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Golder Associates

July 9, 2007

063-7558

Florida Department of Environmental Protection
Bureau of Air Regulation
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Attention: Mr. Syed Arif, P.E.

RE: CF Industries 0570005-033-AC
DEP File No. ~~1050059-055-AC~~
Best Achievable Retrofit Technology Application
CF Industries – Plant City Plant
REQUEST FOR ADDITIONAL INFORMATION

Dear Mr. Arif:

CF Industries (CFI) has received a request for additional information (RAI) from the Florida Department of Environmental Protection (FDEP) dated March 1, 2007, regarding the Best Available Retrofit Technology (BART) determination analysis submitted in January 2007. Each of the FDEP's requests is answered below, in the same order as they appear in the RAI letter. The revised application form pages and application attachments are included as part of this RAI response as attachments.

Sulfuric Acid Plants (SAPs) A, B, C, and D

Comment 1. **As indicated in your BART application, a Prevention of Significant Deterioration (PSD) application was submitted and currently a PSD-Best Available Control Technology (BACT) review is being conducted by the Department to increase production for Plant B. The BART review for SAP B will be coordinated to the extent feasible with the BACT analysis for the same unit.**

Response: Comment noted.

Comment 2. **The BACT/BART evaluations for SAP B will be taken into consideration when evaluating BART for SAP A, SAP C and SAP D while considering differences in processes between the plants.**

Response: Comment noted.

Comment 3. Please consider the relatively high BART SO_2 limits proposed for plants A and B in view of the fact that they are greater than the NSPS values set in the early 1970's for new SAPs. Reconsider as well the averaging periods.

Response: The SO_2 emission rate proposed for "B" SAP is the BACT limit of 3.5 pounds per ton (lb/ton) H_2SO_4, 24-hour average, from the recent PSD permit application for the plant to increase production rate (Draft Permit No. 0570005-021-AC/PSD-FL-355), which is lower than the NSPS limit of 4 lb/ton H_2SO_4 production. The emission rate proposed for "A" SAP is 250 pounds per hour (lb/hr), and is also from the draft permit no. 0570005-021-AC/PSD-FL-355 and lower than the currently permitted rate of 333.3 lb/hr from Title V permit no. 0570005-017-AV. Also, it is to be noted that per Title V permit No. 0570005-017-AV, "A" SAP is not subject to NSPS Subpart H.

Comment 4. Submit a flow diagram of each plant showing the current control technology in use.

Response: Process flow diagram of each SAP is presented in Appendix A.

Comment 5. Please provide sulfur dioxide CEM data summary (lb/ton of 100% H_2SO_4) for all the sulfuric acid plants (SAPs) for the year 2006. For SAP B, also include data for the year 2005. The averaging time should be 24 hours as well as 3 hours. The two averaging times should be depicted in different colors. In providing this data, please present it in a graphical representation against time. On the same graph indicate the production rates for the plants and indicate the turnaround date, if any, for the SAPs on the same axis. A different graph should be made for each of the four SAPs.

Response: Graphs showing 24-hour and 3-hour average SO_2 emissions data from continuous emissions monitoring (CEM) are presented in Figures B-1 through B-8 in Appendix B.

Comment 6. The application presents different available SO_2 abatement methods. One of the methods is tail-gas scrubbing in conjunction with double absorption. Hydrogen peroxide scrubbing has been employed at SAPs. In research done by the Department, Outokumpu Technology (<u>www.outokumutechnology.com</u>) provides a similar process called Peracidox process, which they claim to have low investment costs. Please provide a cost analysis in using that system for further abatement of SO_2 emissions.

Response: Outokumpo Technology, which recently changed its name to Outotec, was contacted for information on the Peracidox process. The information is attached in Appendix C. Based on the list obtained of Peracidox systems installed so far in the world, only two have been in the USA. One of the two Peracidox systems is for a SAP with production capacity 1,466 tons per day (TPD) and the capacity of the other system installed in the USA in 2006 is not available. The capacity of the SAPs at the Plant City facility are 1,300; 1,600; 2,750; and 2,750 TPD for SAP A, SAP B, SAP C, and SAP D, respectively.

After multiple requests were made to provide detailed cost information for a Peracidox system that can achieve a SO_2 emission rate of 3 lb/ton H_2SO_4 in a 3,000 TPD SAP, a basic cost estimate of \$3.4 million (Euro €2.5 million) was provided by Outotec (for the scrubber only). Using this scrubber cost after adjusting it for the individual size of the CFI SAPs and OAQPS cost factors for other direct and indirect costs, a cost analysis was prepared, which is attached in Table C-1 of Appendix C. As shown, the cost effectiveness of removing one ton of SO_2 range from $9,500 to more than $16,000, considered to be very high for a BACT analysis. Therefore, it is concluded that the Peracidox process is not cost effective for the SAPs at the CFI Plant City facility, and is not considered further as BART. Cost effectiveness in terms of dollars per deciview (dv) of visibility improvement is also shown in Table C-1.

Comment 7. Provide sulfur dioxide (SO_2) and nitrogen oxides (NO_x) stack emissions tests for 2005-2006 for all SAP plants.

Response: SO_2 and NO_x stack emissions test for all the SAPs from 2005 to present are presented in Table D-1 of Appendix D. There are no NO_x emissions test data available for "A" and "B" SAPs.

Comment 8. Complete Tables 5-3, 5-4 and 5-5 to include tons per year (TPY) of pollutant removed and cost per ton of pollutant removed in $/ton.

Response: Revised Tables 5-3, 5-4, and 5-5 are attached in Appendix E. Further revisions to Table 5-5 have been made to reflect storage and disposal of the liquid waste stream from the ammonia scrubbing. The ammonium sulfate liquor from the scrubber would be too dilute (65 percent water) to use in the MAP/DAP production process. The SO_2 reduction has been increased to 95 percent, and the actual cost of borrowing money has been accounted for. The resulting cost effectiveness is $4,000 to almost $10,000 per ton of SO_2 removed, and $25 million to $41 million per dv reduction.

Comment 9. No BART analysis for NO_x was included. No emission test data were included. What emission limit are you proposing? Was any NO_x emission limit considered in the modeling? Provide actual test reports to support the NO_x emission estimates used for the SAPs. Please submit a BART analysis and a NO_x emission limit for each plant.

Response: NO_x emission rates were considered for the SAPs in the modeling and the rates are shown in Table 2-3 of the modeling protocol attached with the BART analysis submitted in January 2007. These emission rates were based on the permit limit of 0.12 lb/ton 100 percent H_2SO_4 for the "B", "C", and "D" SAPs and assuming the same emission rate for the "A" SAP.

BART analysis for the "A", "B", and "C&D" SAPs are presented in Sections 5.2, 5.4, and 5.6, respectively, of the BART determination analysis report submitted to the FDEP in January 2007. These analyses focused on the degree of visibility improvement possible for control of NO_x emissions from the SAPs. As explained in Sections 5.2, 5.4, and 5.6 and as shown in Table 3-6 of the report, about 1-percent of the maximum visibility impact for each SAP is due to NO_x emissions. Therefore, it is not efficient to go through the initial steps of BART analysis when only a very small visibility improvement can be achieved from these emissions units. The degree of visibility improvement is one of the five factors to determine BART and must be weighed among the five factors. FDEP is free to determine the weight and significance to be assigned to each factor, but clearly focusing on BART for a pollutant causing insignificant visibility impacts are not in the best interests of FDEP or the facility.

Based on the NO_x emission test data for "C" and "D" SAPs, the baseline NO_x emissions from the "C" and "D" SAPs are 44.6 TPY and 38.9 TPY, respectively (AOR, 2006). There are no NO_x emission test data for "A" and "B" SAPs and using the test results for "C" and "D" SAPs, actual NO_x emissions from the "A" and "B" SAPs are about 20 TPY for each. Based on these low baseline emissions, any further NO_x control would not be cost effective.

Finally, as explained in Sections 5.2, 5.4, and 5.6, there are no known add-on NO_x control techniques that have been applied to SAPs. In all previous BACT analyses for NO_x emissions from the SAPs, BACT has been no add-on control and good combustion process. As a result, in the BART analysis report for CFI, the BART proposed for the "A", "B", "C", and "D" SAPs were existing combustion process and good combustion practice. Currently, the "B", "C", and "D" SAPs have the following NO_x emissions limits and CFI proposes the same limits as BART emission limits for these SAPs:

- "B" SAP – 0.12 lb/ton H_2SO_4, 8.0 lb/hr and 35 TPY
- "C" and "D" SAP – 0.12 lb/ton H_2SO_4, 12.0 lb/hr and 60 TPY for each

Comment 10. Please provide a copy of the vendor quote used in the economic analysis for each of these plants.

Response: The vendor quote used in the cost analysis was originally received in 2004 and has been used in several PSD applications (CF Industries C&D SAP Application, A&B PAP and B SAP PSD Application). The original quote received from Monsanto in 2004 is not available any more. Monsanto was contacted for verification of the cost figure and the response from Monsanto is attached in Appendix F.

Diammonium Phosphate /Monoammonium Phosphate (DAP/MAP) Plants A, X, Y, and Z

Comment 11. For each DAP/MAP plants subject to BART, you are required by Rule 62-296.340, F.A.C., to conduct an analysis of emissions control alternatives. This step includes the identification of available, technically feasible retrofit technologies, and for each technology identified an analysis of the cost of compliance, the energy and non-air quality environmental impacts, and the degree of visibility improvement in affected Class I areas, resulting from the use of the control technology. Please provide this information to the Department for each affected plant.

Response: The overall strategy followed in analyzing the BART control options for the CFI Plant City BART-eligible source (combination of all BART-eligible emissions units at the facility) was to follow the BART determination guidelines contained in Appendix Y of Title 40, Part 51 of the Code of Federal Regulations (40 CFR 51) in a way that makes the most practical sense with the overall goal of improving visibility.

Rule 62-296.340, F.A.C., requires that a BART evaluation be performed in accordance with the criteria of 40 CFR 51.308(e) and the procedures and guidelines in 40 CFR 51, Appendix Y, Guidelines for BART Determinations Under the Regional Haze Rule. According to the BART requirements, the degree of visibility improvement that would be achieved as a result of emissions reductions achievable from the BART-eligible source must be considered. Appendix Y describes the five basic steps of a BART analysis, where the fifth and final step is the evaluation of visibility impacts (visibility improvement determination). When making this determination, the permitting authority has flexibility in setting absolute thresholds, target levels of improvement, or de minimum levels since the dv improvement must be weighed among the five factors. The permitting authority is free to determine the weight and significance to be assigned to each factor. (ref. pg. 39170, Federal Register, July 6, 2005.)

The following overall steps were followed in the BART determination analysis for the CFI BART-eligible emissions units:

- Determine the maximum impacts of the individual BART-eligible units and identify the degree of visibility improvement possible from the emissions unit;
- Determine the pollutant contributions to the maximum impact for each BART-eligible emission unit;
- Focus on the emission units and pollutant(s) that clearly dominate the visibility impacts;
- Identify existing and in-use control technologies;
- For the emission units with significant impacts and for the pollutant that clearly dominates, conduct full scale top-down BART analysis;
- Select BART and propose emission rates.

The State of Florida has not set any bright line for visibility improvement from individual emissions units. Nonetheless, some reasonable level of visibility improvement should be deemed to be insignificant, not warranting further evaluation. This is particularly important for BART-eligible sources that have many BART-eligible emissions units, in order to reduce the time and expense of performing the full BART control technology evaluation. As described further in the BART Determination Report, CFI has concluded that a control technology evaluation is not warranted for certain emissions units due to the insignificant visibility improvement that would result from applying any control technology.

The maximum visibility impacts of the CFI BART-eligible source was presented in Table 3-3 of the BART determination report submitted to the FDEP in January 2007, which showed a maximum impact of 0.68 dv at the Chassahowitzka National Wilderness Area. The individual emissions unit visibility impacts were presented in Table 3-5 and the pollutant contributions for each unit were shown in Table 3-6. It can be clearly seen from these two tables that "A", "B", "C", and "D" SAPs are the dominating units and SO_2 emissions are the most dominating pollutant for visibility impacts from these units. The BART analyses for CFI Plant City therefore, focused on the possibility of additional SO_2 controls from these units. The recently published "Okefenokee Group Contribution Assessment" by VISTAS also concludes that sulfate particles dominate light extinction most of the days and recommend focusing on reducing SO_2 emissions.

The visibility impacts of emissions units other than the SAPs are all less than 0.1 dv. These visibility impacts are considered to be insignificant, and therefore control technologies for these units were not evaluated.

Among the other BART-eligible emission units at the CFI Plant City facility, PM was found to be most contributing pollutant, ranging between 70 and 100 percent of the impacts. SO_2 emissions from these units contributed between 2 and 12 percent and NO_x emissions contributed between 3 and 23 percent. Based on the low baseline SO_2 or NO_x emissions and the low visibility improvement possible, no additional control technology for SO_2 or NO_x emissions were considered in the BART analyses for SO_2 and NO_x from these emissions units. PM emissions from these emissions units are already well controlled and based on the insignificant amount of visibility improvement possible from these units, no additional PM control was proposed for these units.

