

**POWER PLANTS – FGD
LIMESTONE SLURRY PROCESSES
w/ PULVERIZED LIMESTONE**

&

**DSI PROCESSES TO SCRUBBER and/or
IN-FURNACE TREATMENTS**

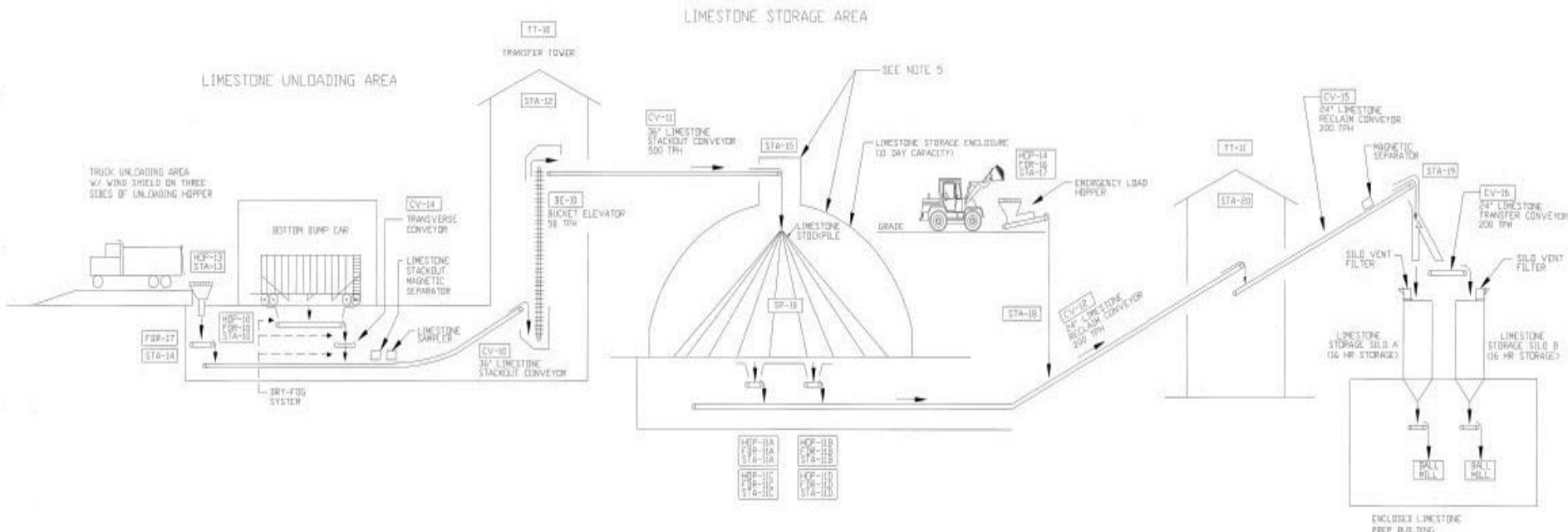
McIlvaine Hot Topic Hour—June 20, 2013

Presented by: Charles S. Alack
Semi-Bulk Systems, Inc.



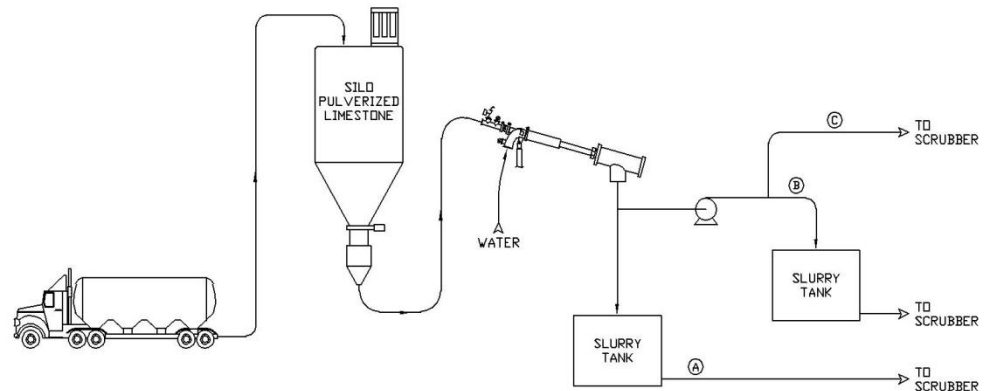
TRADITIONAL PROCESS [Crushed Limestone] FOR LIMESTONE UNLOADING, HANDLING, STORAGE & SLURRY PREP [Ball Mills]

