ENVIRONMENTAL PROTECTION AGENCY

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Reply to Attn of:

Subject: Sintering & Blast Furn. SO_2 Factors; Blast & Reverb. Furn. Part. "

Date: 21 OCT 1971

PRIMARY LEAD SMELTING 12.6
AP-42 Section 7.6
Reference Number #5

To: Acting Chief, Chemical and Combustion Section

I. Purpose:

To obtain information on the operation of lead smelters and determine the emission control technology used. The smelter was also evaluated to determine the possibility of testing to obtain data for setting standards of performance for new stationary sources under the Clean Air Act of 1970.

II. Place and Date:

St. Joe Minerals Corporation lead smelter at Herculaneum, Missouri on August 26, 1971.

III. Attendees:

1. St Joe Minerals Corporation

   J. W. Sherman, Division Manager

2. Office of Air Programs, EPA

   a. H. B. Coughlin, Acting Chief, CCS, SCB
   b. R. T. Jacobs, Jr., Chemical Engineer, SCB

IV. Discussion:

1. Plant Location:

The plant is located in the town of Herculaneum, Missouri. That part of the country contains many trees and those near the smelter appeared to be in the same good condition as trees at a distance. However, the grass near the smelter was sparse and partially brown.

2. General Topics of Discussion:

The setting of performance standards for new stationary sources under the Clean Air Act of 1970 was discussed. Also discussed was the Requirements for Preparation, Adoption, and Submittal of Implementation Plans for states.

3. Process Descirption:

a. The smelter was built in 1890 and is presently the largest lead smelter in the United States with a design capacity of 225,000 tons lead per year from 360,000 tons concentrate per year. They are operating at capacity. The concentrates all come from company owned mines and have an average analysis of 70-72 percent lead, 15-16 percent sulfur.

b. The smelter operation consists of a sintering machine, three blast furnaces (two running and one on standby), two drossing furnaces, and drossing, decopperizing, desilverizing, dezincing, refining, kettles. There is also a silver refinery with retort furnace and cupel. There is control of particulates from the sintering machine and blast and drossing furnaces and control of some sulfur emissions from the sintering machine. There is no control of particulates or sulfur emissions from the rest of the smelter.

c. The sintering machine is of the updraft one pass design with a production rate of 960 tons sinter (45 percent lead) per day. There are two gas streams taken from the machine. The strong gas stream, 30,000 SCFM at 300°F with 5-5 1/2 percent SO_2 but can vary to 3 1/2-7 percent SO_2, is sent to a precleaning system and then to an acid plant for recovery of SO_2. The weak gas stream, 160,000 SCFM with SO_2 concentration unknown but low, is combined with blast furnace and dross furnace gases and sent to a baghouse for removal of particulates before being vented to the atmosphere. About once per week, the machine is shut down for maintenance on the machine and its associated equipment. During startup the acid plant is bypassed for a couple of hours until it is producing a gas stream which can be fed to the acid plant.

d. Each blast furnace has a production rate of 300 tons per day. They are charged periodically charged (with generation of large quantities of dust and smoke into the air) with bullion and slag being removed continuously. The slag, containing 2 percent lead, is granulated with 3/4 being recycled to sintering and the rest being dumped. The undiluted gas from the furnace is calculated at 2-3,000 ppm SO_2 but it has never been measured.

e. The drossing, decopperizing, desilverizing, dezincing, refining kettles and silver refinery have no emission control devices on them. All are located in a large open building.

4. Control of Emissions:

a. Two control systems are used at this smelter. In one the weak gas stream from sintering and the blast and dross furnace gases are combined and treated for particulate removal by two baghouses in parallel. The weak sintering gases have a low dew point and are not flammable while the blast furnace gases have a high dew point and are flammable. By mixing these gases beofre treatment, the possibility of a fire or explosion is reduced and condensation of the sintering gases is prevented. [The other control system is for the strong SO_2 gas stream from sintering. This gas is cleaned to remove particulates and sent to an acid plant for removal of SO_2 as sulfuric acid.]