BART analysis for the "A", "X", "Y", and "Z" DAP/MAP plants were provided in Sections 5.7 and 5.8 of the BART control determination analysis report submitted in January 2007. According to the overall strategy, the BART analysis for the MAP/DAP plants focused on the degree of visibility improvement possible from these plants. As explained in Sections 5.7 and 5.8 and as shown in Table 3-6, each of the MAP/DAP plants account for only a maximum of 0.016 dv visibility impact compared to 0.68 dv for the CFI Plant City BART-eligible source (combination of all BART-eligible units).

Also, 70 to 90-percent of the visibility impact for each DAP/MAP plant is due to PM emissions, which were conservatively modeled by assuming all of it as organic carbon particles with high extinction efficiency. Therefore, the visibility improvement analysis focused on the PM emissions from these plants. As shown in Table 3-6, 2 to 13-percent of the impact is due to sulfate particles and 3 to 23-percent of the impact is due to nitrate particles. Based on the hourly emission rates presented in Table 2-3 of the BART determination report, which are based on test data or AP-42 calculations, the maximum baseline NO_x and SO_2 emissions from any of the MAP/DAP plants are 31 TPY and 11 TPY, respectively. For such small baseline emissions even a small annualized cost will translate to very high average cost effectiveness. Also, 100-percent control of NO_x emissions only has the potential of improving visibility by 23 percent of 0.016 dv; i.e., a 0.004 dv improvement. Similar explanation applies to additional control for SO_2 emissions, which accounts for even smaller improvement in visibility. Additional control of NO_x and SO_2 emissions, therefore make little practical sense.

The PM emissions form the DAP/MAP plants are already extensively controlled using medium and high efficiency wet scrubbers and dust cyclones, which are considered to be BACT for PM emissions in the fertilizer industry. The baseline PM emissions from the MAP/DAP plants are in the range of 35 TPY (based on hourly emission rates presented in Table 2-3 of the BART Determination Report). It is possible to further control these emissions by adding various control technologies. However, adding more control equipment for PM in addition to the BACT controls currently in place make little economical sense as the average cost effectiveness will be very high based on the insignificant visibility improvement that would result of approximately 0.016 dv.

Therefore, the overall BART strategy and the proposed BART emission limits for DAP/MAP Plants are as follows:

- "A" DAP/MAP – Existing control technology, 24-hour average emission limit of 13.0 lb/hr or 0.44 lb/ton P_2O_5;
- "X" DAP/MAP – Existing control technology, 24-hour average emission limit of 13.8 lb/hr or 0.283 lb/ton P_2O_5;
- "Y" DAP/MAP – Existing control technology, 24-hour average emission limit of 15.3 lb/hr or 0.314 lb/ton P_2O_5;
- "Z" DAP/MAP – Existing control technology, 24-hour average emission limit of 15.0 lb/hr or 0.308 lb/ton P_2O_5;

Comment 12. If a determination is made after doing the above analysis that the BART eligible DAP/MAP plant has controls already in place that constitute the most stringent controls available, then please provide emissions data for the affected BART pollutant. The emissions data information can be in the form of continuous emissions monitoring data or stack tests.

Response: It is important to note that Appendix Y of 40 CFR 51, the Guidelines for BART Determination Under the Regional Haze Rule explains BART determination as an analysis, which identifies the best system of continuous emission reduction taking into consideration the technology available, the costs of compliance, the energy and non-air quality environmental impacts of compliance, any pollution control equipment in use or in existence at the source, remaining useful life of the source, and the degree of visibility improvement. Therefore, the control technology identified as BART does not have to be the "most stringent".

As explained in the response to Comment 11, considering the high cost of compliance for NO_x and SO_2 controls and the little visibility improvement possible, BART for NO_x or SO_2 emissions from the MAP/DAP plants are no further controls. Also, considering the high cost of compliance for PM emissions, existing PM control technology employed on the plants, and the little visibility improvement possible, the existing controls are proposed as BART for PM emissions from the MAP/DAP plants.

There are no continuous monitor for SO_2 or NO_x emissions at the MAP/DAP plants. The stack test data for the MAP/DAP plants were presented in Table B-1 of the BART determination report submitted in January, 2007.

Comment 13. Permits for these plants have a PM enforceable limit to exempt the plants from RACT regulations. Please submit particulate matter (PM/PM_{10}) emissions data for the last 2 years of operation for each DAP/MAP plant. Resubmit a proposed BART PM emission limit (lb/ton P_2O_5) for each plant and specify the control technology chosen.

Response: Particulate matter emissions data for the last two years of operation for each DAP/MAP plant were presented in Table B-1 of the BART determination report submitted to FDEP in January 2007. Proposed BART PM emissions limits in lb/hr and in lb/ton P_2O_5 are presented in the response to Comment 12.

Comment 14. Resubmit a flow diagram of each plant showing the current control technology in use.

Response: The process flow diagrams of each DAP/MAP plants are presented in Appendix A.

MODELING

Comment 15. Table 2-3 in the BART application lists 24-hour average emission rates for the BART eligible emissions units for the CF facility. Some of these emission rates are taken from an insufficient PSD application that is currently being reviewed by the Department. According to the modeling protocol, source emission rates should be based on CEM data as a first priority. Please use emission rates that are based on your current operations, not based on future possible permit limits.

Response: A draft PSD permit was issued by FDEP on May 23, 2007 (Draft Permit No. 0570005-021-AC/PSD-FL-355) for the referenced "insufficient PSD application". The emission rates in Table 2-3, which were referenced as proposed in the permit application are now contained in the draft permit and, therefore, should be valid emission rates that can be used in BART modeling.

Comment 16. If upon further review, it is determined that the SAPs emit meaningful amounts of NO_x, then modeling analyses will also be required.

Response: The modeling analyses already included NO_x emission rates from the SAPs and are based on permit allowable emission rates for the "B", "C", and "D" SAPs. The NO_x emission rate used for the "A" SAP is based on the production capacity and the permit limit for the "B" SAP. There are no NO_x test data available for "A" and "B" SAPs. NO_x test data for the "C" and "D" SAPs are presented in Appendix D.

Comment 17. Section 5-16 of the BART application states that the SO2 emission rate for SAP D will be reduced to 38.4 lb/hr. However, 37.8 lb/hr was modeled. Please correct.

Response: The correction has been made and the revised and the revised visibility impact is 0.042 dv compared to the 0.04 dv mentioned in Section 5.5.5 of the BART Determination Report.

Thank you for consideration of this information. The Professional Engineer signature page is provided in Appendix G. If you have any questions, please do not hesitate to call me at (352) 336-5600.

Sincerely,

GOLDER ASSOCIATES INC.

David A. Buff, P.E., Q.E.P.
Principal Engineer

DB/all

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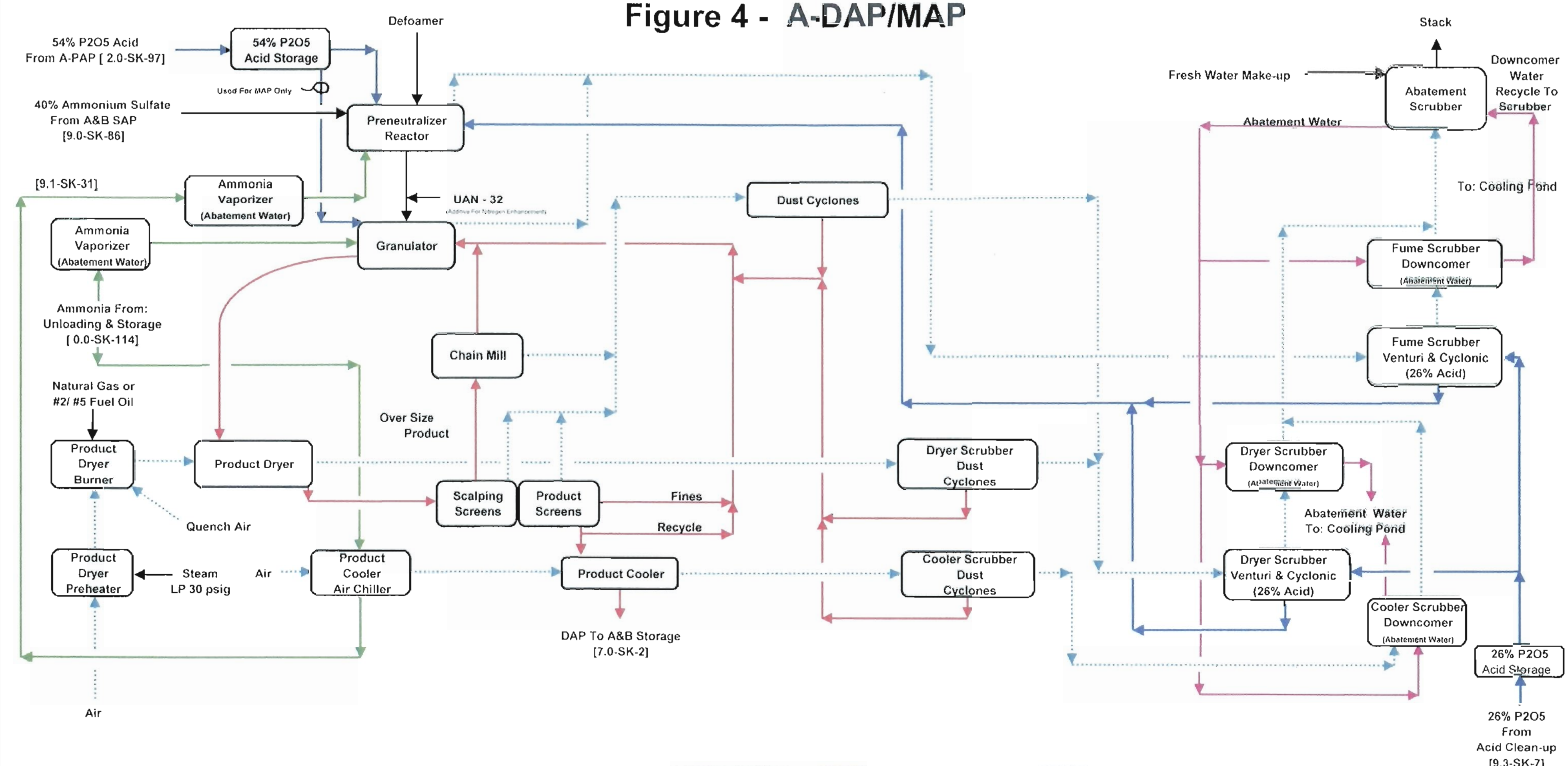
APPENDIX A

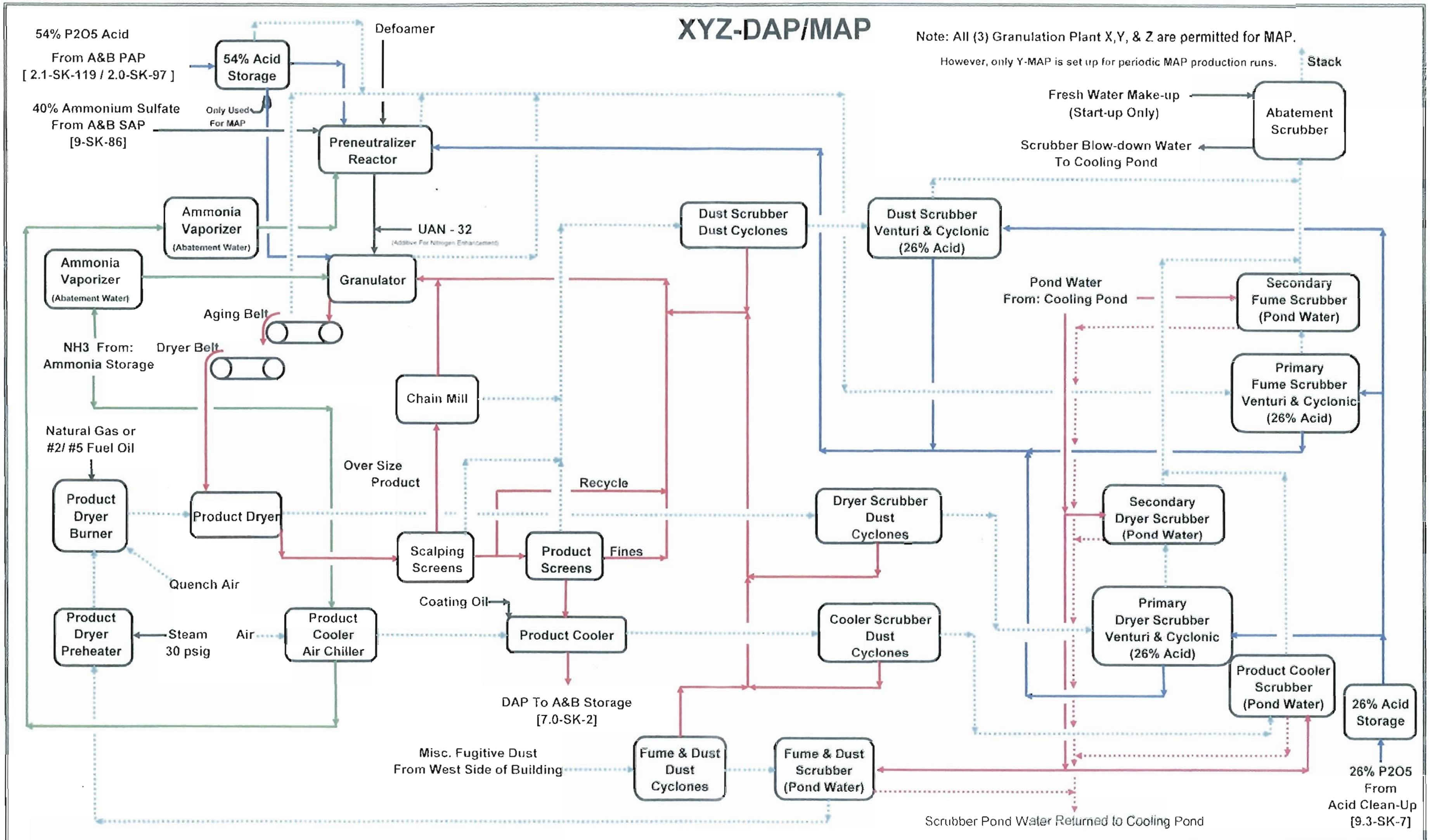
Figure 4 - A-DAP/MAP



Legend		Revision By	Date
Fume or Air Duct	Other	Randy Charlot	01/16/04
26% / 54% P_2O_5 Acid			
Ammonia			
Granular DAP/MAP			
Abatement Water			