- Limestone Supplier delivers crushed limestone to Power Plant
- Power Plant
 - Unload & mechanical convey to storage
 - Mechanical transfer to multiple day bins feeding Ball Mills
 - Operates Ball Mill processes
 - Slurry to storage tanks
 - Feed slurry to Scrubber



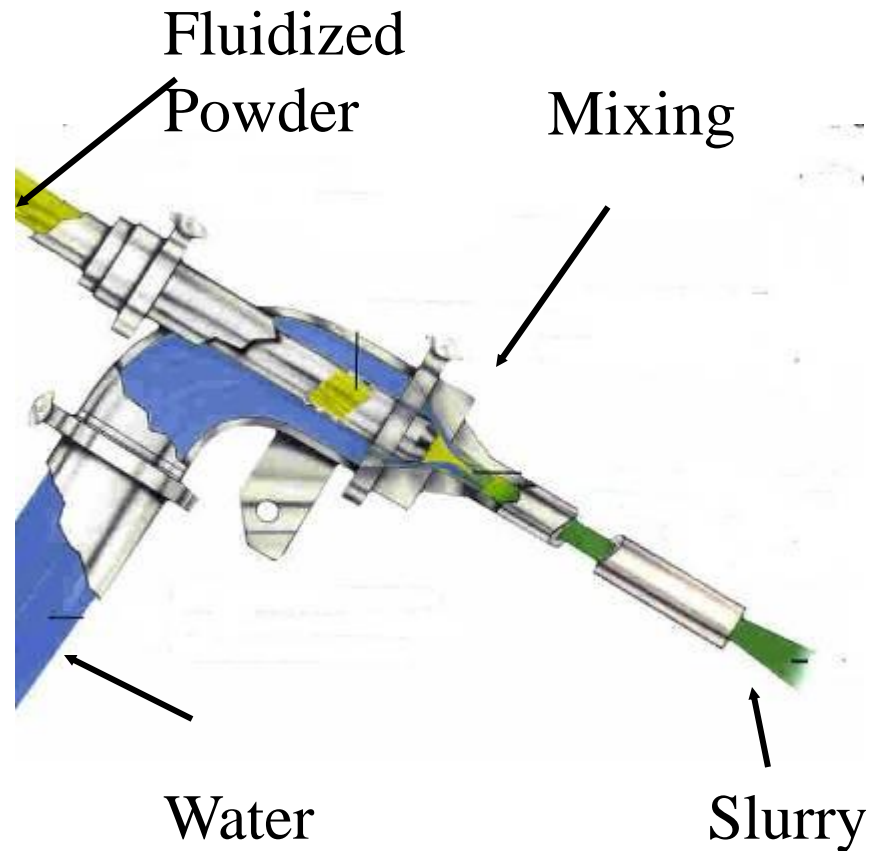
21st CENTURY PROCESSES [Pulverized Limestone] for LIMESTONE UNLOADING, HANDLING, STORAGE & SLURRY PREP [Vacucam® Ejector Mixer]

- Limestone Supplier:
 - Produces pulverized limestone w/ roller mills.
 - Provide logistics for supplier storage and regional distribution
 - Deliver and unload pulverized limestone to Power Plant silo.
- Power Plant
 - Supervision monitors automated slurry making process