b. [The blast furnace gases (190,000 SCFM), dross furnace gases, and weak sintering gas (160,000 SCFM) are combined and sent to two Wheelabrator suction type baghouses of 99.4 percent efficiency in parallel which collect about 1800 tons of material per month.] Each baghouse contain 12 compartments with orlon bags. The inlet temperature is controlled at 180-200°F by adding air as required. [The inlet gas contains 1.5 grains/SCF of particulates and to total emission to the atmosphere is about 600-1,000 pound per day.] One baghouse (#2) contains 5 inch diameter by 10 foot bags with an area of 65,100 square feet. The inlet gas rate is 136,000 ACFM (air to cloth ratio of 2.1 or 2.3 ACFM/square feet with one compartment being cleaned). The other baghouse (#3) contains 8 inch by 22 foot bags with an area of 202,752 square feet. The inlet gas rate is 350,000 ACFM(air to cloth ratio of 1.7 or 1.9 ACFM/square feet with one compartment being cleaned). [The gases from the baghouses are joined with the acid plant tail gas and all are exhausted through a 350 foot concrete stack of 20 foot diameter.] When we were there, the acid plant was not in operation so the stack gas contained about 3300-6500 ppm SO_2 and had an opacity of 30 percent.

c. A new baghouse is planned for this smelter in 1973. When it is completed, the two present ones will be used for the weak sintering gas and drossing furnace gases. The new baghouse will be used for the blast furnaces. The operating pressure in the blast furnaces will be reduced from -0.6 to -2.0 inches water and this should eliminate the loss of dust and smoke which now occurs when the furnaces are charged.

d. [The strong SO_2 gas from the sintering machine is precleaned to remove particulates before going to the acid plant. The 300°F gas from sintering first goes to a water spray chamber; however, no water is added here and it is used only as a settling chamber. When water was used a mud was formed which caused operating problems so that method of pretreatment was eliminated. The gases then go to a Wheelabrator six compartment suction type baghouse with orlon bags having a total area of 42,240 square feet. The inlet gas rate is 46,000 ACFM (air to cloth ratio of 1.1 or 1.3 ACFM/square feet with one compartment being cleaned). The gas from the baghouse goes to a scrubber. The weak acid from the scrubber is sent to an SO_2 stripper, then to a lime pit for neutralization, and then is sent to the river. The gas from the scrubber is sent to two electrostatic precipitators in parallel.] The ESPs were made by Western Precipitator and are of the pipe type. Each one has 132 lead pipes of ten inch diameter by 15 foot for a collection area of square feet. The gas inlet each ESP is about 90°F (15,000 ACFM for a ratio of 350 square feet/1000 ACFM).

e. [The acid plant is of the Chemico design and contains a Chemico type mist eliminator. It was built in 1969 and is a single absorption plant with a design capacity of 300 tons per day with a six percent inlet SO_2 concentration. It makes 93 percent acid and has a tail gas SO_2 concentration of 1,500-2,500 ppm.] The inlet gas rate and concentration are controlled by variable fans on both the strong and weak gas streams from sintering, however, the acid plant feed gas can sometimes vary in both rate and strength. [The tail gas is joined with other plant gases and all are vented through a common stack.] While we were there, the acid plant was down for maintenance of equipment that had been demaged by corrosion.

f. Trace element emissions from the smelter have not been measured. However, it is felt by the plant personnel that these emissions would be low. The only element of which they are aware is arsenic and based upon the inlet feed concentration the emissions of this element would be about 35 tons per year.

5. Feasibility of Testing:

a. During the plant visit a visual survey was made of the plant ductwork and stacks. A meeting was held with Mr. J. Rom the Project Officer for non-ferrous smelters, Chemical and Metallurgical Section, Emissions Testing Branch to determine the possibility of conducting emission tests in the smelter.

b. Acid plant inlet gas, between the ESP and drying tower, can be tested with valid results being obtained. There is a 45 foot straight, horizontal run of 4 foot diameter fiberglass ductwork. There are presently no ports in this ductwork.

c. Acid plant tail gas is joined with other plant gases and exits through the main stack. However, there is a 20 foot straight, horizontal run of six foot diameter insulated ductwork carrying the tail gas which could be tested with valid results being obtained. There are presently no ports in this ductwork.

d. The plant gases from the main baghouses, blast furnace, dross furnace, and weak sintering gas, should not be tested in the ductwork between the baghouse and stack but could be tested in the stack (which also contains acid plant tail gas) with valid results being obtained. The concrete stack has no sampling ports but they could probably be installed if the company agrees.

V. Conclusions and Recommendations:

a. Both the inlet and tail gases of the acid plant can and should be tested to determine the inlet SO_2 and outlet SO_2, acid mist, and particulate emissions from a metallurgical acid plant.

b. The plant gases from the main baghouses and in the main stack can be tested. Since it contains gases from many sources and the particulate emissions from each source could not be determined we may not wish to test this stack. However, since many lead smelters use this configuration a test to determine the emissions from such a configuration may be desirable.

Pollution Control