CF Industries, Inc.
Plant City Phosphate Complex
P.O. Drawer L
Plant City, Florida 33564
Phone: (813) 782-1591
Fax: (813) 788-9126

Title	DWR. NO
A-DAP/MAP Process Block Flow Diagram	5.0-SK-101



Legend		Revision By	Date
Fume or Air Duct	Other	Randy Charlot	7/11/06
26% / 40% P_2O_5 Acid			
Ammonia			
Granular DAP/MAP			
Process Water	Process To Pond		

CF Industries, Inc.
Plant City Phosphate Complex
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Phone: (813) 782-1591
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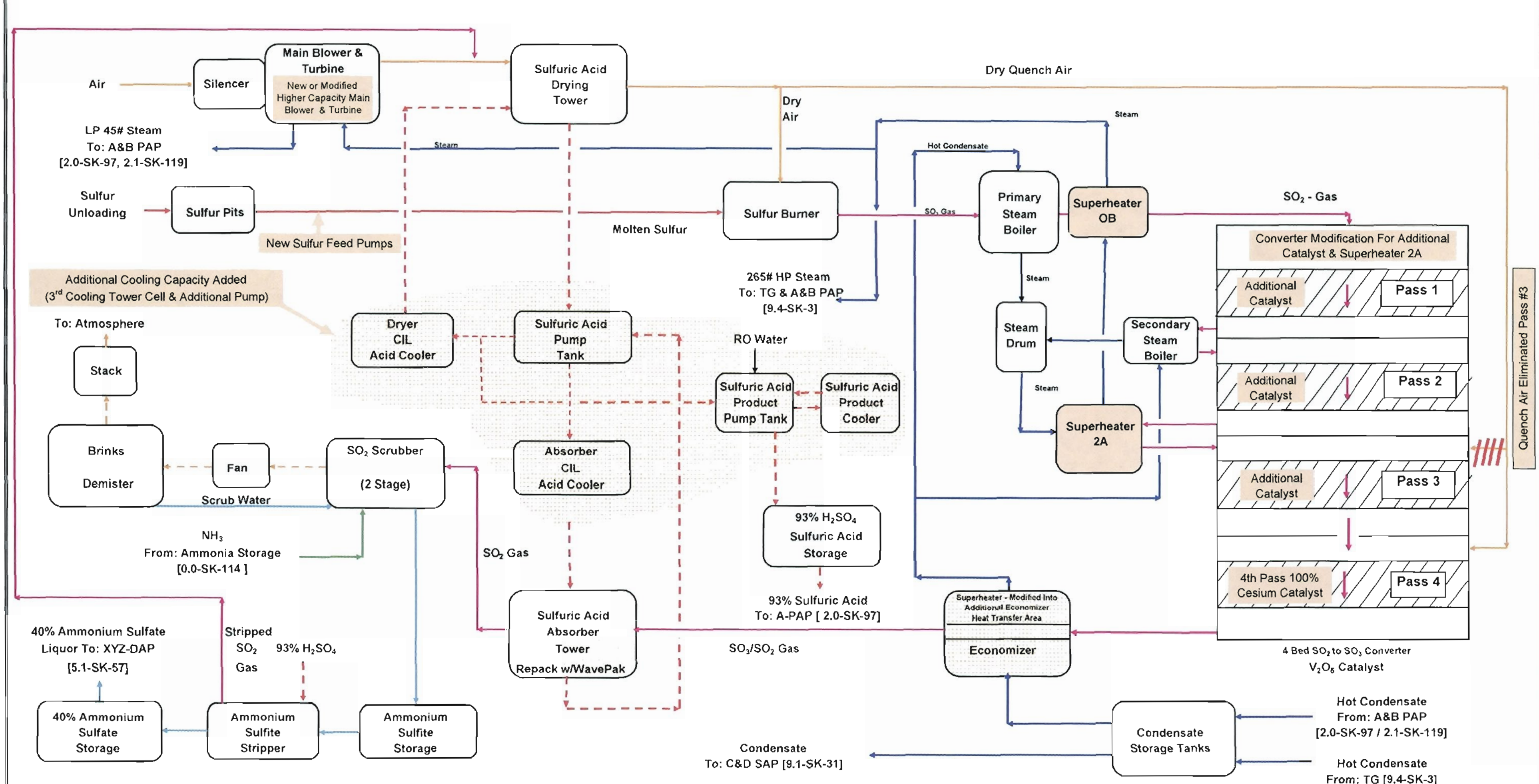
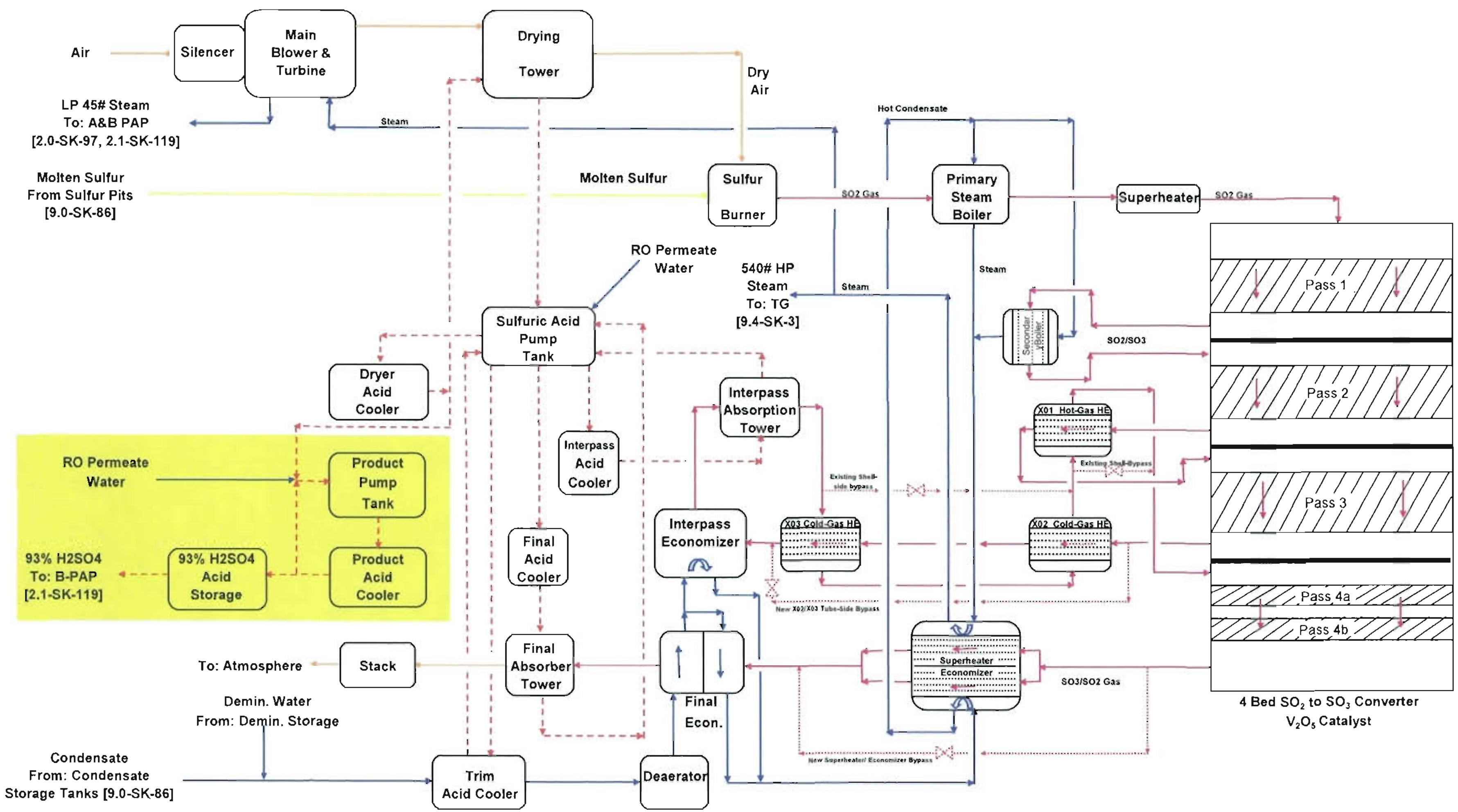
Title	DWR. NO
XYZ-DAP/MAP Granulation Block Flow Diagram	5.1-SK-57

Increased Sulfuric Acid Production B-SAP - Proposed Modifications



Legend		By	Date	CF Industries, Inc.	Title	DWR. NO
Sulfuric Acid	Sulfur	Randy Charlot	1/10/07	Plant City Phosphate Complex	A&B Sulfuric Acid Plants & Ammonium Sulfate	9.0-SK-86
Steam/Condensate	Ammonia			P.O. Drawer L	Process Block Flow Diagram	
Process Gas SO_2/SO_3	Scrub Liquor			Plant City, Florida 33564	Proposed B-SAP Upgrades	
Air	Air + trace SO_2			Phone: (813) 782-1591		
Other				Fax: (813) 788-9126		90-SK-86.XLS

C & D Sulfuric Acid Plant (Double Absorption)



Legend		By	Date
Sulfuric Acid	Gas Bypass		
Gases SO_2/SO_3		Randy Charlot	2/28/2007
Steam/Condensate			
Air			
Sulfur			

CF Industries, Inc.
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Title	DWR. NO
C&D Sulfuric Acid Plants Process Block Flow Diagram	9.1-SK-31

91-SK-31.XLS

APPENDIX B

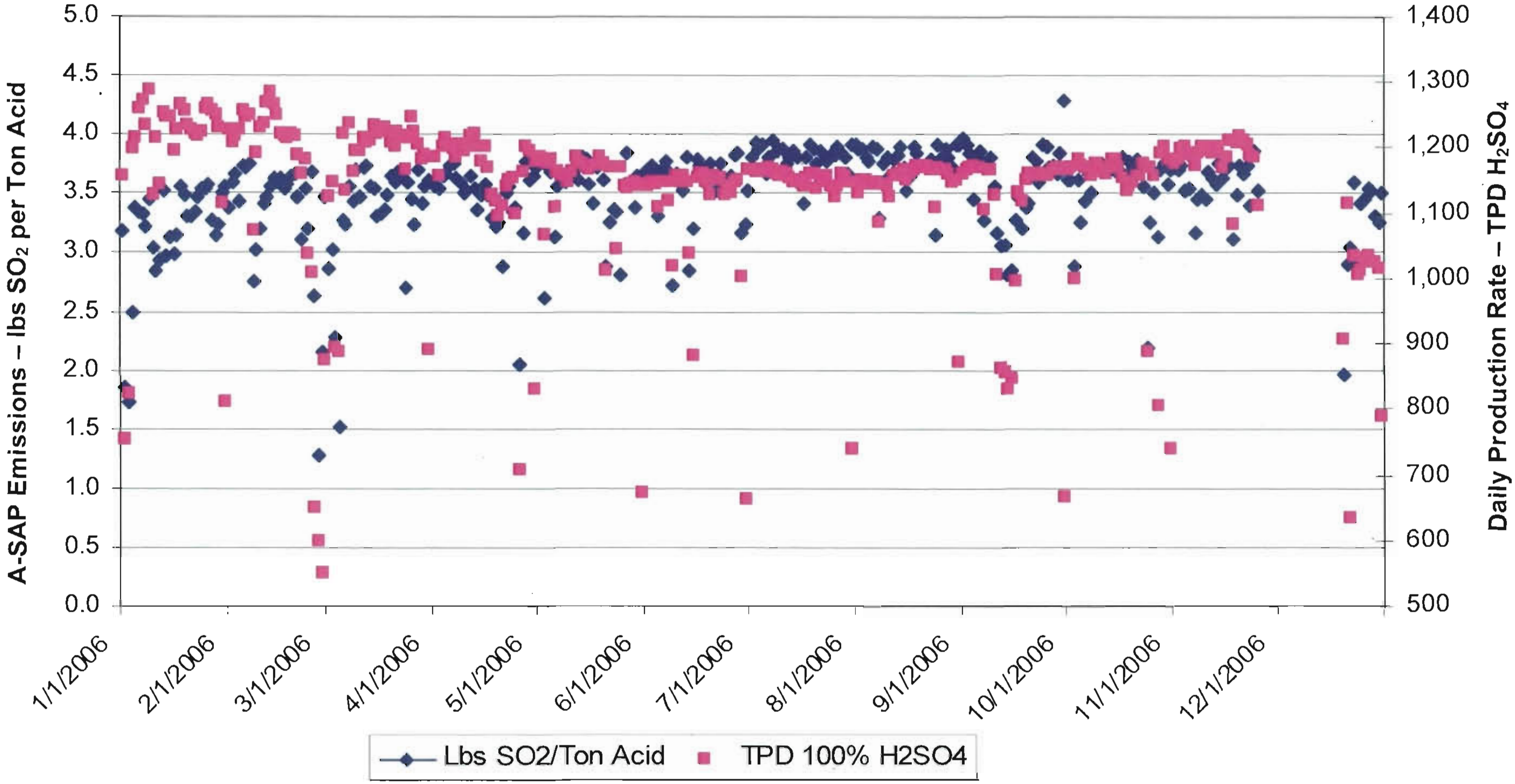

Figure B-1
CF Plant City Phosphate Complex
A-SAP SO_2 Emissions - Daily Average Pounds SO_2/Ton H_2SO_4

Source: Golder, 2007.