VACUCAM® Ejector Mixer

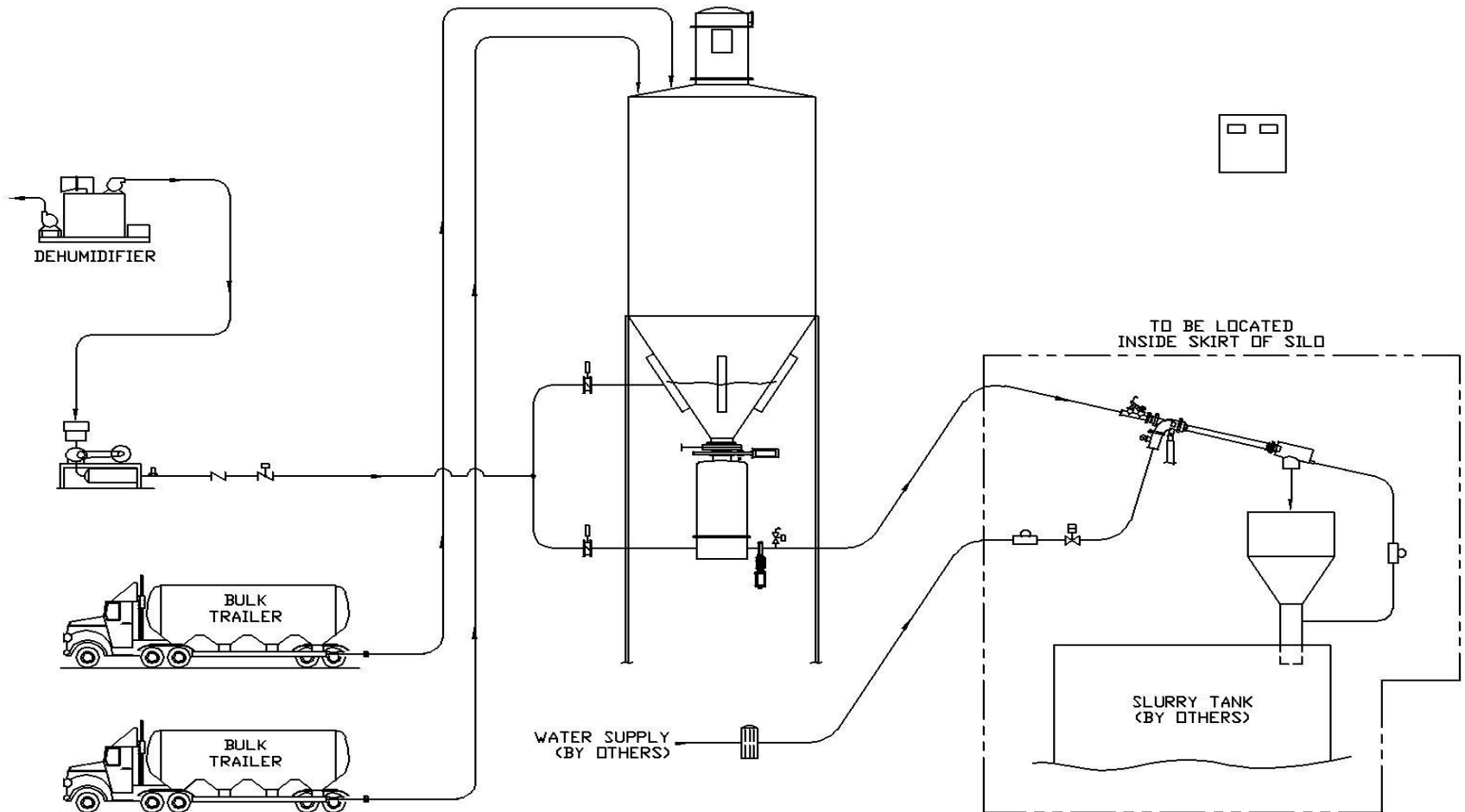
- High Performance
- High Wetting/Dispersion Efficiency
- Operates under high vacuum for exposing maximum surface area of liquid to dry product
- No moving parts
- No maintenance



