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P.O. Box 2000
Mulberry, FL 33860
www.mosaicco.com
Tel 863-428-2500

Certified Mail 7003 1010 0004 7147 4102
Return Receipt Requested

March 8, 2005

RECEIVED
MAR 15 2005
BUREAU OF AIR REGULATION

Mr. Robert Bull
Bureau of Air Regulation
Florida Department of Environmental Protection
Twin Towers Office Building - MS 5505
2600 Blair Stone Road
Tallahassee, FL 32399-2400

Re: Arcadis Testing Proposal for HF Emissions From Process Water Cooling Pond – South Pierce

Dear Mr. Bull:

Enclosed you will find a copy of a proposed testing plan for measuring HF emissions from the process water cooling pond at the Mosaic South Pierce plant.

Once you have had an opportunity to review this plan we can discuss it at your convenience.

Thank you.

Sincerely,

P. A. Steadham
Environmental Services
Florida Concentrates

PAS:jp\SP-Bull_Arcadis_030805
enclosure

cc: D. B. Jellerson
J. A. Golwitzer
C. D. Turley
J. B. Upton
G. J. Kissel – Tampa FDEP
R. Hashmonay – Arcadis – w/o enclosure

DETERMINATION OF HF FLUXES FROM THE COOLING POND AT SOUTH PIERCE GYPSUM STACK USING OPTICAL REMOTE SENSING

WORK DESCRIPTION

MARCH 2005

ARCADIS

Infrastructure, buildings, environment, communications

ARCADIS

Determination of HF Fluxes from the Cooling Pond at South Pierce Gypsum Stack Using Optical Remote Sensing

Introduction

ARCADIS is pleased to propose air monitoring services to Mosaic Phosphate Company to make measurement-based determinations of the emission flux of HF from cooling ponds using our patented Optical Remote Sensing--Radial Plume Mapping (ORS-RPM) method. This proposal covers one five-day sampling effort, potentially scheduled for the April timeframe. Our proposal is for measurements to obtain an average emission flux from the entire cooling pond. The emission flux will be converted to an emission rate for HF in lbs/acre for the entire cooling pond system (the blue area in Figure 1), including any contribution from the Stack ponds. On each day of the five-day period, the weather forecast will be noted to determine which measurement configuration will be optimum under the given wind conditions for the purpose of determining the emission rates for hydrogen fluoride at different segments of the pond.

With favorable weather, we expect the five-day monitoring period to be sufficient to obtain a reliable estimate of the total emission rate from the entire cooling pond that surrounds the gypsum stack at the South Pierce facility. Contingencies due to unfavorable weather may require several extra days of monitoring.

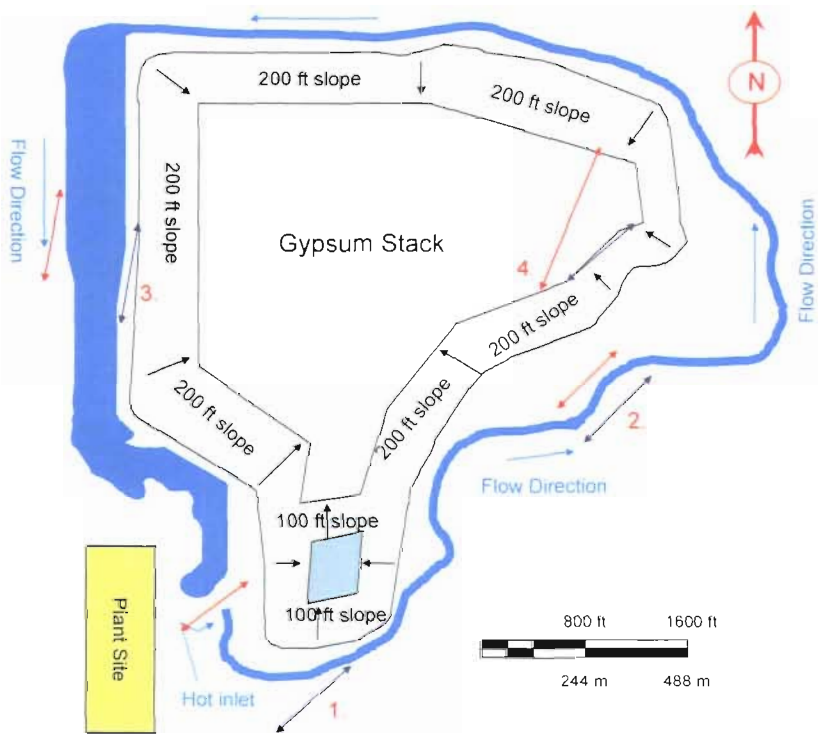

Figure 1:
Map of the Mosaic Phosphate Company's Gypsum Stack and Cooling Pond Facilities, South Pierce Plant, Polk County, Florida. Four monitoring locations, suitable for southeast wind direction, are depicted here (red numbers 1 to 4), using a red double-headed arrow to indicate the approximate position of the downwind scanning OP-FTIR and the blue arrow depict the approximate position of the upwind OP-FTIR.

The Method

Two OP-FTIR sensors will be set up along the shore, on opposite sides of the cooling–pond segment, at three different locations along its length. One of the sensors will be used to determine the HF concentrations upwind of the cooling-pond segment and the other will be used to determine the downwind flux at the shore line. The OP-FTIRs transmit their infrared beams to corner-cube retroreflector arrays that return the beams back to the sensors. Thus the sensors receive an infrared beam that has traversed the HF plume twice. This in effect doubles the signal level, improving the detection sensitivity and the measurement precision.

A weather station will set up near the OP-FTIR beams to make wind speed and direction measurements that are simultaneous to the HF measurements. A measurement-based determination of the flux of hydrogen fluoride emitted from the cooling pond will be made using the Radial Plume Mapping (RPM) method. The exact location and configuration at the three monitoring sites along the pond will be determined by the wind direction at the time of the measurement. Figure 1 shows an example of the configurations that may be used for a south-east wind. The measurement will be made at the inlet, under any wind direction, however the locations of at the southeast corner and near the end (west or northwest corner) will be optimized for the particular wind direction at the time. In addition, a fourth measurement site will be located on the gypsum stack to determine the flux from the cooler ponds that reside there.

At each of these locations, the OP-FTIR on the downwind side of the pond (red double-headed arrows in Figure 1) will scan its infrared beam to two different retroreflectors. One retroreflector, designated as the ground-level retro, is set up at ground level (~1-meter elevation) and the second retroreflector, designated as the elevated-level retro, is setup on a scissor jack at an elevation between 10 and 17 meters. A schematic of this setup is shown in Figure 2. The downwind OP-FTIR measures path-integrated concentrations of HF along two path segments that lie in a vertical plane. Ground-level concentrations of HF are determined from the lower beam and the vertical gradient of HF is determined from the elevated beam. The second OP-FTIR is setup to measure along a single beam path to determine upwind contributions to the HF Flux.