REV.	SCALE:	
DESIGN		
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Golder Associates

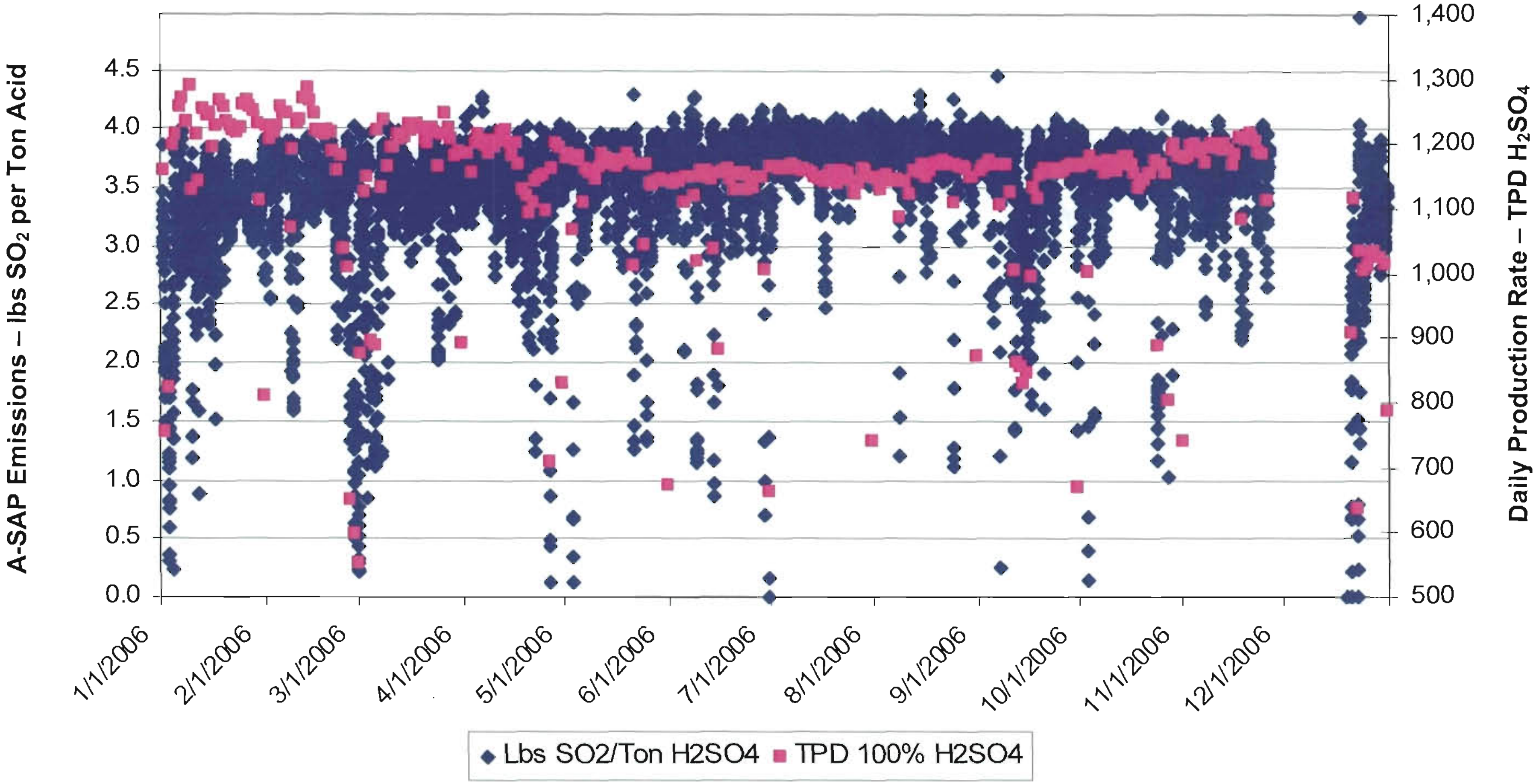

Figure B-2
CF Plant City Phosphate Complex
A-SAP SO_2 Emissions - 3 Hr Rolling Avg Pounds SO_2/Ton H_2SO_4

Source: Golder, 2007.

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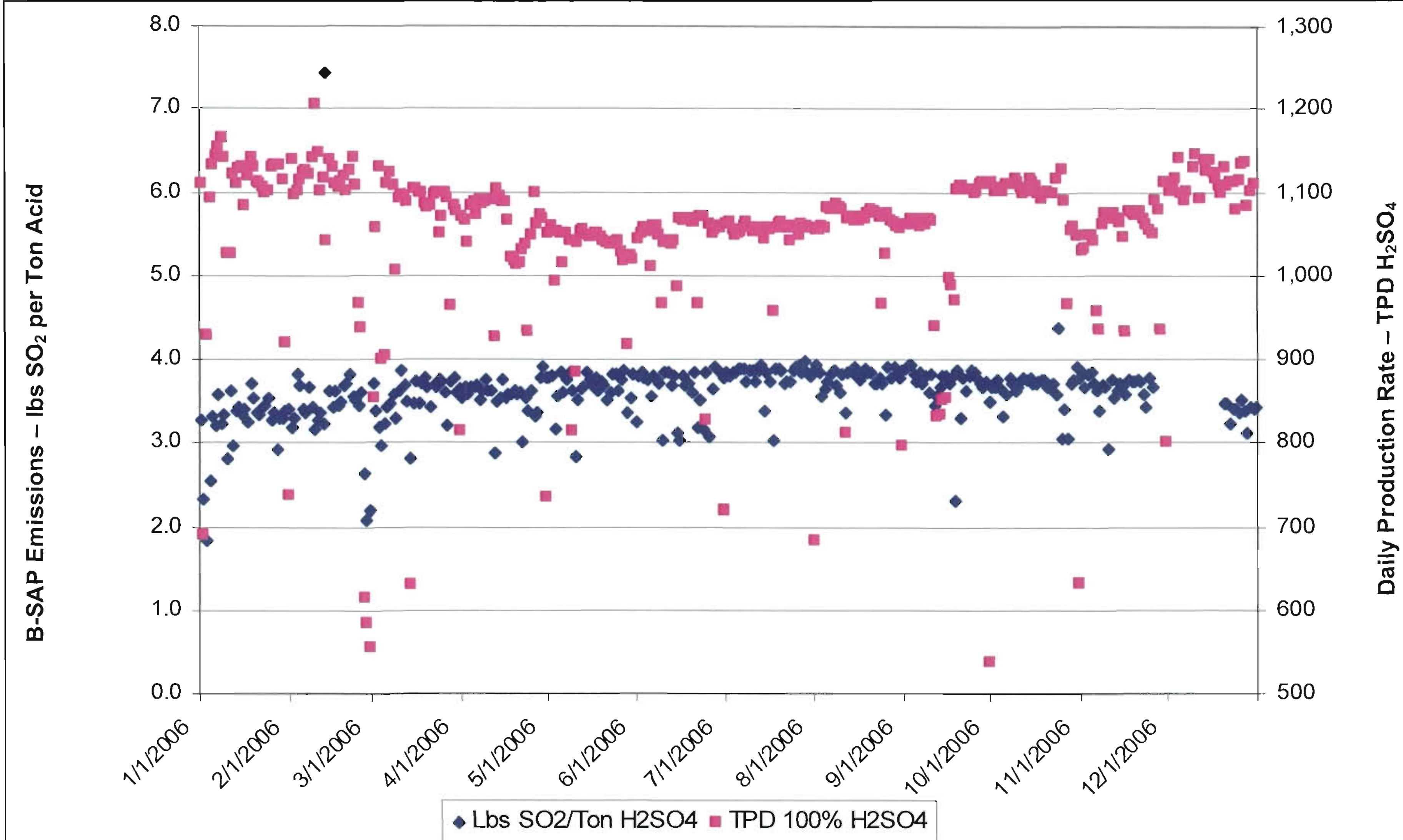

Figure B-3
CF Plant City Phosphate Complex
B-SAP SO_2 Emissions - Daily Average Pounds SO_2/Ton H_2SO_4

Source: Golder, 2007.

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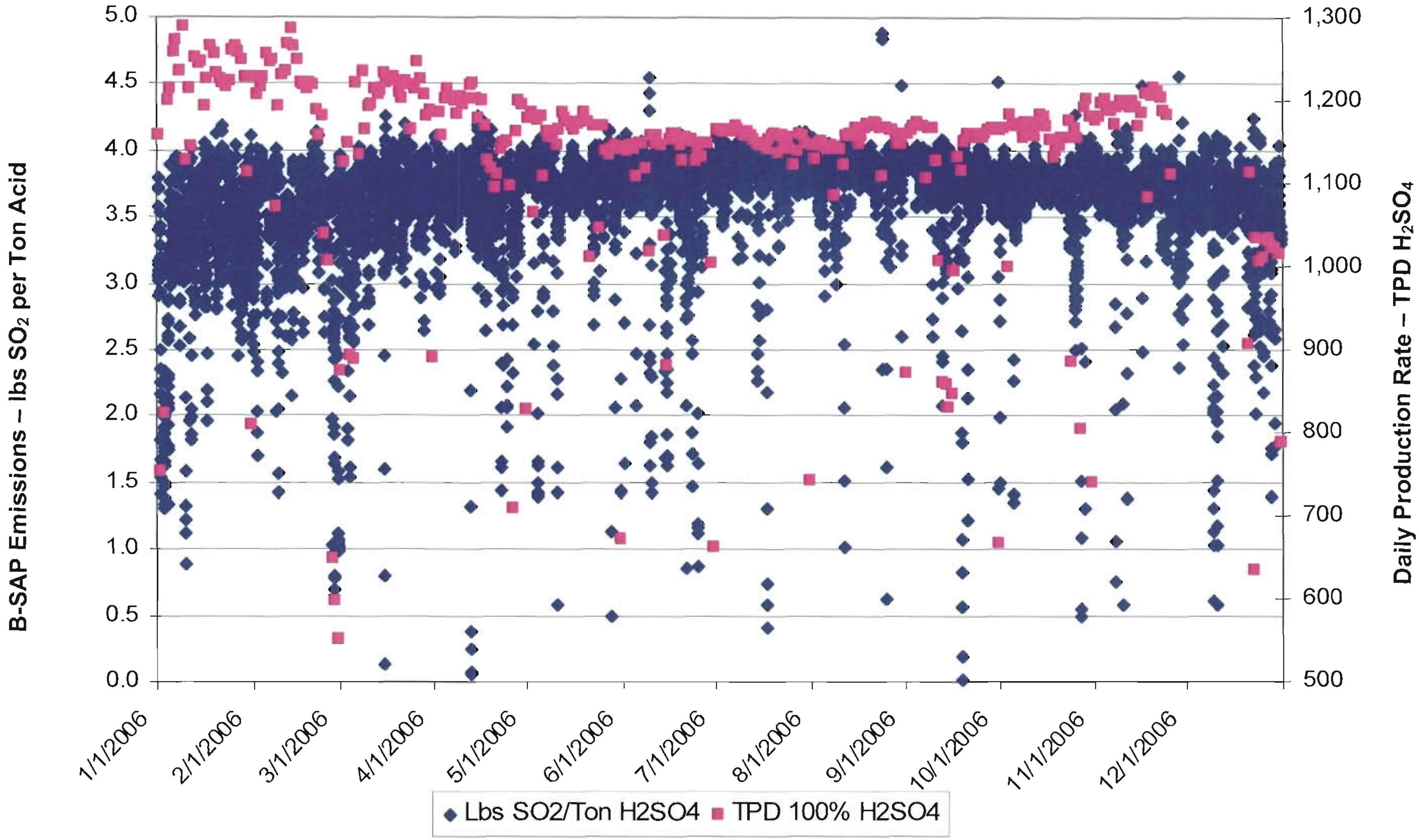

Figure B-4
CF Plant City Phosphate Complex
B-SAP SO_2 Emissions - 3 Hr Rolling Average Pounds SO_2/Ton H2SO_4

Source: Golder, 2007.