POWER PLANT Process Options

1. Single Pass Process Direct Into Slurry Storage Tank
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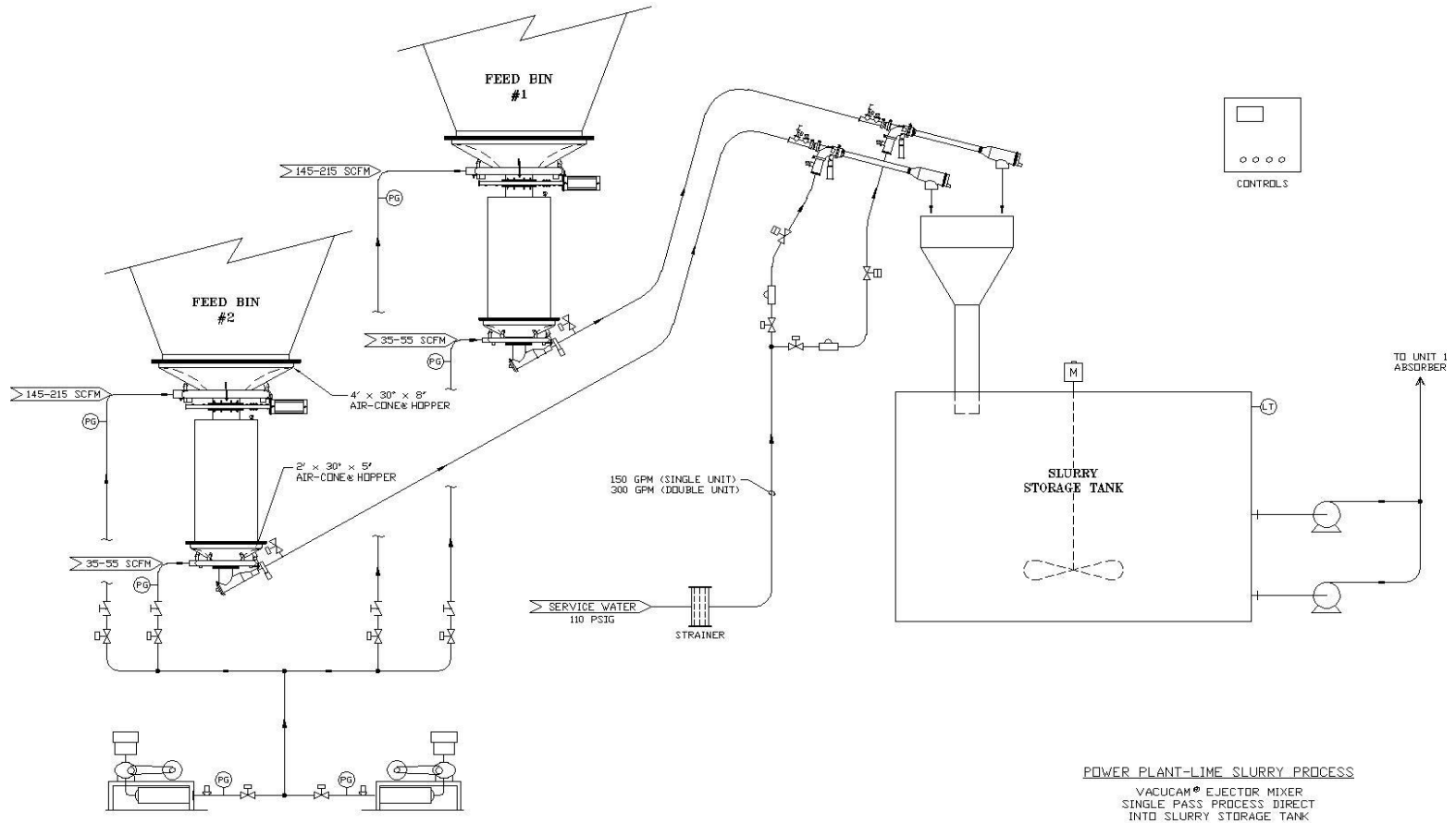
POWER PLANT-LIMESTONE SLURRY PROCESS SINGLE PASS PROCESS DIRECT INTO SLURRY STORAGE