The path-integrated concentrations from the two beam paths are input to an optimization algorithm that maps the concentrations on the vertical plane. The emission flux through the measurement plane is determined

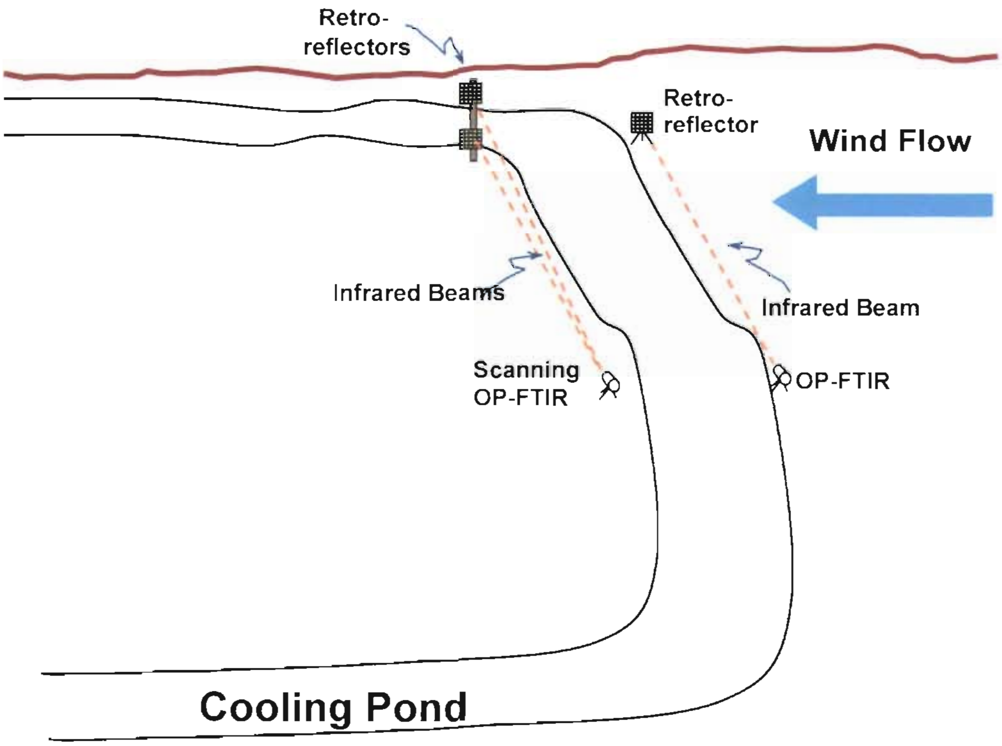

Figure 2: Configuration of Radial Plume Mapping with OP-FTIR along Shores of Cooling Pond. The two-beam system is set up on the downwind shore of the pond and the single-beam system is setup on the upwind shore. This configuration determines the HF flux from the area in between the beams from the two OP-FTIR systems.

from the determined area-integrated concentrations times the wind speed component normal to the plane. This method has been validated in controlled-release studies, sponsored by USEPA,[1] DOD and DOE. EPA has developed a draft protocol that is presently under peer review. Upon completion of the review the protocol will become an EPA approved conditional method for measuring emissions from area sources.

The flux determinations will be made at three locations along the cooling pond. In the example in Figure 1 for a consistent southeast wind, the three locations are depicted by the red numbers, at the cooling pond inlet (1), ~ 1500 meters downstream from the inlet (2), and at the final segment of the pond (3), ~ 900 meters from the end. The total flux from the pond will be determined by interpolation between these three points and an extrapolation from point 3 to the end. The emission rate, Q, is determined by integrating the interpolated emission flux multiplied

[1] Modrak, M.T., R.A. Hashmonay, and R. Kagann, Measurement of Fugitive Emissions at a Region I Landfill, USEPA Research and Development EPA-600/R-04-001, Contract No. 68-C99-201, Work Assignment No. 4-003, January 2004.

by the pond width, $W(x)$ along the length, x, of the pond,

$$Q = \int Flux(x)W(x)dx.$$

In practice this calculation can be performed by dividing the pond into segments and multiplying the area of each segment by the emission flux interpolated to the distance of the given segment from the source (or distance from points 2 or 3), and then adding the Qs calculated for all of the segments.

The emission flux by the cooler ponds on the gypsum stack will be determined from a single measurement that is depicted at location 4 in Figure 1. If access on the divider dikes is possible, a more optimum configuration may be possible. The concept used here is referred to as a "virtual flux box" in which flux is determined from the segment of the pond that is between the upwind beam (blue double-headed arrow in Figure 1) and the downwind beam (red arrow). This determination is made by subtracting the upwind contribution from the total flux that is determined by the downwind, two-beam OP-FTIR. The flux determined in this segment then can be applied to the entire acreage of the stack ponds to determine the total emission rate from the stack pond. This value added to the emission rate from the cooling pond will be the total emission rate for the South Pierce stack site. This calculation could be refined by adding more monitoring points, but that would require a monitoring effort longer than one week.

MEASUREMENT CONFIGURATIONS AND WIND DIRECTION

The measurement configuration that will be used on any given day will be chosen in the morning after obtaining a detailed briefing from an ARCADIS meteorologist. The information necessary for choosing the configuration will be the predicted range of wind speed and direction for the morning and for the afternoon. From this information, the measurement configuration will be chosen that is most appropriate for the expected general wind direction.

THE CHEMICAL ANALYSIS

Open-Path FTIR

The OP-FTIR measurements and spectroscopic analysis will follow the procedures in the USEPA Compendium Method TO-16.[2]

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[2] U.S. Environmental Protection Agency, *Compendium Method TO-16: Long-Path Open-Path Fourier Transform Infrared Monitoring of Atmospheric Gases,* Center for Environmental Research Information-Office of Research and Development, US

The raw data are interferograms that are converted to absorbance spectra in which chemicals that passed through the infrared beam leave absorption bands in which the absorbance intensities follow a linear relationship to the concentration-pathlength product. These bands have intricate structure and shapes that are unique to each of the absorbing molecular species. The qualitative analysis is performed by a multi-variant regression program that fits the shape of the bands in the measured spectra to the shapes of reference spectra for both hydrogen fluoride and water vapor.

The reference spectra are used as a quantitative calibration set; the chemical concentration for each reference was measured and recorded. The path-integrated concentration is obtained from the least-squares-fitting parameter for HF. The detection limits are determined for each measurement the standard error of the fit, propagated to the concentration determination. In cases of non-detects, the measurement-based determination of the detection limit provides an upper limit to the path-integrated concentration.

EPA, Cincinnati, Ohio, Jan. 1999, EPA/625/R-96/010b.

The calibration of the spectral reference for HF will be checked against HF Spectral Reference in the Pacific Northwest National Laboratory Library.

QUALITY ASSURANCE PROCEDURES

The Open-path FTIR and all other field measurement equipment will be subjected to quality assurance procedures specified in the *ECPB Optical Remote Sensing Facility Manual*[3]. We will follow both, pre-deployment and in-the-field procedures and the QA test results will be included in the final report.