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Golder Associates

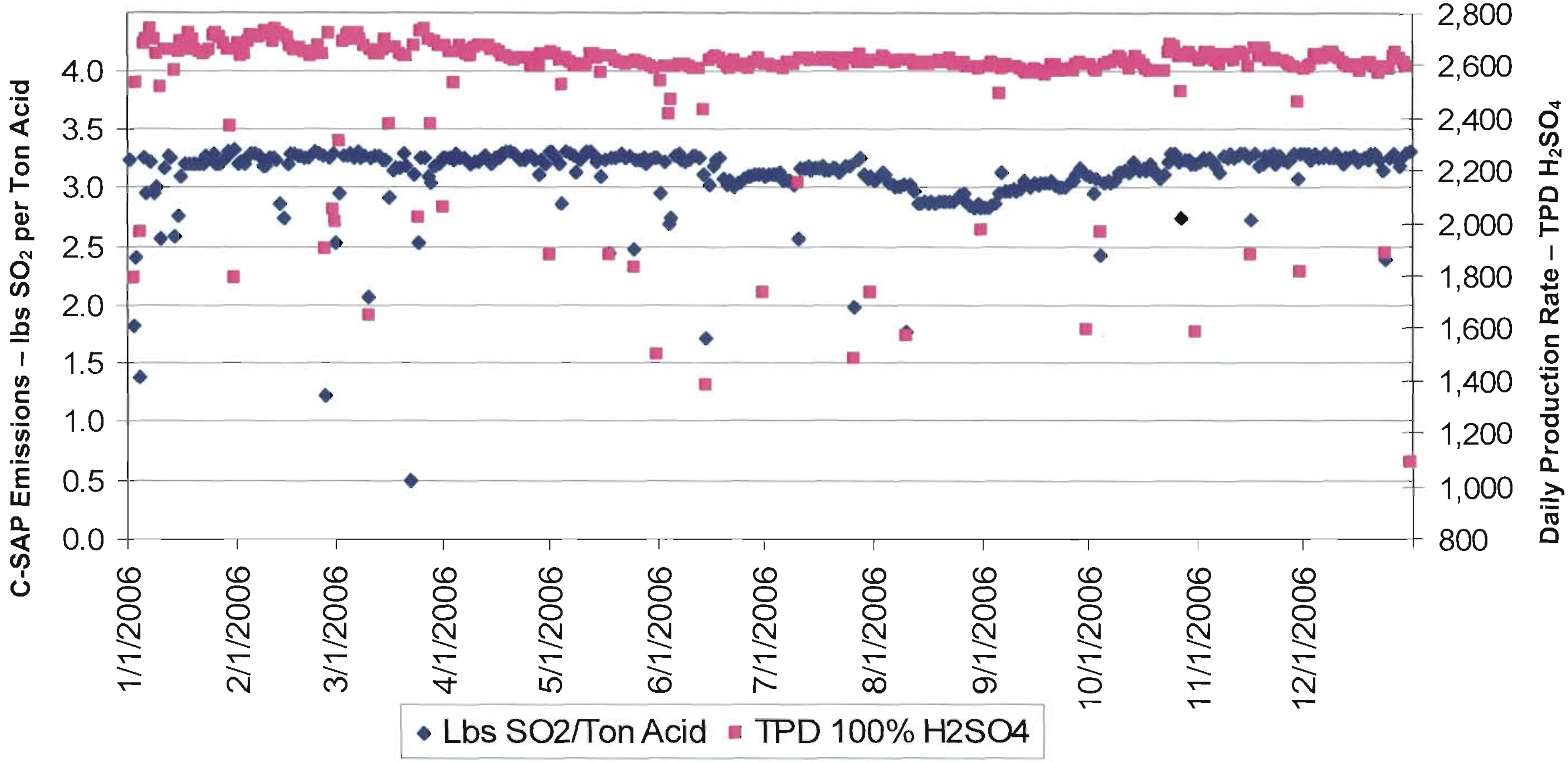

Figure B-5.
CF Plant City Phosphate Complex
C-SAP SO_2 Emissions - Daily Average Pounds SO_2/Ton H_2SO_4

Source: Golder, 2007.

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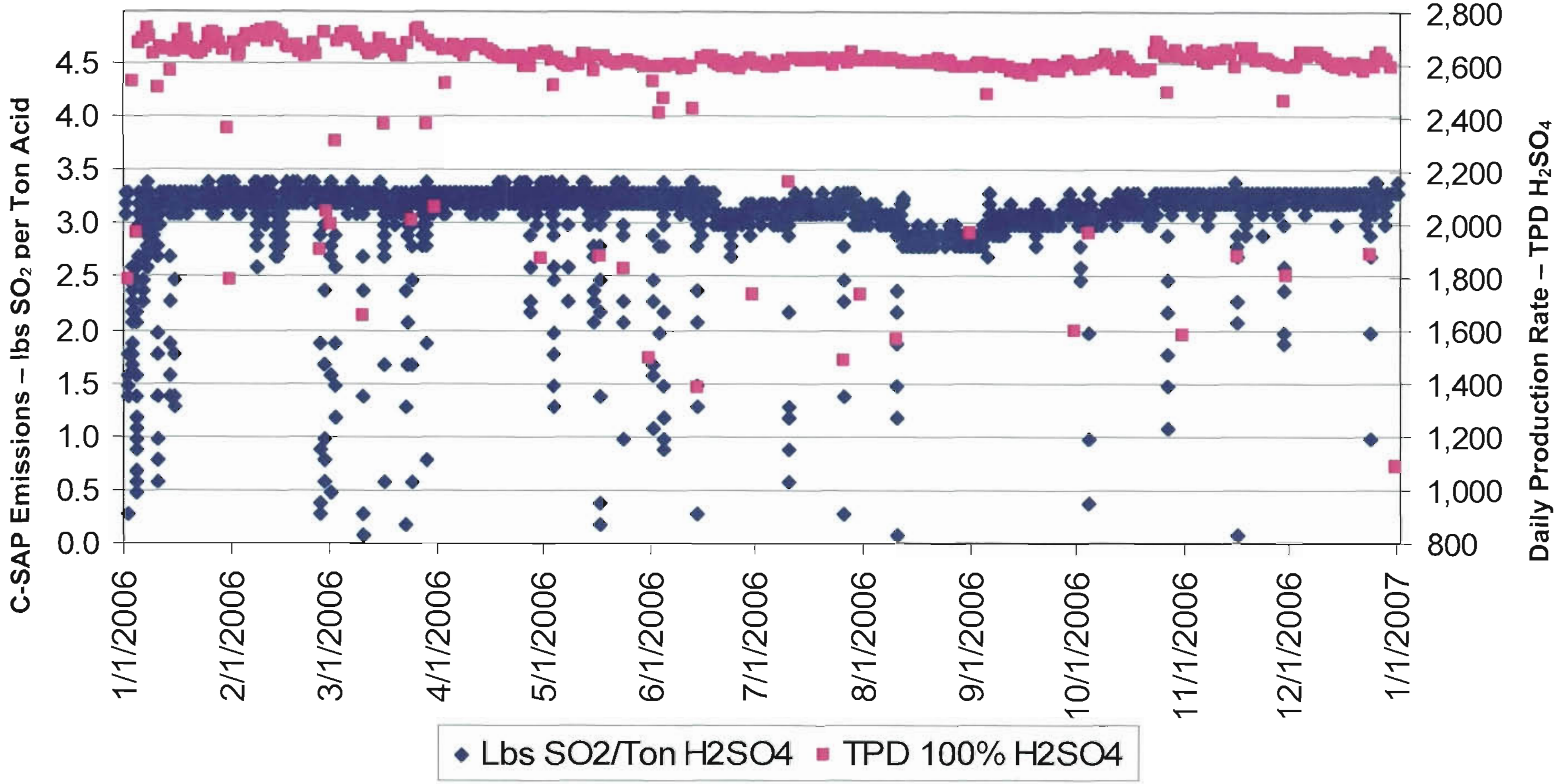

Figure B-6.
CF Plant City Phosphate Complex
C-SAP SO_2 Emissions - 3 Hr Rolling Average Pounds SO_2/Ton H_2SO_4

Source: Golder, 2007.

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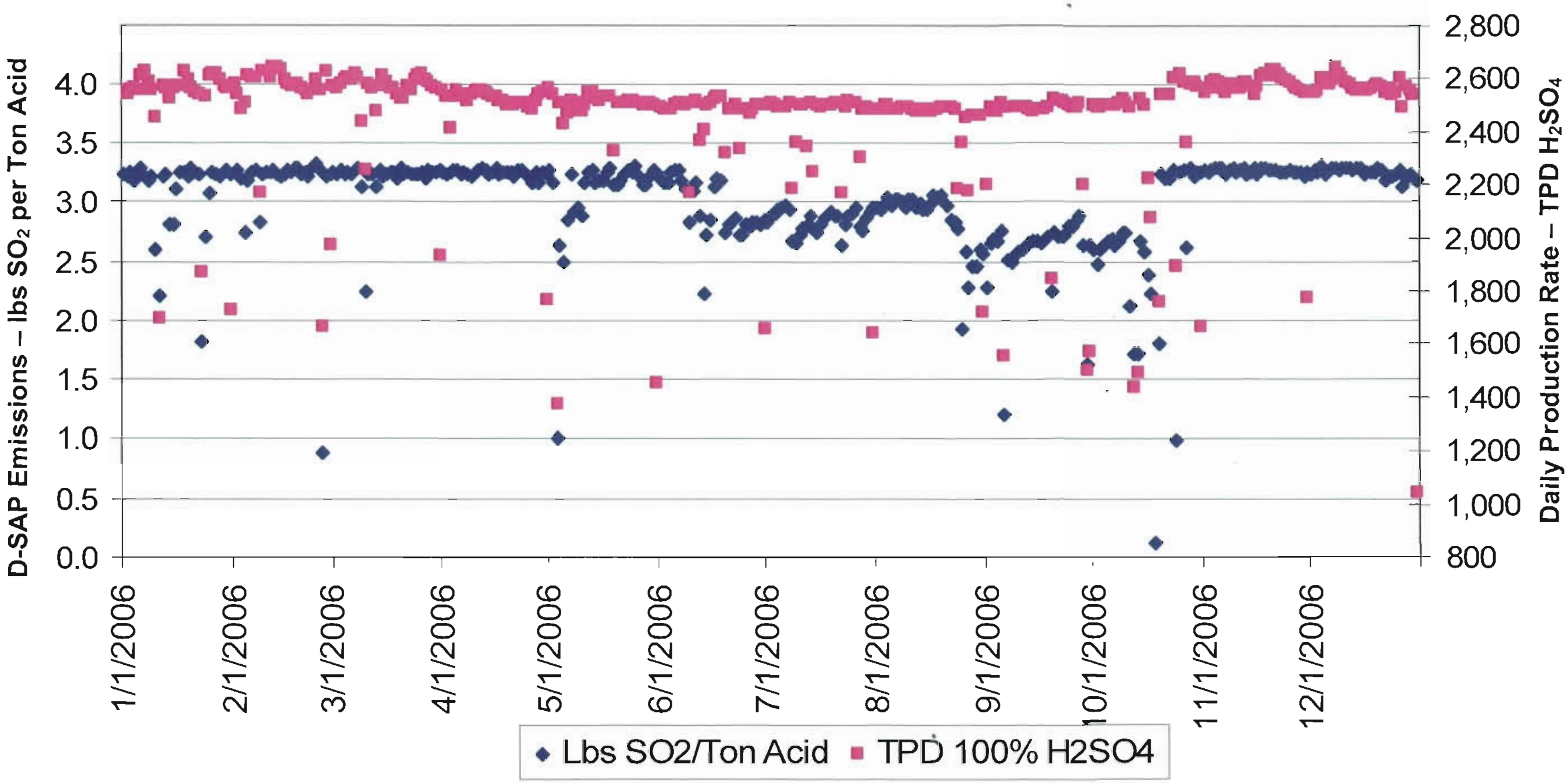

Figure B-7.
CF Plant City Phosphate Complex
D-SAP SO_2 Emissions - Daily Average Pounds SO_2/Ton H_2SO_4

Source: Golder, 2007.