POWER PLANT-LIMESTONE SLURRY PROCESS

SINGLE PASS PROCESS DIRECT INTO SLURRY STORAGE

Dual Silo Feed to Dual Mixer System

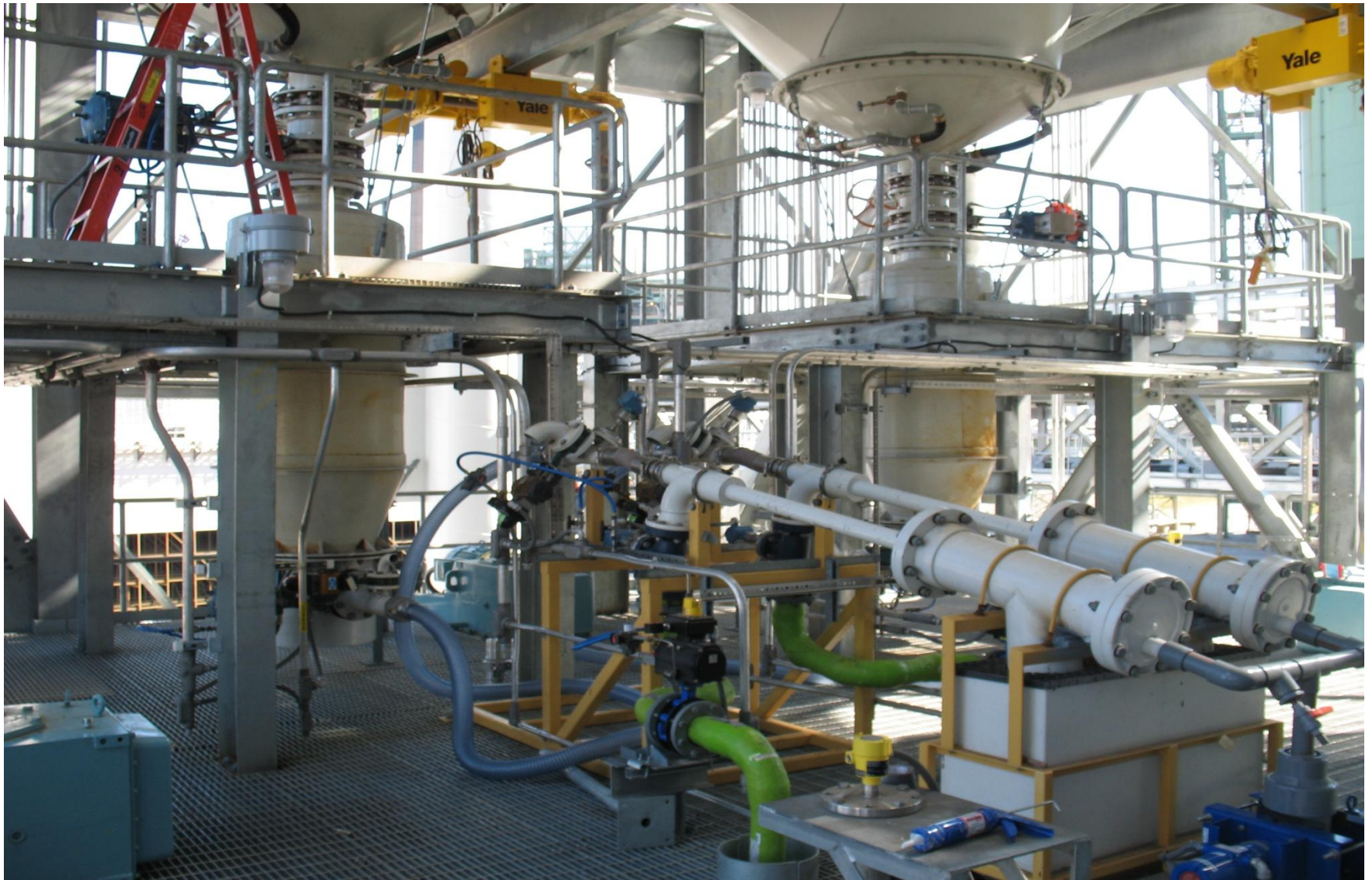


Pulverized Limestone Storage Two silos w/ Dual Cone Outlets



VACUCAM® LIMESTONE SLURRY PROCESS
DUAL EJECTOR MIXER SINGLE PASS IN-LINE SLURRY