FINAL REPORT

All of the results will be detailed and summarized in a report. The hydrogen fluoride measurements will be tabulated with the general wind direction. Each one-minute average determination will listed along with the standard error of the regression fit to the reference HF spectrum. In the measurements in which HF is not detected, the detection limit, determined from the standard error, will be recorded as the upper limit to the HF concentration. The report will

[3] ECPB (Emission Characterization Prevention Branch) Optical Remote Sensing Facility Manual, Prepared for the US EPA NRMRL Revision 1 April 2004

include a table with all the determinations of the emission rate of HF along with the wind direction and wind speed.

An error analysis will also be included in the report. The analysis will include all possible sources of systematic and random error propagated to the chemical measurements and to the emission rate determinations.

The average emission rate in pounds/acre and an estimate of the yearly emission rate in tons/year will be presented in the report based on the temporally resolved emission rate measurement from the cooling pond.

ATTACHMENT 1

SUPPLEMENTAL AND UPDATED INFORMATION
SOUTH PIERCE PLANT

Facility-wide Items

1. Please include a provision allowing for 5 percent downtime for monitors and recording equipment due to maintenance, calibration or malfunction, as allowed under certain NSPS.

2. Please note that a total of the daily records may differ somewhat from the annual totals due to inventory adjustments. IMC relies on the daily records for the purposes of annual reports.

3. Please include a provision that would allow equivalency of the methods for recording monitoring parameters such as strip charts, manual records, electronically logged manual reading, electronic records, and electronically filtered records.

4. The procedure, for revision of emission control equipment operating parameter ranges, should be clarified to allow the testing, reporting and implementing of off-permit changes for indicator ranges established for MACT, CAM and emission units under the current facility-wide Condition No. 14. Suggested wording is as follows:

An excursion would occur in case of emission control equipment operating $\pm$ 20 percent of the baseline established value of the daily average of the indicator range determined during annual compliance testing. If an excursion occurs, corrective action will be initiated, including an evaluation of what corrective action is appropriate. The excursion would not be considered a violation if compliance testing is conducted within 30 days to demonstrate compliant operations within the updated indicator range (with due 15-day prior written, including email, notice to FDEP).

Emission Unit-Specific Items (grouped by topic)

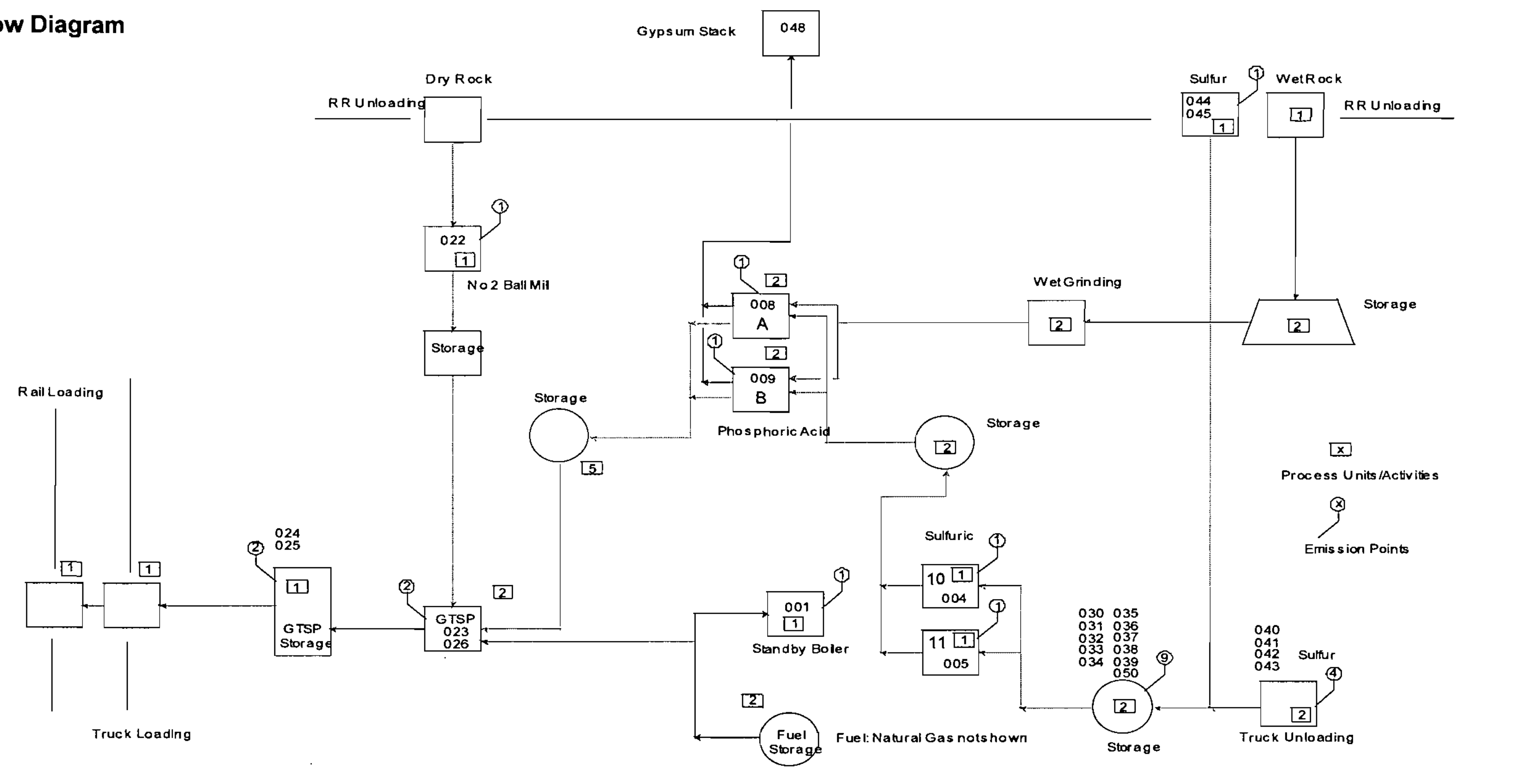
5. EU 004 and EU 005:

Specific Conditions C10 and C16: The required calculations for the sulfuric acid plants should allow equivalent methods (Reich test) used for determining the SO2 strength. Equivalent methods of monitoring and reporting should be allowed in the permit. For example, approval of a procedure for electronic calculation of the lb/ton conversion factor required for sulfuric plants that is part of an electronic report generated using programming or software.

6. Please delete the following units as they have been eliminated:

002 – West Loadout
003 – Purified MAP/DAP Plant
012 – Purified MAP/DAP Plant, Silo No. 3
013 – Purified MAP/DAP Plant, Bagging Machine
014 – Purified MAP/DAP Plant, Bulk Truck Loading
016 – Silicofluoride Plant Dryer
017 – Silicofluoride Plant Packaging
027 – Purified MAP/DAP Plant, Silo No. 2
028 – Purified MAP/DAP Plant, Silo No. 1
029 – Purified MAP/DAP Plant, Bulk Railcar Loading
034 – Vent 5, Molten Sulfur Tank 1
044 – Molten Sulfur Rail Pit, North Vent
045 – Molten Sulfur Rail Pit, South Vent
046 – MAP/DAP Filter Cake Dryer

Flow Diagram



Control Equipment Discription

This is the overall process flow diagram for South Pierce. The emission points and emission unit ID numbers are shown.