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Golder Associates

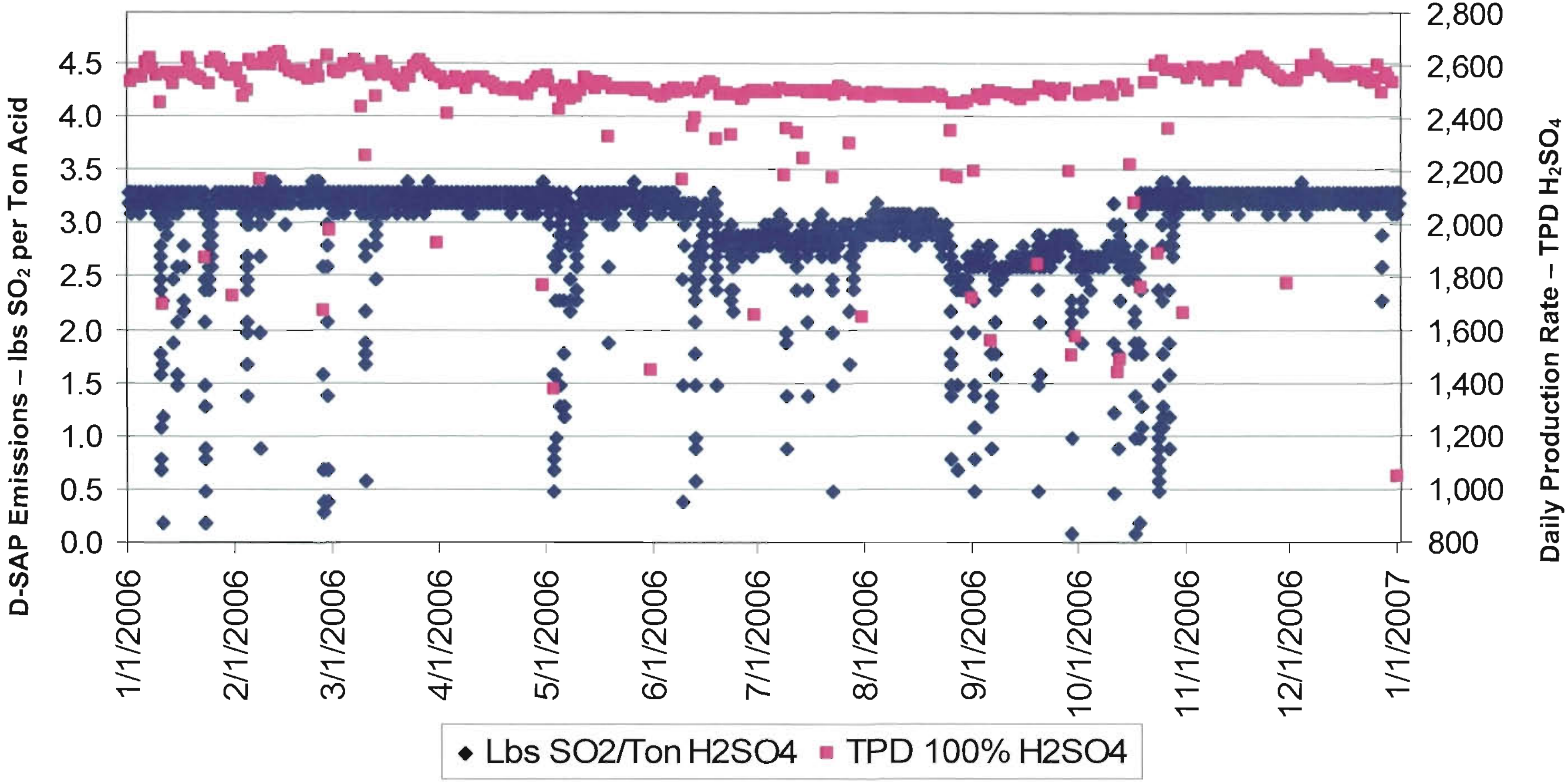

Figure B-8.
CF Plant City Phosphate Complex
D-SAP SO_2 Emissions - 3 Hr Rolling Average Pounds SO_2/Ton H_2SO_4

Source: Golder, 2007.

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REVIEW		

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APPENDIX C

Outokumpu Technology

Process description

Peracidox® Process

The process is a joint development of Outokumpu Technology and Südchemie AG for improving the quality of sulphuric acid plant tail gases.

The Peracidox® process serves to reduce the residual SO_2 content of tail gases from double-catalysis plants, thus improving the air and effluent pollution control previously reached.

The process is characterized by it's ease of control and by the relatively small amount of mechanical equipment required. The process can also be utilized to improve the tail gas conditions during start-up and shut down periods, when the conversion efficiency of the catalyst is not optimized.

Tail gas cleaning unit based on the Peracidox" process for a 330 mtpd Mh double-catalysis plant based on spent acid decomposition.

Outokumpu Technology

Peracidox® process

The Peracidox® process is an oxidation-based sulphur dioxide removal process developed by Outokumpu Technology and Südchemie for purifying the already very dilute tail gas from sulphuric acid plants. It does not lead to any by-products or waste, producing only sulphuric acid, which is recycled to the main sulphuric acid plant.

Principle

Hydrogen peroxide is used to oxidize sulphur dioxide to sulphuric acid:

$$SO_2 + H_2O_2 \longrightarrow H_2SO_4$$

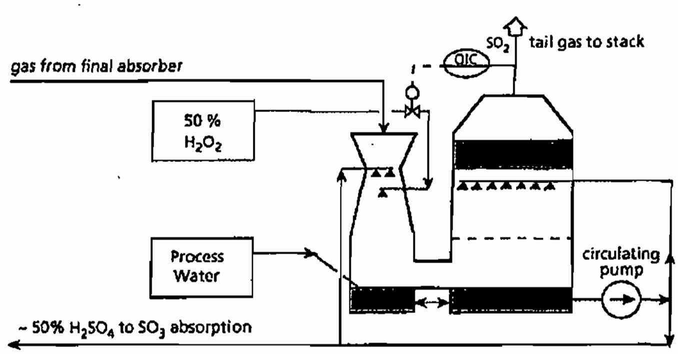
The flow diagram shows the Peracidox® process. Tail gas leaving the final absorber of the sulphuric acid plant is washed in a two-stage Peracidox scrubber with dilute sulphuric acid in which the hydrogen peroxide is dissolved. The attainable sulphur dioxide content in the off gas is as low as 20 ppm SO_2. Sulphuric acid vapour and residual sulphur trioxide are reduced accordingly.

Implementation

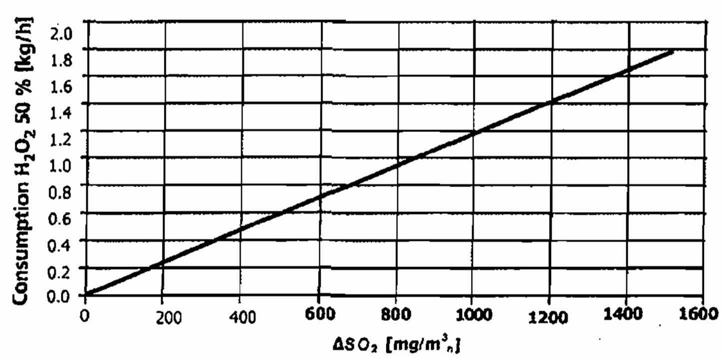
The oxidant is introduced to the acid circuit of the first scrubbing stage at a stoichiometric rate proportional to the sulphur dioxide to be removed (see Diagram). Any residual oxidant in the solution overflowing to the second scrubbing stage finally reacts there with the incoming tail gases. The overflow, which is bled from the circuit consists of dilute sulphuric acid only; the optimum concentration is 50 % H_2SO_4: it is introduced to the final or intermediate absorber of the main acid plant in lieu of dilution water.

Advantages

- ❑ No additional products (sulphuric acid as product, no waste water, no residues)
- ❑ Low opacity
- ❑ High conversion efficiency (virtually stoichiometric)
- ❑ High reliability
- ❑ Low investment cost
- ❑ High flexibility with respect to various SO_2 contents of the gas



Peracidox® **scrubber**



Consumption of H_2O_2 for every 1000 m^3_n/h tailgas

Outokumpu Technology
Ludwig-Erhard-Straße 21- D 61408 Oberursel- Germany
Tel: +49 6171 9693 400- Fax +49 6171 9693 251
http://www.outokumpu.com

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OUTO KUMPU

Peracidox® Process

for improving the quality of sulphuric acid plant tail gases

References

Company	Country	Plant Capacity (mtpd Mh)	Start-up Date	Remarks
Südchemie AG	Germany	250	1971	based on Peroxy- disulphuric acid
Röhm GmbH	Germany	490	1973	based on H_2O_2
Companhia Uniao Fabril	Portugal	718	1976	based on H_2O_2
Degussa AG	Germany	330	1980	based on H_2O_2
Stadtwerke Münster Block 3	Germany	7	1990	based on H_2O_2 Power Station, 126 000 m^3/h (STP)
Kemira Kemi	Sweden	1330	1993	based on H_2O_2
Newmont Gold	USA	490	1994	based on H_2O_2.
CPM	Brazil	400	2001	based on H_2O_2
n.a.	Germany	n.a.	2005	based on H_2O_2
n.a.	USA	n.a.	2006	based on H_2O_2

Mohammad, Sal

From: Klaus.Knabel@outotec.com
Sent: Monday, May 14, 2007 7:44 AM
To: Mohammad, Sal
Subject: Re: FW: Outokumpu Peracidox scrubber

Dear Mr. Mohammad,

for your process data the consumption of peroxid will be approx. 40 Kg/h.
The indicative cost for the scrubber and only the scrubber will be approx.
2.5 Million € LSTK.
If you have any questions don't hesitate to contact us.

With best regards
Dr. Klaus Knabel

Senior Product Engineer, Sulfuric Acid / Off-gas

Tel: +49-6171-9693 193
Mobile: +491726889152
Fax: +49-6171-9693 251
e-mail: klaus.knabel@outotec.com

Outotec GmbH
Ludwig-Erhard-Strasse 21, D-61440 Oberursel, Germany Tel. +49(6171)9693-0, Fax +49(6171) 9693-123, www.outotec.com P.O. Box 1862, D-61408 Oberursel, Germany, VATREG No. DE 811 166 325.
TaxNo. 12557140780
Commercial Registry: Bad Homburg HRB 7241 Board of Management: Dr. Peter Weber (Chairman), Rainer Lüdecke

Please note that Outokumpu Technology changed its name to Outotec on April 24, 2007.

Mohammad, Sal

From: Klaus.Knabel@outotec.com
Sent: Wednesday, May 09, 2007 5:41 AM
To: Mohammad, Sal
Subject: Re: FW: Outokumpu Peracidox scrubber

Dear Mr. Mohammad,

sorry for the late response from our side.
We are working on a more detailed indicative price for such an installation.
You will get this informations next week.
Based on the demand of our US client it is not possible to gave you more information about the plant in USA.

With best regards
Dr. Klaus Knabel

Senior Product Engineer, Sulfuric Acid / Off-gas

Tel: *49-6171-9693 193
Mobile: +491726889152
Fax: *49-6171-9693 251
e-mail: klaus.knabel@outotec.com

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TaxNo. 12557140780
Commercial Registry: Bad Homburg HRB 7241 Board of Management: Dr. Peter Weber (Chairman), Rainer Lüdecke

Please note that Outokumpu Technology changed its name to Outotec on April 24, 2007.

"Mohammad, Sal" <Sal_Mohammad@golder.com>

08.05.2007 22:23

To: <Klaus.Knabel@outokumputechnology.com>

cc

Subject: FW: Outokumpu Peracidox scrubber

Dr. Knabel,

I was wondering if you are able to provide additional cost details of your Peracidox srubber based on my request dated April 11 with some additional design data for a double-absorption SAP? Also, based on your list of Peracidox systems installed so far, is the plant capacity for the system installed in USA in 2006 available?

Thanks in advance for your response.

Sincerely,
Sal Mohammad
Project Engineer
Golder Associates Inc.
6241 NW 23rd Street, Ste. 500
Gainesville, FL 32653
352/336-5600
www.golder.com

-----Original Message-----
From: Mohammad, Sal
Sent: Wednesday, April 11, 2007 12:19 PM
To: 'Klaus.Knabel@outokumputechnology.com'
Subject: RE: Outokumpu Peracidox scrubber

Dr. Knabel,
Thank you for your response. I have provided some design parameters below and would very much appreciate if you can provide some cost information based on these. If you want additional information we would be happy to send you those.

Plant: Double-absorption
Production capacity: 3,000 tons per day
Current SO2 emissions: 3.5 lb/ton of H2SO4 production (24-hour average)
Target SO2 emissions: 3.0 lb/ton of H2SO4 production
Plant has a 200 ft stack with exit flow rate around 150,000 acfm at 160 degrees F temperature

Thank you,

Sal Mohammad
Project Engineer
Golder Associates Inc.
Gainesville Office
6241 NW 23rd Street, Ste. 500
Gainesville, FL 32653
352/336-5600
www.golder.com

-----Original Message-----
From: Klaus.Knabel@outokumputechnology.com
[mailto:Klaus.Knabel@outokumputechnology.com]
Sent: Wednesday, April 11, 2007 10:16 AM
To: Mohammad, Sal
Subject: Outokumpu Peracidox scrubber

Dear Mr. Mohammad

Attached you will find some information about the Peracidox-process.
For sure is it possible to use a Peracidox.Scrubber after a SAP to reduce SO2-Emissions. Without more information about the size of such a unit and the required performance data it is hard to give you any serious cost information.
Approx. the cost will be in the range of several Mio $ for the installation.