DIRECT TO SLURRY STORAGE



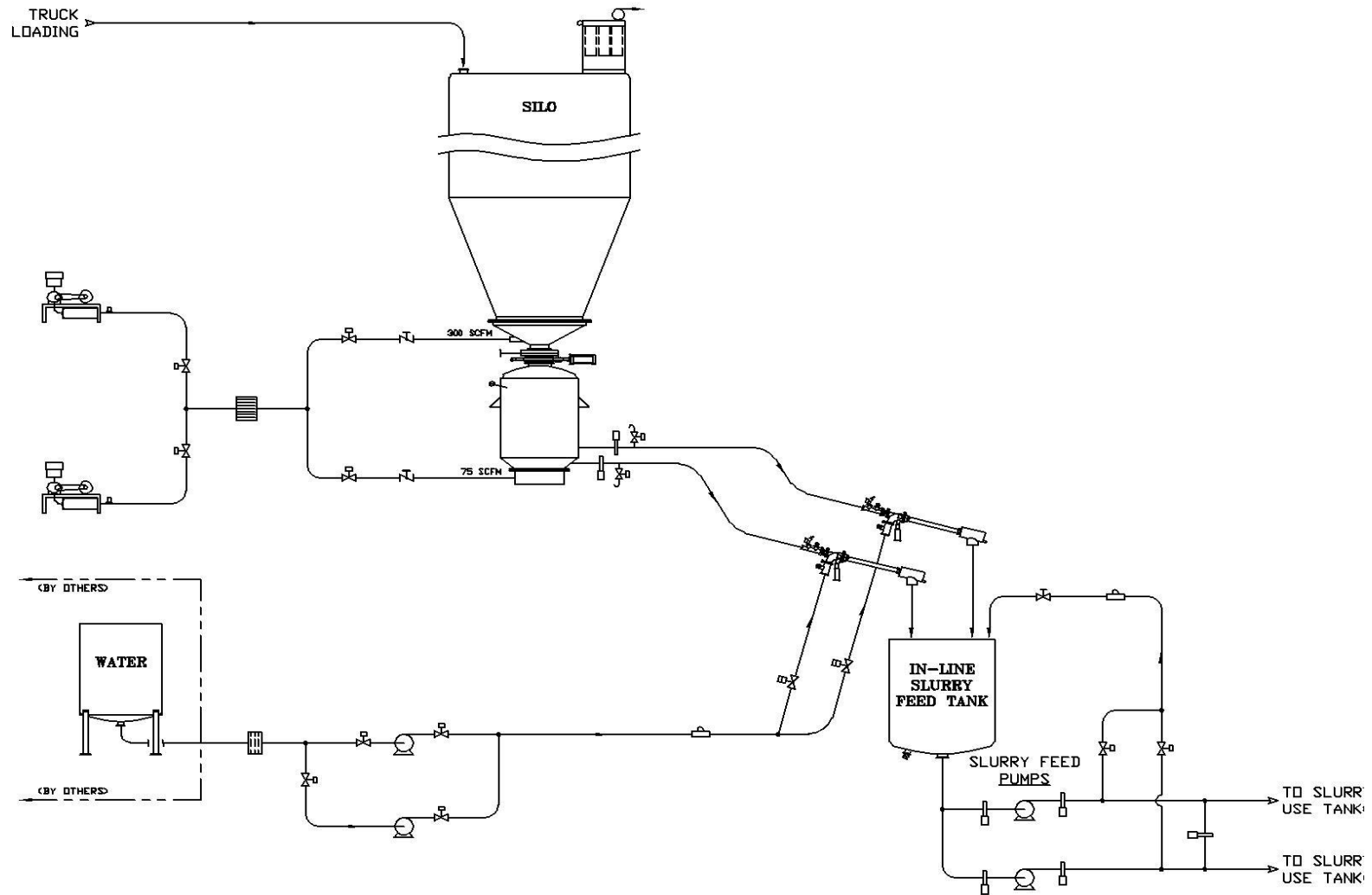




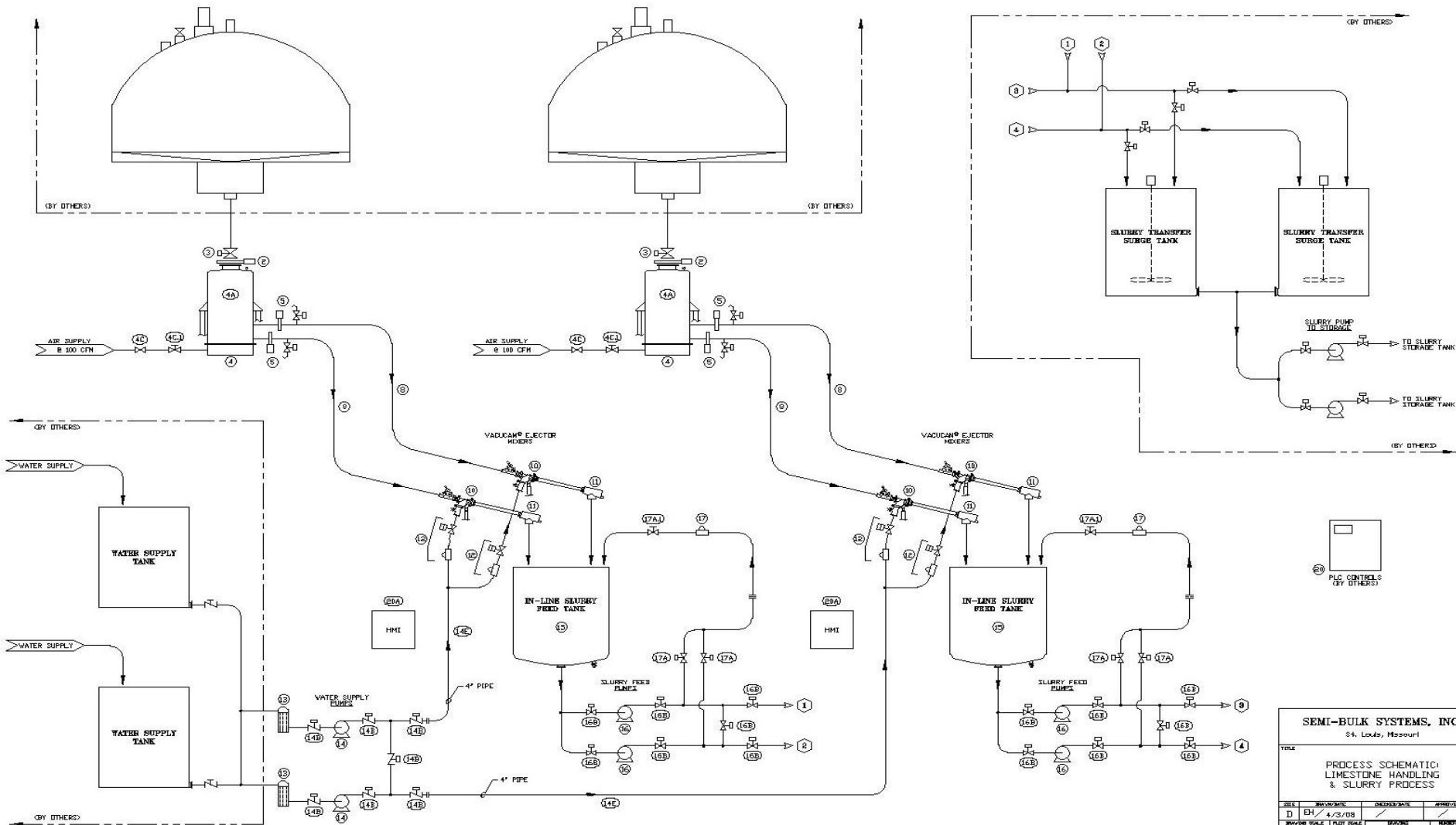
POWER PLANT Process Options

1. Single Pass Process Direct Into Slurry Storage Tank
 2. Single Pass In-Line Process to Remote Slurry Storage Tanks