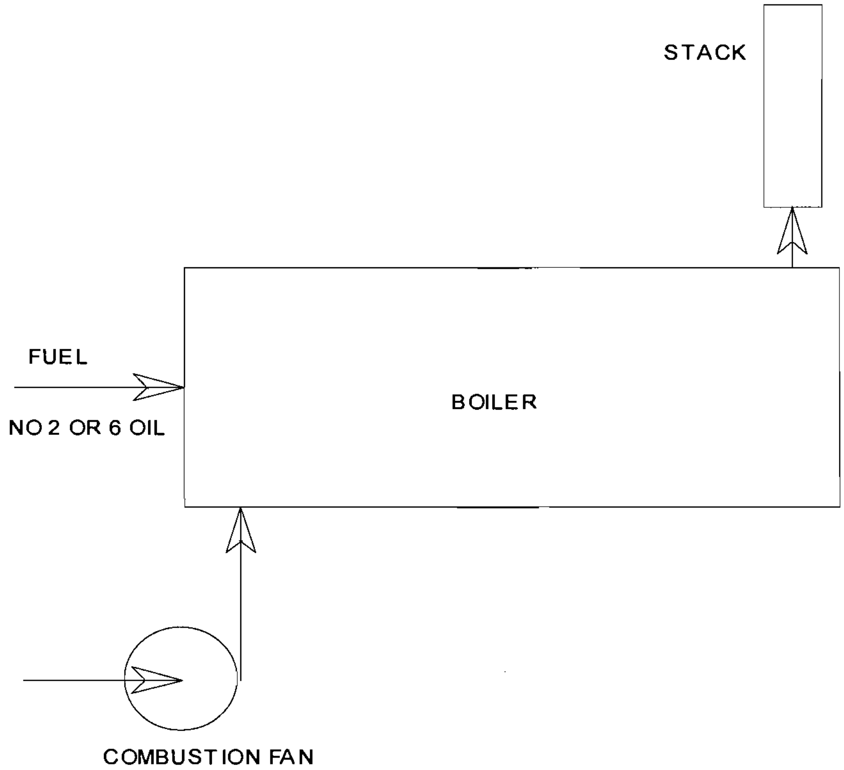
Emission Unit: **South Pierce**

ID No.: **all**

Facility: **IMC Phosphates South Pierce Plant**

ID No.: **1050055**

Flow Diagram



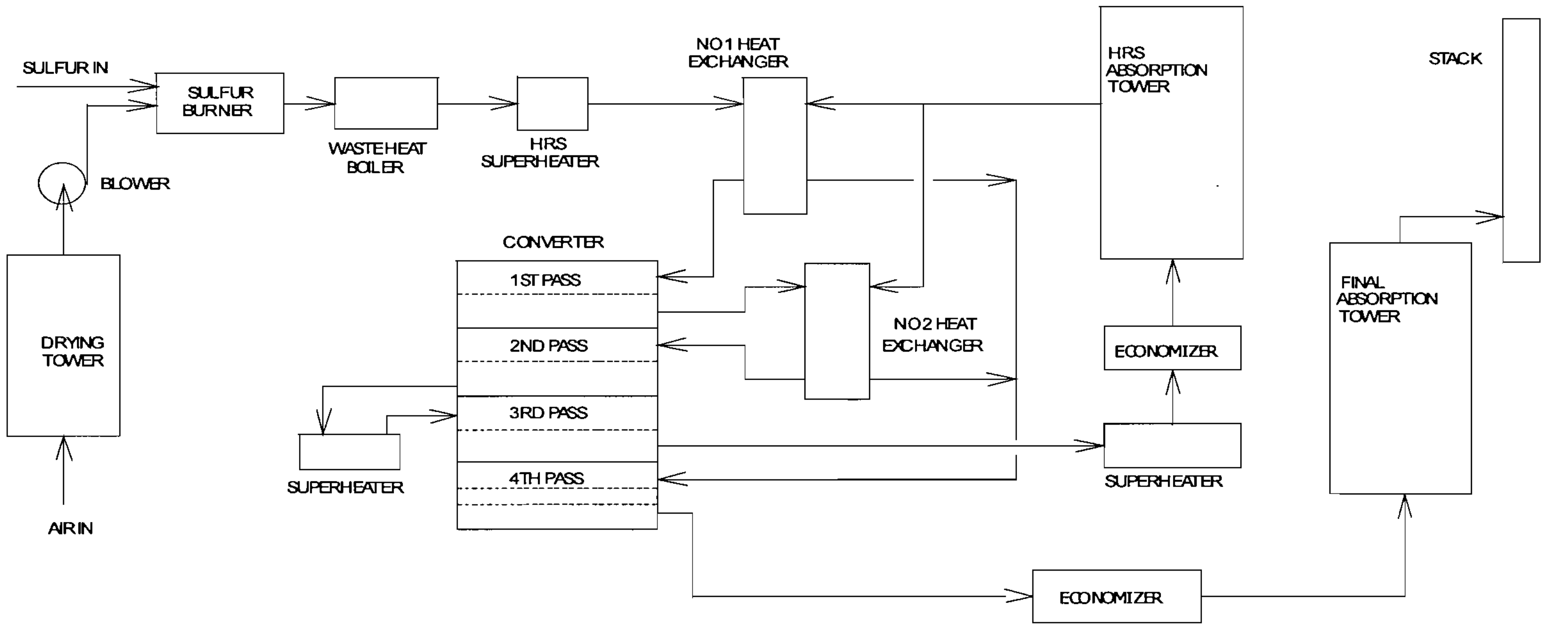
Control Equipment Discription

The boiler has no specific emission controls. The emissions are limited by the type of fuel oil consumed.

Emission Unit: **Auxiliary Boiler** ID No.: **001**

Facility: **IMC Phosphates South Pierce Plant** ID No.: **1050055**

Flow Diagram



Control Equipment Discription

The Sulfuric Acid Plant consists of a double absorption system. Acid Mist emissions are controlled by a demister.

