GREEN FOR LIFE
environmental

PROJECT DESCRIPTION

Electric Arc Furnace Dust Recycling Facility

Purpose
GFL Environmental proposes to install High Temperature Metal Recovery (HTMR) Electric Arc Furnace Dust (EAFD) recycling technology at the Brant Street Facility (227-237 Brant Street, Hamilton, Ontario), with approval to receive, store and recycle Ontario waste class 143 (residues from steel making) solid hazardous waste.

This project addresses a current need in southern Ontario, by providing steel mills with a new local Canadian alternative to recycle one of their largest (generated 24 hours a day, 7 days a week) waste streams. The goal is to recover valuable resources from the waste, prepare those resources for reuse, and significantly reduce landfilling (thus curtailing contaminated leachate and extending the lifespans of landfills) and eliminate long hauling of hazardous waste over the border. The Brant Street Facility is ideally located to manage this waste stream, as it is in close proximity to major steel mills. It offers a local solution to regularly practiced long distance hauling of this waste stream into the United States (which will reduce CO2 emissions and reduce steel mill environmental risk). It also reduces reliance on waste disposal sites and waste management services outside of Canada, and lessons energy/water consumption and environmental burden associated with mining virgin raw material for zinc production (*i.e.*, zinc ore).

Steel scrap contains a significant portion of zinc-galvanized steel. Zinc, during the processing of steel scrap, is evaporated with other impurities and collected in the form of EAFD. Due to the nature of EAFD, steel producers generally arrange to have it disposed or transport it outside of Canada to be recycled. This project intends to change that practice by introducing a more environmentally conscious (*i.e.*, cradle-to-cradle) and local Canadian cost-effective option. The HTMR technology will separate zinc and lead from EAFD generated by steel mills in order to prepare it for beneficial reuse.

Project Details
EAFD will be delivered to the Brant Street Facility from steel mills in bulk. All waste storage and processing at the site will occur indoors. The proposed project technology includes a pelletizer and dust control system, thermo-process for extraction of zinc using a rotary furnace, hydrometallurgical process for refining zinc using processing tanks and reactors, filter-presses, product and by-product storage, water osmosis for wastewater treatment and reuse, and air control systems. More detail about this technology and its processes is provided below.

EAFD is conveyed into an air-sealed hopper from bulk storage (*i.e.*, silo). Pre-mixed additives are discharged into a second air-sealed hopper. The mixture of the EAFD and additives homogenize in an auger, which is then charged into a pelletizing drum via screw conveyor. Water is sprayed into the pelletizing drum to bind the loose particulate material. The rotary action of the pelletizing drum agglomerates the wet loose material into round pellets. The pelletizer has a maximum solid feed rate of 2,000 kg/hour.

The wet pellets are loaded into another hopper, from which they are fed into the pellet dryer to reduce water content. Dried pellets are transferred to the rotary furnace through an enclosed conveyor. The heat for the pellet dryer is supplied from the HTMR furnace to provide heat to evaporate water. The gas stream discharged from the pellet dryer is directed to a central air control system.

The HTMR reactor is a rotary furnace. The process is a countercurrent system, where dried pellets flow in the opposite direction of the hot process gas. The dried pellets are charged into the rotary furnace at one end, while process gas injection ports are located at the other end. The process gases, which become saturated with evaporated/volatilized metals and metal oxides, flow towards the opposite end of the rotary tube.

The pellets are exposed to high temperatures. Processing temperature, retention time, gas velocity, and processing environment are continuously controlled. Volatilization of metals from the pellets cause desirable separation of zinc and other volatile metals from iron and other non-volatile metals. The volatilized metal are subsequently re-oxidized to metal oxides and alkali metal salts that exit from the rotary tube into the gas cooler.

Residual non-volatile material (*i.e.*, slag or iron/calcium pellets) is generated. The slag is cooled in the rotary tube and exits into a hopper, which discharges into a designated storage area. There, the slag is stored and prepared for shipment off-site for further reuse or disposal.

The exiting hot process gas from the rotary furnace, which is saturated with zinc vapours, is cooled using a heat exchanger. This cooling process precipitates evaporated metals by reducing the temperature of the process gas (the reduced temperature permits precipitation of solid particles and collection of solids in the baghouse dust collector). The heat exchanger also serves as a dropout chamber for precipitated particulates contained in the gas stream.

The cooled gas stream from the heat exchanger enters the zinc collector system (*i.e.*, baghouse dust collector). Particulate matter, including zinc and other metal oxides and alkali metal halides, is filtered out and collected in the dust collector. The filtered air stream from the zinc baghouse dust collector, and the combustion gas stream from the HTMR burners, are mixed in a heat-recuperating vessel and sent to the mixing chamber where the temperature of the gas stream is regulated.

A central air control system is designed to control (has a manufacturer's guarantee of 99% removal efficiency of particulate matter) emissions from the entire HTMR process.

Human Machine Interface (HMI) software collects important parameters of the process and presents the information to Operations Staff. The system has two operator interface terminals, one in the building where the processing equipment is housed and another in the administrative building. The HTMR process is continuous with all parameters operating at steady state levels. In a case of parameter deviation, alarms are initiated to advise Operations Staff of a change in process status. The HMI program communicates with PLC and all critical equipment.

The zinc concentrate collected by the zinc dust collector includes metallic zinc, metal oxides and alkali metal hydrides. The zinc concentrates collected by the process gas cooler and baghouse dust collector are transferred to the zinc purification system to separate the impurities from the zinc and zinc oxide. Due to its insolubility in water, zinc and zinc oxide particles will settle in a refining tank while the soluble compounds (such as salts) will remain in the tank bath. Zinc oxide slurry from the tank is removed by filtration after washing the filter cake. Wet zinc filter cake from the zinc purification system is transferred to the zinc dryer. The dried zinc product is cooled down in the receiving hopper and transferred for future shipment to metal refining companies or other end users. The wastewater generated from zinc washing is purified via water osmosis system and reused.

Expectations

Using this recycling technology, a high recovery efficiency of zinc and lead can be achieved with very low iron content in the produced zinc concentrate and very low residual zinc and lead content in the produced iron pellets. Zinc concentrate will be sold on the market to zinc refineries for reuse. The residual iron/calcium pellets will be reused in cement production or as a filler. Furthermore, energy from the recycling process will be recovered and used to heat the building.