(See attached file: Peracidox_Process_Page2.pdf)(See attached file: Peracidox_Process_Page1.pdf)(See attached file: References_Peracidox.pdf)

With best regards

Dr. K. Knabel

Senior Product Engineer, Sulfuric Acid / Off-gas

Tel: *49-6171-9693 193
Mobile: +491726889152
Fax: *49-6171-9693 251
e-mail: klaus.knabel@outokumputechnology.com

Outokumpu Technology GmbH
Ludwig-Erhard-Strasse 21, D-61440 Oberursel, Germany Tel. +49(6171)9693-0, Fax +49(6171) 9693-123, www.outokumputechnology.com P.O. Box 1862, D-61408 Oberursel, Germany, VATREG No. DE 811 166 325.
TaxNo. 12557140780
Commercial Registry: Bad Homburg HRB 7241 Board of Management: Dr. Peter Weber (Chairman), Rainer Lüdecke

----- Forwarded by Kerstin Riemann/Metallurgy/OBERURSEL/Outokumpu on 11.04.07 15:49 -----

<smohammad@golder.com>
03.04.07 22:28

To: <acid@outokumputechnology.com>
cc:
Subject: Enquiry for Outokumpu Technology

Question : I would like to receive more information on your Peracidox system. Has it been employed commercially at SAPs? Is it possible to employ the system on SAPs with 1,600 tons/day production capacity? I will also appreciate approximate cost information.

```
Name          : salahuddin mohammad
Email         : smohammad@golder.com
From          : United States
Phone         : 352 336 5600
Company/Org   : Golder Associates
Company desc  : 6241 NW 23rd St, Suite 500
Sent from     :
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Mohammad, Sal

From: Klaus.Knabel@outokumputechnology.com
Sent: Wednesday, April 11, 2007 10:16 AM
To: Mohammad, Sal
Subject: Outokumpu Peracidox scrubber

Attachments: Peracidox_Process_Page2.pdf; Peracidox_Process_Page1.pdf; References_Peracidox.pdf

Peracidox_Process_Page2.pdf Peracidox_Process_Page1.pdf References_Peracidox.pdf (25

Dear Mr. Mohammad

Attached you will find some information about the Peracidox-process.
For sure is it possible to use a Peracidox.Scrubber after a SAP to reduce SO2-Emissions.
Without more information about the size of such a unit and the required performance data it is hard to give you any serious cost information.
Approx. the cost will be in the range of several Mio $ for the installation.

(See attached file: Peracidox_Process_Page2.pdf)(See attached file: Peracidox_Process_Pagel.pdf)(See attached file: References_Peracidox.pdf)

With best regards

Dr. K. Knabel

Senior Product Engineer, Sulfuric Acid / Off-gas

Tel: *49-6171-9693 193
Mobile: +491726889152
Fax: *49-6171-9693 251
e-mail: klaus.knabel@outokumputechnology.com

Outokumpu Technology GmbH
Ludwig-Erhard-Strasse 21, D-61440 Oberursel, Germany Tel. +49(6171)9693-0, Fax +49(6171) 9693-123, www.outokumputechnology.com P.O. Box 1862, D-61408 Oberursel, Germany, VATREG No. DE 811 166 325.
TaxNo. 12557140780
Commercial Registry: Bad Homburg HRB 7241 Board of Management: Dr. Peter Weber (Chairman), Rainer Lüdecke

----- Forwarded by Kerstin Riemann/Metallurgy/OBERURSEL/Outokumpu on 11.04.07 15:49 -----

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|          |             <smohammad@golde|
|          |             r.com>          |
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|          |                         |
|          |         03.04.07 22:28  |
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>--------------------------------------------------------------------------------------------
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  |
|
  |          To:       <acid@outokumputechnology.com>
|
  |          cc:
|
  |          Subject: Enquiry for Outokumpu Technology
|

>--------------------------------------------------------------------------------------------
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Question : I would like to receive more information on your Peracidox system. Has it been employed commercially at SAPs? Is it possible to employ the system on SAPs with 1,600 tons/day production capacity? I will also appreciate approximate cost information.

Name : salahuddin mohammad
Email : smohammad@golder.com
From : United States
Phone : 352 336 5600
Company/Org : Golder Associates
Company desc : 6241 NW 23rd St, Suite 500
Sent from :

TABLE C-1
COST EFFECTIVENESS OF HYDROGEN PEROXIDE SCRUBBING ON CFI "A", "B", "C", and "D" SAPs

Cost Items	Cost Factors[a]	Cost of Peracidox System ($) "A" SAP	"B" SAP	"C" SAP	"D" SAP
DIRECT CAPITAL COSTS (DCC):					
Purchased Equipment Cost (PEC)					
Scrubber (EC)	Vendor quote[b]	1,456,098	1,792,120	3,080,206	3,080,206
Instrumentation	10% of EC	145,610	179,212	308,021	308,021
Freight	5% of EC	72,805	89,606	154,010	154,010
Taxes	Florida Sales Tax: 6.25% of EC	91,006	112,008	192,513	192,513
Total PEC:		1,765,518	2,172,946	3,734,750	3,734,750
Direct Installation Costs					
Foundations & Supports	12% of PEC	211,862	211,862	211,862	211,862
Handling & Erection	40% of PEC	706,207	706,207	706,207	706,207
Electrical	1% of PEC	17,655	17,655	17,655	17,655
Piping	30% of PEC	529,655	529,655	529,655	529,655
Painting/Insulation	2% of PEC	35,310	35,310	35,310	35,310
Total Direct Installation Costs		1,500,690	1,500,690	1,500,690	1,500,690
Total DCC (PEC + Direct Installation):		3,266,209	3,673,636	5,235,441	5,235,441
INDIRECT CAPITAL COSTS (ICC)					
Engineering	10% of PEC	176,552	176,552	176,552	176,552
Construction and field expenses	10% of PEC	176,552	176,552	176,552	176,552
Contractor Fees	10% of PEC	176,552	176,552	176,552	176,552
Startup	1% of PEC	17,655	17,655	17,655	17,655
Performance test +	1% of PEC	17,655	17,655	17,655	17,655
Total ICC:		564,966	564,966	564,966	564,966
PROJECT CONTINGENCY (Retrofit):	25% of DCC+ICC	957,794	1,059,650	1,450,102	1,450,102
TOTAL CAPITAL INVESTMENT (TCI):	DCC + ICC + Project Contingencies	4,788,968	5,298,252	7,250,508	7,250,508
DIRECT OPERATING COSTS (DOC):					
(1) Operating Labor					
Operator	12 hr/day, $30/hr, 365 days/yr	131,400	131,400	131,400	131,400
Supervisor	15% of operator cost	19,710	19,710	19,710	19,710
(2) Maintenance					
Labor	2 hr/shift, $40/hr, 2 shifts/day	58,400	58,400	58,400	58,400
Materials	100% of maintenance labor	58,400	58,400	58,400	58,400
(3) Operating Materials					
Hydrogen Peroxide (H_2O_2)	40 kg/hr, $0.345/lb	266,437	266,437	266,437	266,437
H_2O_2 Freight	$3.5/mile from Charleston, SC	22,500	22,500	22,500	22,500
(20 trips/yr in 40,000 gallon trucks)	(approx. 450 miles)	22,500	22,500	22,500	22,500
Water makeup	X gph, $2.36/1000 gal	unknown	unknown	unknown	unknown
(4) Liquid Waste Disposal	103 lb/hr, $30/ton	13,534	13,534	13,534	13,534
(5) Electricity - Operating	$0.06/kWh, X kW, 8760 hr/yr	unknown	unknown	unknown	unknown
Total DOC:		592,881	592,881	592,881	592,881
INDIRECT OPERATING COSTS (IOC):					
Overhead	60% of oper. labor & maintenance	320,608	320,608	320,608	320,608
Property Taxes	1% of total capital investment	9,578	10,597	14,501	14,501
Insurance	1% of total capital investment	9,578	10,597	14,501	14,501
Administration	2% of total capital investment	19,156	21,193	29,002	29,002
Total IOC:		358,920	362,994	378,612	378,612
CAPITAL RECOVERY COSTS (CRC):	CRF of 0.1627 times TCI (10 yrs @ 10%)	779,165	862,026	1,179,658	1,179,658
ANNUALIZED COSTS (AC)	DOC + IOC + CRC	1,730,967	1,817,901	2,151,151	2,151,151
BASELINE SO_2 EMISSIONS (TPY) :	Highest actual emissions in 2003-2004	682.0	718.0	1,509.0	1,402.0
CONTROLLED SO_2 EMISSIONS (TPY) :	15% Reduction (Vendor info for system from 3.5 lb/ton to 3 lb/ton H2SO4)	579.7	610.3	1,282.7	1,191.7
REDUCTION IN SO_2 EMISSONS (TPY):	Baseline - Controlled	102.3	107.7	226.4	210.3
COST EFFECTIVENESS:	$ per ton of SO2 Removed	16,920	16,879	9,504	10,229
BASELINE VISIBILITY IMPACT (dv) :	Table 3-6, Highest from 2001-2003	0.145	0.174	0.237	0.232
CONTROLLED VISIBILITY IMPACT (dv) :	Assumed Reduction, 15% [c]	0.123	0.148	0.201	0.197
REDUCTION IN VISIBILITY IMPACT (dv) :	Baseline - Controlled	0.022	0.026	0.036	0.035
COST EFFECTIVENESS OF VISIBILITY REDUCTION ($/dv) :	AC/Reduction in visibility	79,584,667	69,651,391	60,510,587	61,814,694

[a] Unless otherwise specified, factors and cost estimates reflect OAQPS Cost Manual, Section 5, Sixth edition.

[b] Based on information on the costs of Peracidox Process Hydrogen Peroxide scrubbing from Outotec (formerly Outokumpo Technology). Vendor cost for 3,000 TPD system prorated based on the permit capacity of the SAPs at CFI.

[c] Since more that 99% of the visibility impacts from the SAPs is due to sulfate particles, reduction in visibility impact is conservatively assumed same as the reduction in SO_2 emissions.

APPENDIX D

TABLE D-1
SUMMARY OF RECENT EMISSION TESTS AT THE SAP PLANTS
CF INDUSTRIES, PLANT CITY FACILITY

Test Date	Unit	SO_2		NO_x	
		avg lb/hr	avg lb/ton H_2SO_4[a]	avg lb/hr	avg lb/ton H_2SO_4[a]
A SAP					
2005	A SAP	154.4	3.09	--	--
2006	A SAP	182.7	3.58	--	--
2007	A SAP	174.0	3.40	--	--
B SAP					
2005	B SAP	151.2	3.10	--	--
2006	B SAP	169.5	3.57	--	--
2007	B SAP	166.8	3.66	--	--
C SAP					
2005	C SAP	371.2	3.33	10.68	0.10
2006	C SAP	367.7	3.32	10.68	0.09
2007	C SAP	367.3	3.30	9.52	0.09
D SAP					
2005	D SAP	369.7	3.42	11.15	0.10
2006	D SAP	356.8	3.39	11.15	0.10
2007	D SAP	367.3	3.37	8.75	0.08

Source: CF Industries, 2007.

APPENDIX E

TABLE 5-3
COST EFFECTIVENESS OF DOUBLE ABSORPTION SAP, CF INDUSTRIES "A" SAP
(Revised June, 2007)

Cost Items	Cost Factors[a]	Cost ($)
DIRECT CAPITAL COSTS (DCC):		
Purchased Equipment Cost (PEC)		
Converter + Absorption Tower	Vendor Quote [b]	13,737,997
Instruments and Controls	Included	0
Freight	Included	0
Taxes	6.25% Sales Tax	858,625
Total PEC:		14,596,622
Direct Installation Costs		
Foundation and Structure Support	Included	0
Handling & Erection	Included	0
Electrical	Included	0
Piping	Included	0
Insulation for ductwork	Included	0
Painting	Included	0
Total Direct Installation Costs		0
Total DCC (PEC + Direct Installation):		14,596,622
INDIRECT CAPITAL COSTS (ICC)		
Engineering	10% of PEC	1,459,662
Construction and field expenses	10% of PEC	1,459,662
Contractor Fees	10% of PEC	1,459,662
Startup	1% of PEC	145,966
Performance test +	1% of PEC	145,966
Total ICC:		4,670,919
PROJECT CONTINGENCY (Retrofit):	25% of DCC+ICC	4,816,885
TOTAL CAPITAL INVESTMENT (TCI)	DCC + ICC + Project Contingencies	24,084,426
DIRECT OPERATING COSTS (DOC):		
(1) Operating Labor		
Operator	12 hr/day, $30/hr, 365 days/yr	131,400
Supervisor	15% of operator cost	19,710
(2) Maintenance	Engineering estimate, 1% PEC	145,966
(3) Replacement Parts	Engineering estimate, 1% PEC	145,966