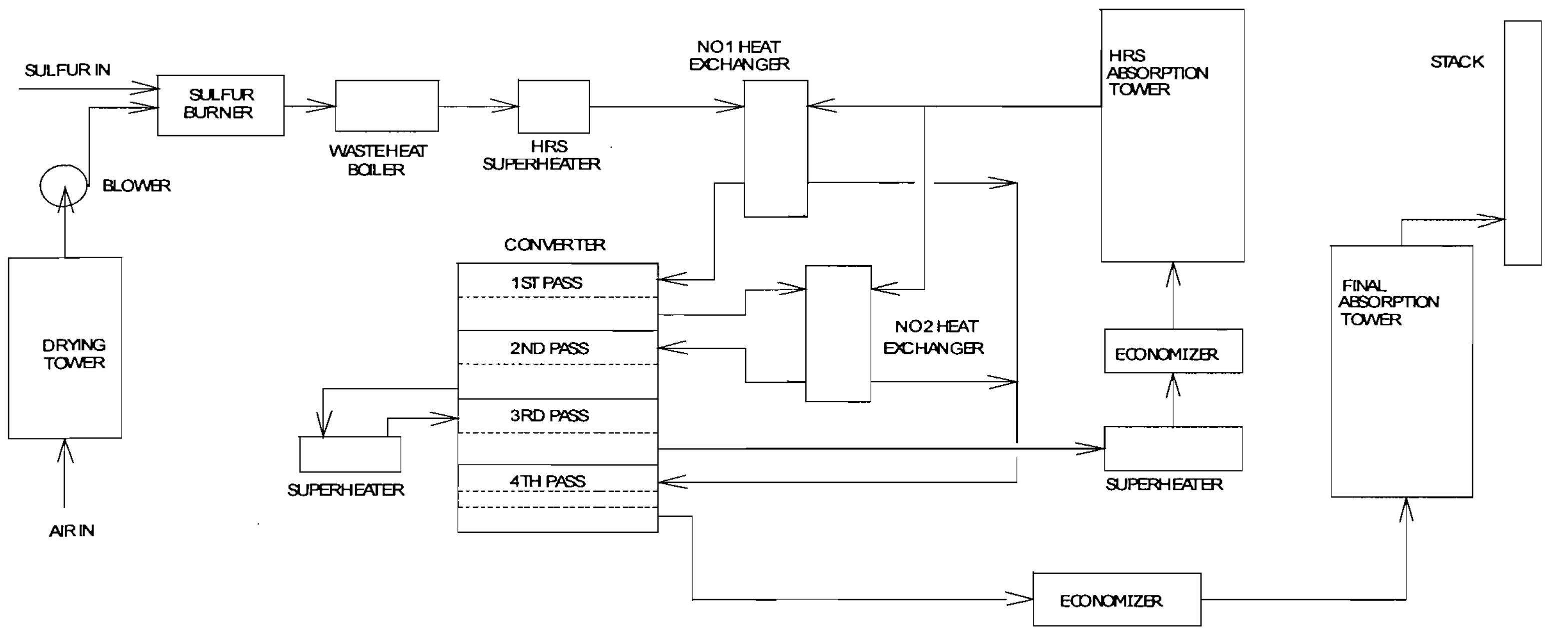
Emission Unit: **Sulfuric Acid Plant No. 10**

ID No.: **004**

Facility: **IMC Phosphates South Pierce Plant**

ID No.: **1050055**

Flow Diagram



Control Equipment Discription

The Sulfuric Acid Plant consists of a double absorption system. Acid Mist emissions are controlled by a demister.

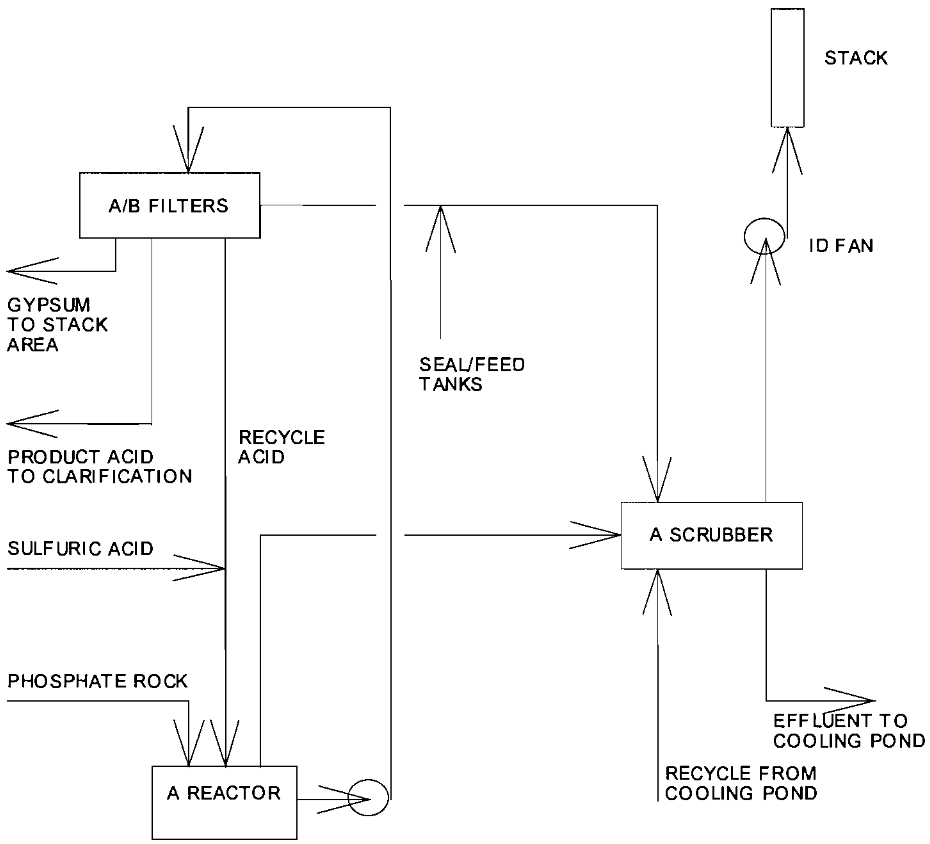
Emission Unit: **Sulfuric Acid Plant No. 11**