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Single Pass In-Line Process to Remote Slurry Storage Tanks



Limestone Slurry Process Dual Domes & Slurry Processes

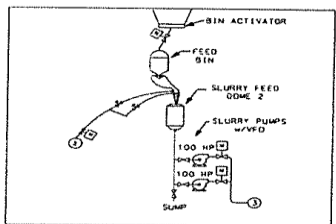
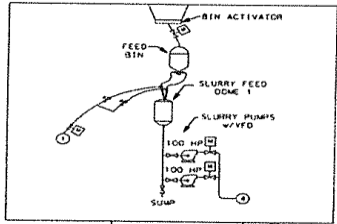
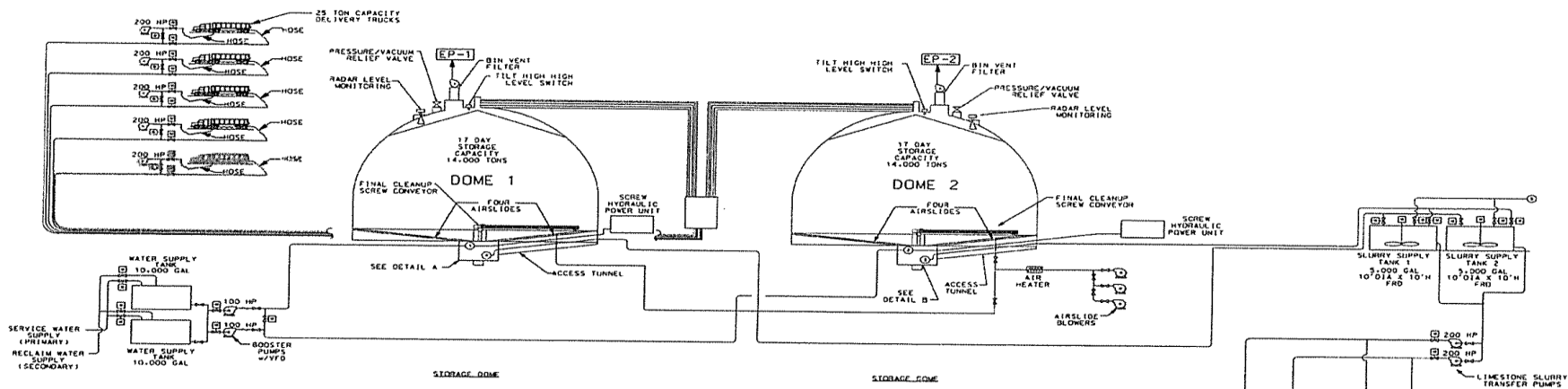


