) and the pregnant liquor is cooled so that precipitation of aluminium oxide occurs. The precipitated material is removed from the process stream by filtration and calcined to produce aluminium oxide.

In the Hall-Heroult process, aluminium oxide is dissolved in an electrolytic bath composed mainly of cryolite, sodium aluminium fluoride and aluminium fluoride. The electrolytic cells consist of open steel vessels, that are lined with carbon. The carbon lining serves as the cathode for electrical conductance. Consumable carbon anodes (Soderberg or prebaked type) are used to provide a carbon source to react with the oxygen liberated in the electrolysis.

The major pollutants/wastes generated are (i) red mud (solid waste) from refining of bauxite; (ii) fluoride emission (air pollutant) and spent pot lining (solid waste) from electrolytic stage. The red mud is highly alkaline and hence needs special precaution while disposing to avoid pollution of surface as well ground water resources. The specific generation of red mud in our country is 1.16 – 1.4 T/T of alumina production. The total generation of red mud in India is about 2 million TPA.

The specific generation rate for spent pot lining in our country varies from 43 to 62 Kg per tonne of aluminium produced. The spent pot lining carbon portion contains 4-8% leachable fluoride as well 0.01-0.025% leachable cyanide, requiring handling and management as per Hazardous Wastes (Management & Handling) Rules, 1989.

The existing pollution control/waste management systems and the requirements are tabulated below :

Existing Management System	**Requirements**
Red Mud : a) Wet disposal : In this method, washed red mud slurry containing 10 – 30% solids is pumped to the pond.	Dry disposal in secured land fill, as dry disposal requires much less space (1/3 to 1/5 of Wet disposal) and less seepage is expected.

b) Dry disposal : In this method, the red mud disposed contains 30 – 50% moisture and also known as thickened tailing disposal	
Spent Pot Lining : a) Flouride recovery followed by use as fuel. b) Disposal in secured landfill to avoid leakage of fluoride and cyanide.	a) Fluoride recovery followed by reuse for carbon portion (Impact of such reuses need to be investigated). b) Disposal in secured landfill for refractory portion.
Fluoride emission : a) Dry scrubbing (using alumina): By this most of the fluoride is recycled into the system. b) Wet scrubbing. This causes water pollution. The treatment of water pollutants results in generation of solid waste (calcium fluoride).	Dry scrubbing, as this helps in recycling fluoride and also there is no water pollution.

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Steel Industry

Iron and Steel is one of the largest sectors of industries in India. Though the production of steel is vital for the economic growth but its production is a major source of pollution. The production of steel causes water, air and noise pollution and generation of solid wastes including hazardous waste. The main units of steel industry causing pollution are coke oven and by-product plant, steel melting shop, sintering plant, blast furnace, refractory material plant and captive thermal power plant.

The existing pollution control systems and the needs are tabulated below:

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Coke Oven by-product Plant

Technologies/Current Practices	Requirements
Coke Oven In coke ovens the volatile materials released during cooking flows from the oven to the by-product plants where ammonia, benzol, xylene, toluene, tar, pitch and tar acids are recovered. The operations are associated with fugitive and stack emissions. The PAH compounds released during cooking operation as fugitive emissions are carcinogenic in nature. The technologies available to control the pollution are - HPLA system - Hydraulic door and door frame cleaner - Doors with double knife edge and rope sealing - Water sealed AP caps - Screw feeder	- Land based pushing and charging emission control with dust extraction system - Automation for process operations - Self sealing air cooled doors - Possibility of coke dry quenching needs to be tried out • Effluent treatment plant to treat cyanide, phenol, ammonia, COD etc. - Hazardous waste (tar sludge and ETP sludge) handling and disposal following Hazardous Waste Handling, Rules; or, tar sludge / ETP sludge charging alongwith the coal fines in the coke ovens
Sintering Plant - ESP / bag filter / wet scrubber for process emissions - ESP / bag filter / wet scrubber for work zone environment	- ESP / bag filters with higher efficiency of removal for process emissions.
Thermal Power Plant - ESP for the emissions	- Proper management and utilisation of fly ash
Steel Melting Shop - ESP/ bag filter wet scrubber for the process emissions	- Proper operation and maintenance of air emission control and effluent treatment systems.

- Effluent treatment comprising settling unit and re-circulation system for the treated effluent	
Blast Furnace - ESP / bag filter / wet scrubber for air emissions	- Proper operation and maintenance of ESP / bag filter / wet scrubber for air emissions - BF slag utilisation
Lime / dolomite plant - ESP bag filter / multiclones for process and work zone dust emissions	- Effective operation and maintenance of ESP / bag filter / multiclones for process and work zone dust emissions
Mills - Oil & Grease traps and settling tanks for waste water treatment	- API separators and settling tanks for wastewater treatment
Raw material handling units - Enclosures and water sprinkling system	- Improvements in the systems for controlling fugitive emissions.

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Cement Plant

The Cement plants can be classified into three categories i.e. Wet process kiln , semi-dry process kiln and dry process kiln. Cement industry contributes air pollution mainly in the form of particulate matter. The major sources of dust generation in the cement plants are : limestone crusher, raw mill, kiln, clinker cooler, coal mill, cement mill and packing plant.

The existing pollution control systems and the requirements are tabulated as follows:

Technologies/Current Practices	**Requirements**
Out of the three processes, wet process kiln is the most energy intensive. Most of the cements have switched over to dry process.	Wet process kilns be converted to dry process kilns.
Multi-cyclones/ESPs/Bag filters to control particulate matter generated from various sections of the cement industry.	Recommended dust collectors for different sections are : Lime Stone Crusher - Bag Filter

	Raw Mill - Bag filter/ESP Kiln - Bag Filter/ESP Clinker Cooler - ESP/Bag filter with heat exchanger Coal Mill - Bag Filter/ESP Cement Mill - Bag Filter/ESP Packing Plant - Bag Filter

The Cement industry has potential to utilise the industrial solid waste like flyash and slag as a raw material to produce flyash pozzolana cement, & slag cement. On the one hand, this technology of reuse of waste material will conserve natural resources of limestone and on the other hand it will solve the problem associated with disposal of waste material. It is to be borne in mind that quality-wise flyash pozzolana cement and slag cement is as good as ordinary Portland cement. Use of flyash, slag and other compatible waste material should be encouraged for utilisation in cement manufacturing.

The dust collected in pollution control devices is a valuable material. The pay back period of ESP and fabric filter for a 3000 TPD cement plant is 10 and 13 months respectively.

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