ID No.: **005**

Facility: **IMC Phosphates South Pierce Plant**

ID No.: **1050055**

Flow Diagram



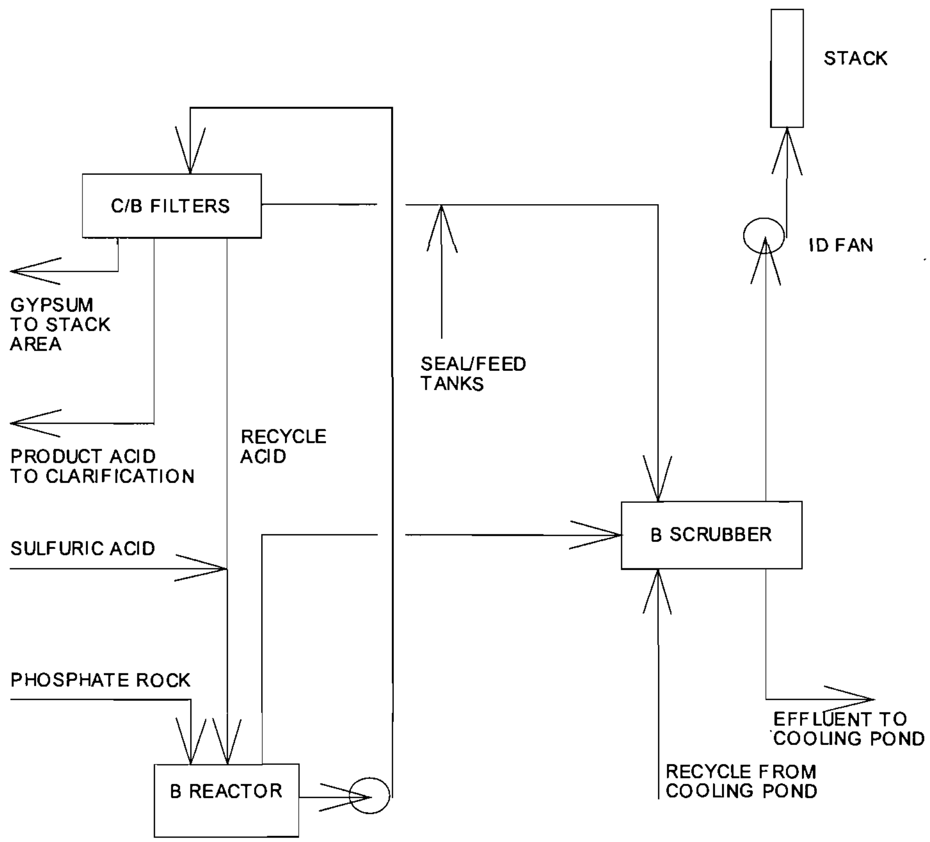
Control Equipment Discription

The emissions from the reactor, filter and seal tanks are controlled by a crossflow scrubber using process water. The scrubber contains Kimre Pads as its packing material.

Emission Unit: **Phosphoric Acid Plant - A Train** ID No.: **008**

Facility: **IMC Phosphates South Pierce Plant** ID No.: **1050055**

Flow Diagram

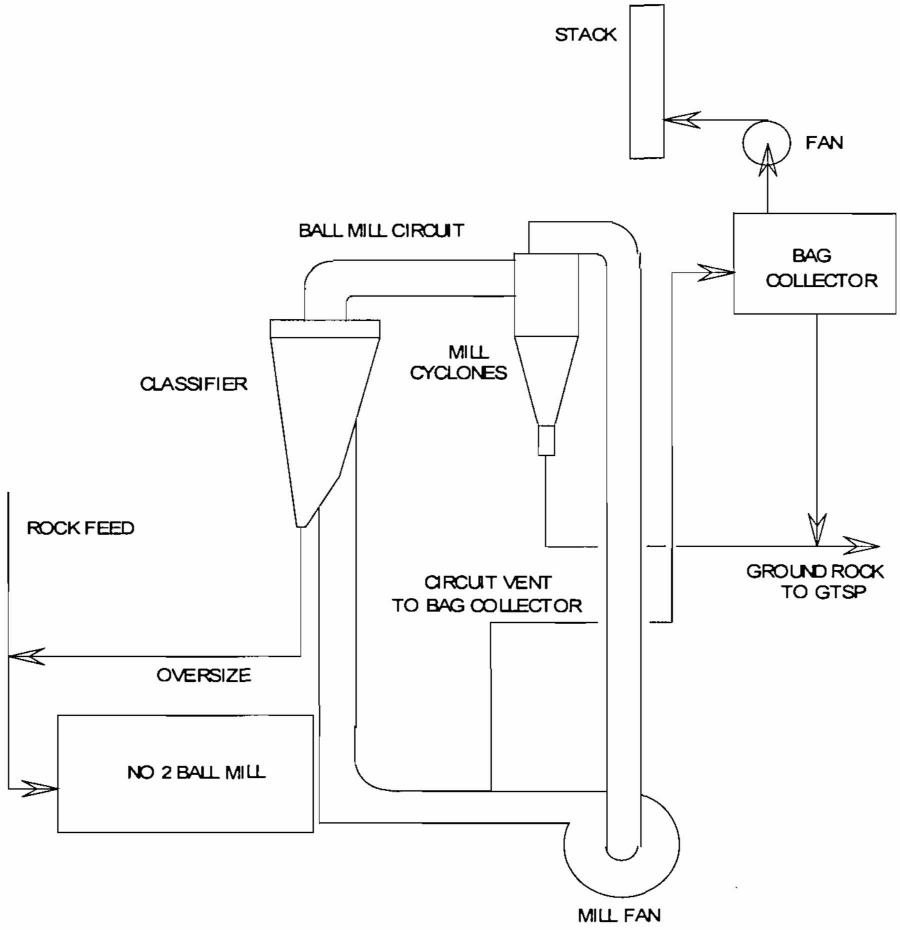


Control Equipment Discription

The emissions from the reactor, filter and seal tanks are controlled by a crossflow scrubber using process water. The scrubber contains Kimre Pads as its packing material.

Emission Unit: **Phosphoric Acid Plant - B Train**	ID No.: **009**
Facility: **IMC Phosphates South Pierce Plant**	ID No.: **1050055**