(4) Electricity - Operating	$0.07/kWh, 8760 hr/yr	70,000
Total DOC:		513,042
INDIRECT OPERATING COSTS (IOC):		
Overhead	60% of oper. labor & maintenance	178,246
Property Taxes	1% of total capital investment	240,844
Insurance	1% of total capital investment	240,844
Administration	2% of total capital investment	481,689
Total IOC: .		1,141,623
CAPITAL RECOVERY FACTOR (CRF)*:	n=yrs; i = %	0.1627
CAPITAL RECOVERY COSTS (CRC):	CRF of 0.1627 times TCI (10 yrs @ 10%)	3,918,536
ANNUALIZED COSTS (AC)	DOC + IOC + CRC	5,573,201
BASELINE SO_2 EMISSIONS (TPY):	Highest actual emissions in 2003-2004	682.0
CONTROLLED SO_2 EMISSIONS (TPY):	95% Reduction	34.1
REDUCTION IN SO_2 EMISSONS (TPY):	Baseline - Controlled	647.9
COST EFFECTIVENESS:	$ per ton of SO2 Removed	8,602
BASELINE VISIBILITY IMPACT (dv):	Table 3-6, Highest from 2001-2003	0.145
CONTROLLED VISIBILITY IMPACT (dv):	Assuming 95% Reduction	0.007
REDUCTION IN VISIBILITY IMPACT (dv):	Baseline - Controlled	0.138
COST EFFECTIVENESS OF VISIBILITY REDUCTION ($/dv):	*AC/Reduction in visibility*	*40,458,812*

Footnotes:

[a] Unless otherwise specified, factors and cost estimates reflect OAQPS Cost Manual, Section 3, Sixth edition.

[b] Based on 1996 Monsanto quote to convert two single-absorption 1,300 TPD SAPs to double-absorption for the price of $16.2 million and one plant for the price of $10 million. Cost inflated to 2007 dollars using US Department of Labor's Producer Price Index.

TABLE 5-4
COST EFFECTIVENESS OF DOUBLE ABSORPTION SAP, CF INDUSTRIES "B" SAP
(Revised June, 2007)

Cost Items	Cost Factors[a]	Cost ($)
DIRECT CAPITAL COSTS (DCC):		
Purchased Equipment Cost (PEC)		
Converter + Absorption Tower	Vendor Quote [b]	16,908,304
Instruments and Controls	Included	0
Freight	Included	0
Taxes	6.25% Sales Tax	1,056,769
Total PEC:		17,965,073
Direct Installation Costs		
Foundation and Structure Support	Included	0
Handling & Erection	Included	0
Electrical	Included	0
Piping	Included	0
Insulation for ductwork	Included	0
Painting	Included	0
Total Direct Installation Costs		0
Total DCC (PEC + Direct Installation):		17,965,073
INDIRECT CAPITAL COSTS (ICC):		
Engineering	10% of PEC	1,796,507
Construction and field expenses	10% of PEC	1,796,507
Contractor Fees	10% of PEC	1,796,507
Startup	1% of PEC	179,651
Performance test +	1% of PEC	179,651
Total ICC:		5,748,823
PROJECT CONTINGENCY (Retrofit):	25% of DCC+ICC	5,928,474
TOTAL CAPITAL INVESTMENT (TCI):	DCC + ICC + Project Contingencies	29,642,371
DIRECT OPERATING COSTS (DOC):		
(1) Operating Labor		
Operator	12 hr/day, $30/hr, 365 days/yr	131,400
Supervisor	15% of operator cost	19,710
(2) Maintenance	Engineering estimate, 1% PEC	179,651
(3) Replacement Parts	Engineering estimate, 1% PEC	179,651
(4) Electricity - Operating	$0.07/kWh, 8760 hr/yr	70,000
Total DOC:		580,411
INDIRECT OPERATING COSTS (IOC):		
Overhead	60% of oper. labor & maintenance	198,456
Property Taxes	1% of total capital investment	296,424
Insurance	1% of total capital investment	296,424
Administration	2% of total capital investment	592,847
Total IOC:		1,384,151
CAPITAL RECOVERY FACTOR (CRF)*:	n=yrs; i = %	0.1627
CAPITAL RECOVERY COSTS (CRC):	CRF of 0.1627 times TCI (10 yrs @ 10%)	4,822,814
ANNUALIZED COSTS (AC):	DOC + IOC + CRC	6,787,377
BASELINE SO_2 EMISSIONS (TPY) :	Highest actual emissions in 2003-2004	718.0
CONTROLLED SO_2 EMISSIONS (TPY) :	95% Reduction	35.9
REDUCTION IN SO_2 EMISSONS (TPY):	Baseline - Controlled	682.1
COST EFFECTIVENESS:	$ per ton of SO2 Removed	9,951
BASELINE VISIBILITY IMPACT (dv) :	Table 3-6, Highest from 2001-2003	0.174
CONTROLLED VISIBILITY IMPACT (dv) :	Assuming 95% Reduction	0.009
REDUCTION IN VISIBILITY IMPACT (dv) :	Baseline - Controlled	0.165
COST EFFECTIVENESS OF VISIBILITY REDUCTION ($/dv) :	AC/Reduction in visibility	41,060,959

Footnotes:

[a] Unless otherwise specified, factors and cost estimates reflect OAQPS Cost Manual, Section 5, Sixth edition.

[b] Based on 1996 Monsanto quote to convert two single-absorption 1,300 TPD SAPs to double-absorption for the price of $16.2 million and one plant for the price of $10 million. Cost inflated to 2007 dollars using US Department of Labor's Producer Price Index.

TABLE 5-5
COST EFFECTIVENESS OF AMMONIA SCRUBBING, CF INDUSTRIES "C" OR "D" SAP
(Revised July, 2007)

Cost Items	Cost Factors[a]	Ammonia Scrubber System Cost ($) "C" SAP	Ammonia Scrubber System Cost ($) "D" SAP
DIRECT CAPITAL COSTS (DCC):			
Purchased Equipment Cost (PEC)			
Absorber + packing + auxiliary equipment	Vendor quote for 2,750 TPD plant[b]	8,000,000	8,000,000
New Blower	100,000 SCFM for providing 30"	250,000	250,000
Mist eliminator	~50 candles	300,000	300,000
Ammonia storage tank	not necessary	0	0
Two ammonium sulfate storage tanks	Vendor quote	600,000	600,000
Instrumentation	10% of EC	915,000	915,000
Freight	5% of EC	457,500	457,500
Taxes	6.25% Sales Tax	571,875	571,875
Total PEC:		11,094,375	11,094,375
Direct Installation Costs			
Items excluded from vendor quote: amm. sulfate storage tanks			
Foundations	12% of PEC for tanks	87,120	87,120
Handling & erection	40% of PEC for tanks	304,920	304,920
Electrical	1% of PEC for tanks	7,260	7,260
Piping	30% of PEC for tanks	217,800	217,800
Insulation	1% of PEC for tanks	7,260	7,260
Painting	1% of PEC for tanks	7,260	7,260
Total Direct Installation Costs		631,620	631,620
Total DCC (PEC + Direct Installation):		11,725,995	11,725,995
INDIRECT CAPITAL COSTS (ICC):			
Engineering	10% of PEC	1,109,438	1,109,438
Construction and field expenses	10% of PEC	1,109,438	1,109,438
Contractor Fees	10% of PEC	1,109,438	1,109,438
Startup	1% of PEC	110,944	110,944
Performance test +	1% of PEC	110,944	110,944
Total ICC:		3,550,200	3,550,200
PROJECT CONTINGENCY (retrofit)	25% of DCC+ICC	3,819,049	3,819,049
TOTAL CAPITAL INVESTMENT (TCI):	DCC + ICC	19,095,244	19,095,244
DIRECT OPERATING COSTS (DOC):			
(1) Operating Labor			
Operator	12 hr/day, $30/hr	131,400	131,400
Supervisor	15% of operator cost	19,710	19,710
(2) Maintenance			
Labor	2 hr/shift, $40/hr, 2 shifts/day	58,400	58,400
Materials	100% of maintenance labor	58,400	58,400
(3) Operating Materials			
Ammonia	0.53 tons NH_3/ton SO_2, $325/ton	259,925	241,495
(4) Liquid Waste Disposal	5.9 tons Amm. Sulfate sol./ton SO_2, $77/ton[c]	651,262	605,082
(5) Electricity - Operating	$0.07/kWh, 700 kW, 8760 hr/yr	429,240	429,240
Total DOC:		1,608,337	1,543,727
INDIRECT OPERATING COSTS (IOC):			
Overhead	60% of oper. labor & maintenance	316,701	305,643
Property Taxes	1% of total capital investment	190,952	190,952
Insurance	1% of total capital investment	190,952	190,952
Administration	2% of total capital investment	381,905	381,905
Total IOC:		1,080,511	1,069,452
CAPITAL RECOVERY FACTOR (CRF)*:	n=yrs; i = %	0.1627	0.1627
CAPITAL RECOVERY COSTS (CRC):	CRF of 0.1627 *times* TCI *(10 yrs @ 10%)*	3,107,663	3,107,663
ANNUALIZED COSTS (AC):	DOC + IOC + CRC	5,796,511	5,720,842
BASELINE SO_2 EMISSIONS (TPY) :	Highest actual emissions in 2003-2004	1,509.0	1,402.0
CONTROLLED SO_2 EMISSIONS (TPY) :	95% Reduction	75.5	70.1
REDUCTION IN SO_2 EMISSIONS (TPY):	Baseline - Controlled	1,433.6	1,331.9
COST EFFECTIVENESS:	$ per ton of SO_2 Removed	4,043	4,295
BASELINE VISIBILITY IMPACT (dv) :	Table 3-6, Highest from 2001-2003	0.237	0.232
CONTROLLED VISIBILITY IMPACT (dv) :	Assuming 95% Reduction	0.012	0.012
REDUCTION IN VISIBILITY IMPACT (dv) :	Baseline - Controlled	0.225	0.220
COST EFFECTIVENESS OF VISIBILITY REDUCTION ($/dv) :	AC/Reduction in visibility	25,745,107	25,956,634

Footnotes:

[a] Unless otherwise specified, factors and cost estimates reflect OAQPS Cost Manual, Section 3, Sixth edition.

[b] Based on quote from MECS, Inc., March 2007.

[c] Based on molecular weights, ammonium sulfate MW= 128; SO_2 MW = 64. Solution is 34% amm. sulfate. 128/64 / 0.34 = 5.9.

***The CRF is computed according to the standard formula:**

$CRF = i(1+i)^n/[(1+i)^n-1]$

where: i = annual interest rate (decimal)

n = control system life (years)

APPENDIX F

MECS, INC.
14522 South Outer Forty Rd.
Chesterfield, MO 63017
314-275-5700
314-275-5701 FAX
www.mecsglobal.com

March 14, 2007

Mr. Randy Charlot
CF Industries, Inc.
P.O. Drawer "L"
Plant City, FL 33565

Randy,

The OOM for an ammonia scrubber for C or D plant at 2750 STPD would run about $8M per plant. This is just for the scrubber battery limits and does not include any storage or costs for piping the ammonia / ammonia sulfate to and from C or D plant.

Regards,

John Horne
MECS
Office Ph: 314-275-5812
Mobile Ph: 314-616-0082
Fax Ph: 314-275-5918
Email: john.r.horne@mecsglobal.com

APPENDIX G

FACILITY INFORMATION

Professional Engineer Certification

1.	Professional Engineer Name: **David A. Buff** Registration Number: **19011**
2.	Professional Engineer Mailing Address... Organization/Firm: **Golder Associates Inc.**** Street Address: **6241 NW 23rd Street, Suite 500** City: **Gainesville** State: **FL** Zip Code: **32653**
3.	Professional Engineer Telephone Numbers... Telephone: **(352) 336-5600** ext.**545** Fax: **(352) 336-6603**
4.	Professional Engineer Email Address: **dbuff@golder.com**
5.	Professional Engineer Statement:

I, the undersigned, hereby certify, except as particularly noted herein, that:*

(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this application for air permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and

(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.

(3) If the purpose of this application is to obtain a Title V air operation permit (check here ☐, if so), I further certify that each emissions unit described in this application for air permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance plan and schedule is submitted with this application.

(4) If the purpose of this application is to obtain an air construction permit (check here ☒, if so) or concurrently process and obtain an air construction permit and a Title V air operation permit revision or renewal for one or more proposed new or modified emissions units (check here ☐, if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.

(5) If the purpose of this application is to obtain an initial air operation permit or operation permit revision or renewal for one or more newly constructed or modified emissions units (check here ☐, if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.

David A. Buff
Signature

7/5/07
Date

(seal)

* Attach any exception to certification statement.

**** Board of Professional Engineers Certificate of Authorization #00001670**