Flow Diagram

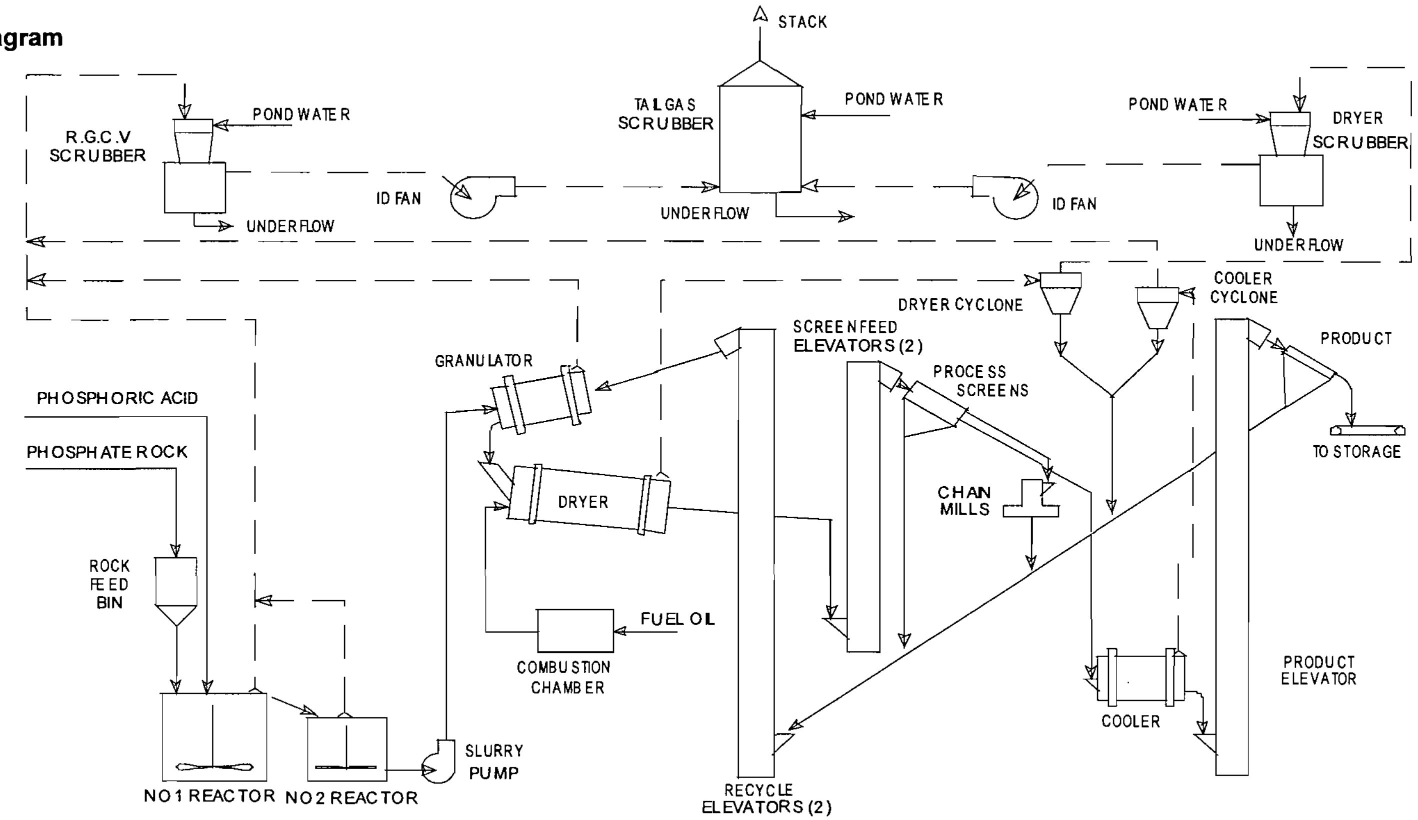


Control Equipment Discription

The emissions are controlled by a pulse type bag collector. It is vented by a fan located upsteam from the collector. The fan discharges to a vertical stack.

Emission Unit: **No. 2 Ball Mill Grinding System**	ID No.: **022**
Facility: **IMC Phosphates South Pierce Plant**	ID No.: **1050055**

Flow Diagram



Control Equipment Discription

The emissions are controlled by two parallel systems each consisting of venturi scrubber followed in series by vertical 2-stage packed scrubber using process water.

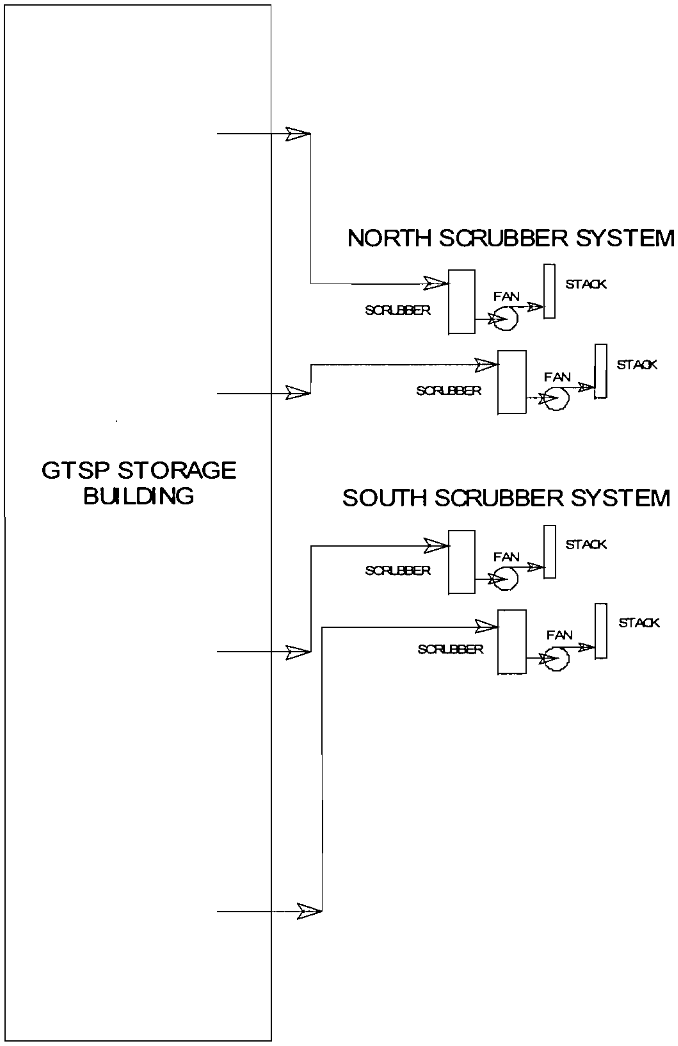
Emission Unit: **GTSP Production Plant**

ID No.: **023**

Facility: **IMC Phosphates South Pierce Plant**

ID No.: **1050055**

Flow Diagram

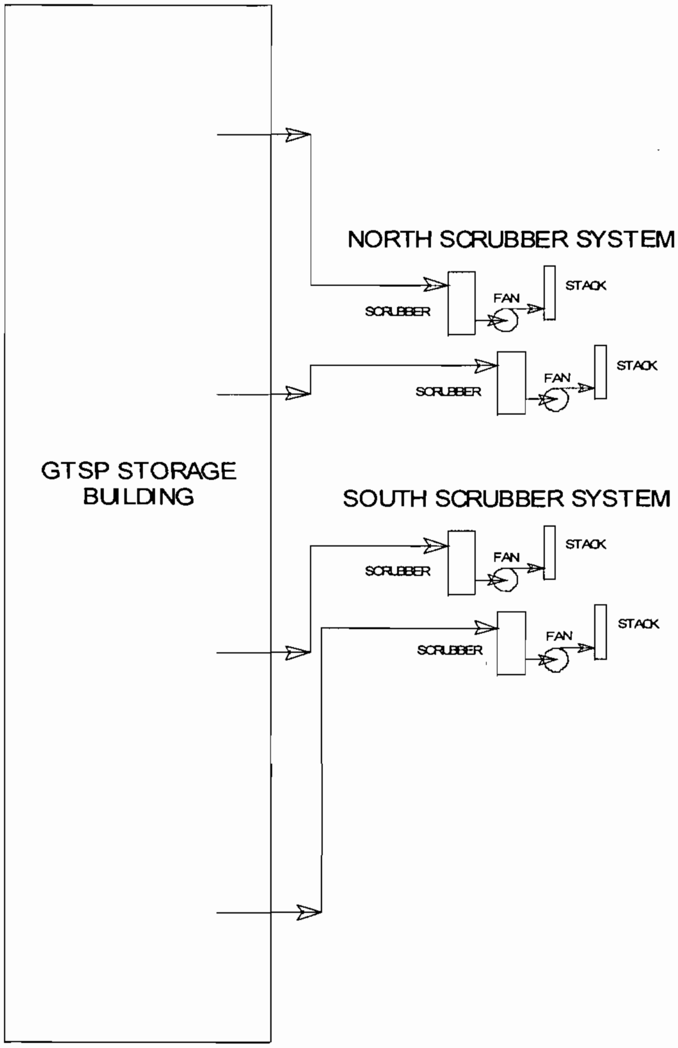


Control Equipment Discription

The emissions are controlled by two parallel systems each consisting of two cyclonic scrubbers and fans. Each scrubber pair vents to a common vertical stack. Each scrubber uses process water as the scrubbing liquid.

Emission Unit:	**GTSP East Storage Building - North Scrubbers**	ID No.:	**024**
Facility:	**IMC Phosphates South Pierce Plant**	ID No.:	**1050055**

Flow Diagram



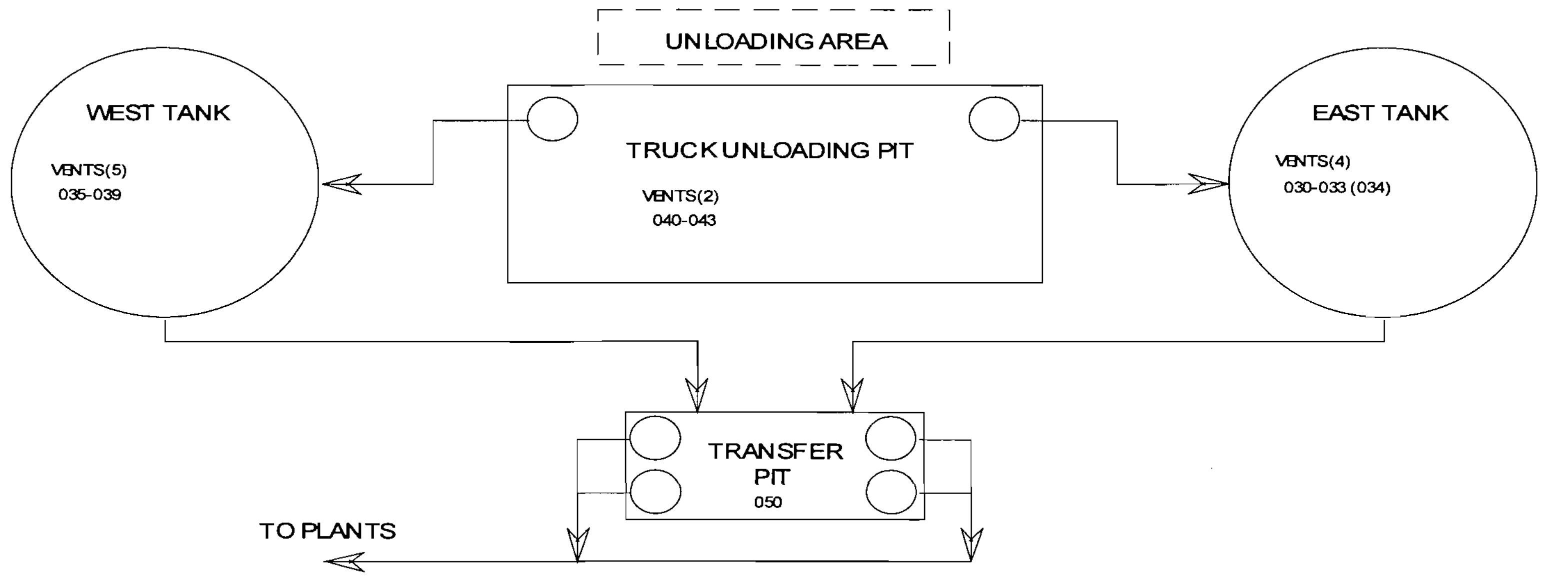
Control Equipment Discription

The emissions are controlled by two parallel systems each consisting of two cyclonic scrubbers and fans. Each scrubber pair vents to a common vertical stack. Each scrubber uses process water as the scrubbing liquid.

Emission Unit: **GTSP East Storage Building - South Scrubbers** ID No.: **025**

Facility: **IMC Phosphates South Pierce Plant** ID No.: **1050055**

Flow Diagram



Control Equipment Discription

The molten sulfur handling system has no specific emission control equipment. Handling practices are specified by the Rule 62-296.411, F.A.C., Sulfur Storage and Handling Facilities.

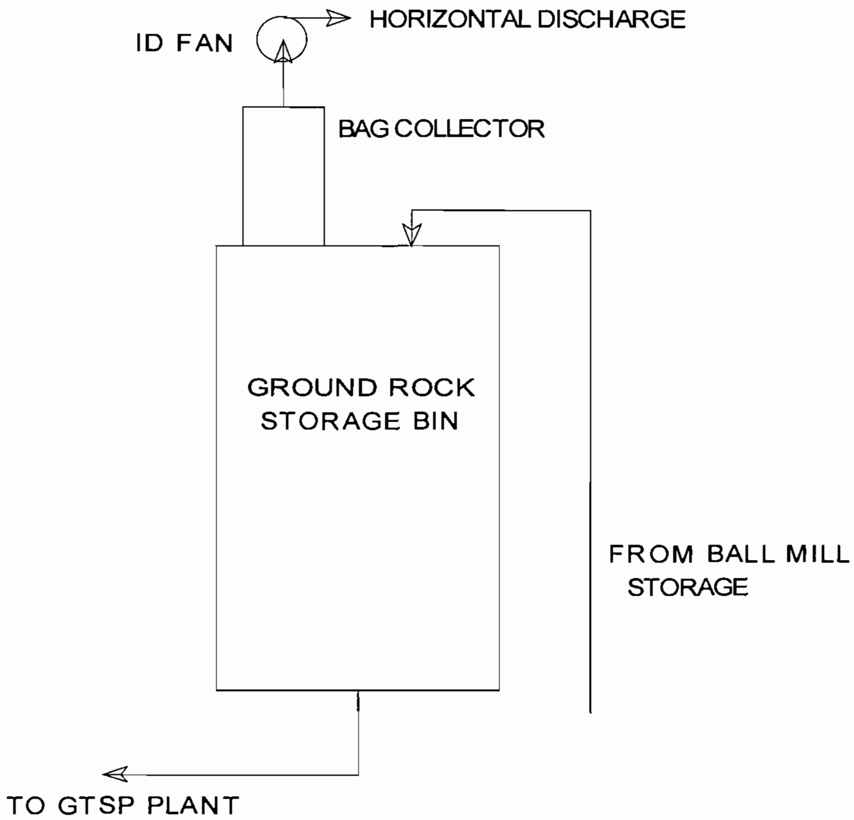
Emission Unit: **Molten Sulfur System**

ID No.: **30-43, 50**

Facility: **IMC Phosphates South Pierce Plant**

ID No.: **1050055**

Flow Diagram



Control Equipment Discription

The emissions are controlled by a pulse type bag collector. It is vented by a fan located upsteam from the collector. The fan discharges horizontally.

Emission Unit: **GTSP Rock Hopper Bin** ID No.: **026**

Facility: **IMC Phosphates South Pierce Plant** ID No.: **1050055**