SEMI-BULK SYSTEMS, INC. St. Louis, Missouri			
TITLE PROCESS SCHEMATIC LIMESTONE HANDLING & SLURRY PROCESS			
DATE	BY/DATE	DESIGNED BY	APPROVED BY
D	EH 4/2/08		
SCALE	FEED SCALE	REVISED	NUMBER
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DUAL DOME STORAGE PULVERIZED LIMESTONE



Limestone Slurry Process Dual Domes & Slurry Processes



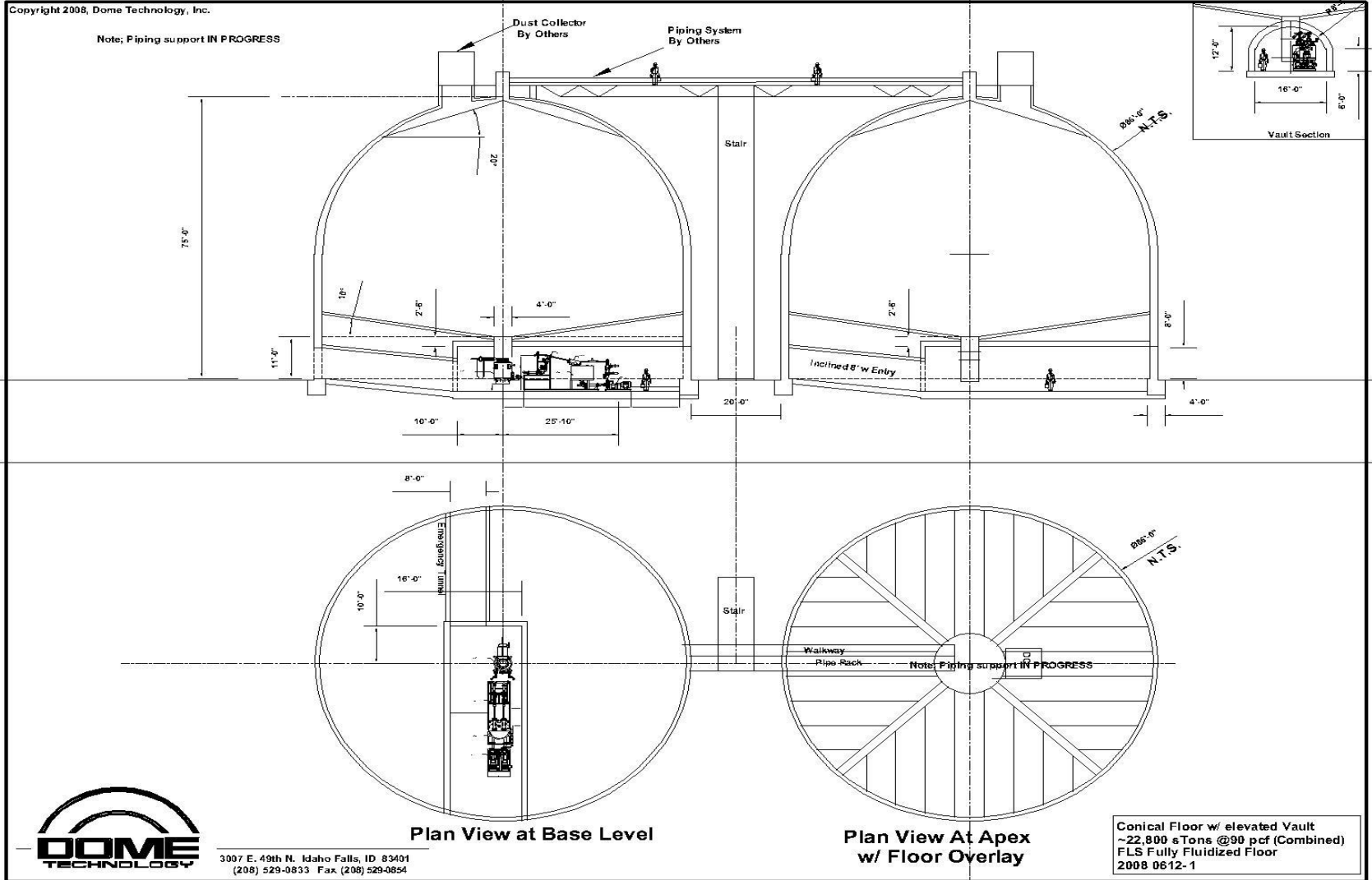
LEGEND
EP- EMISSION POINT

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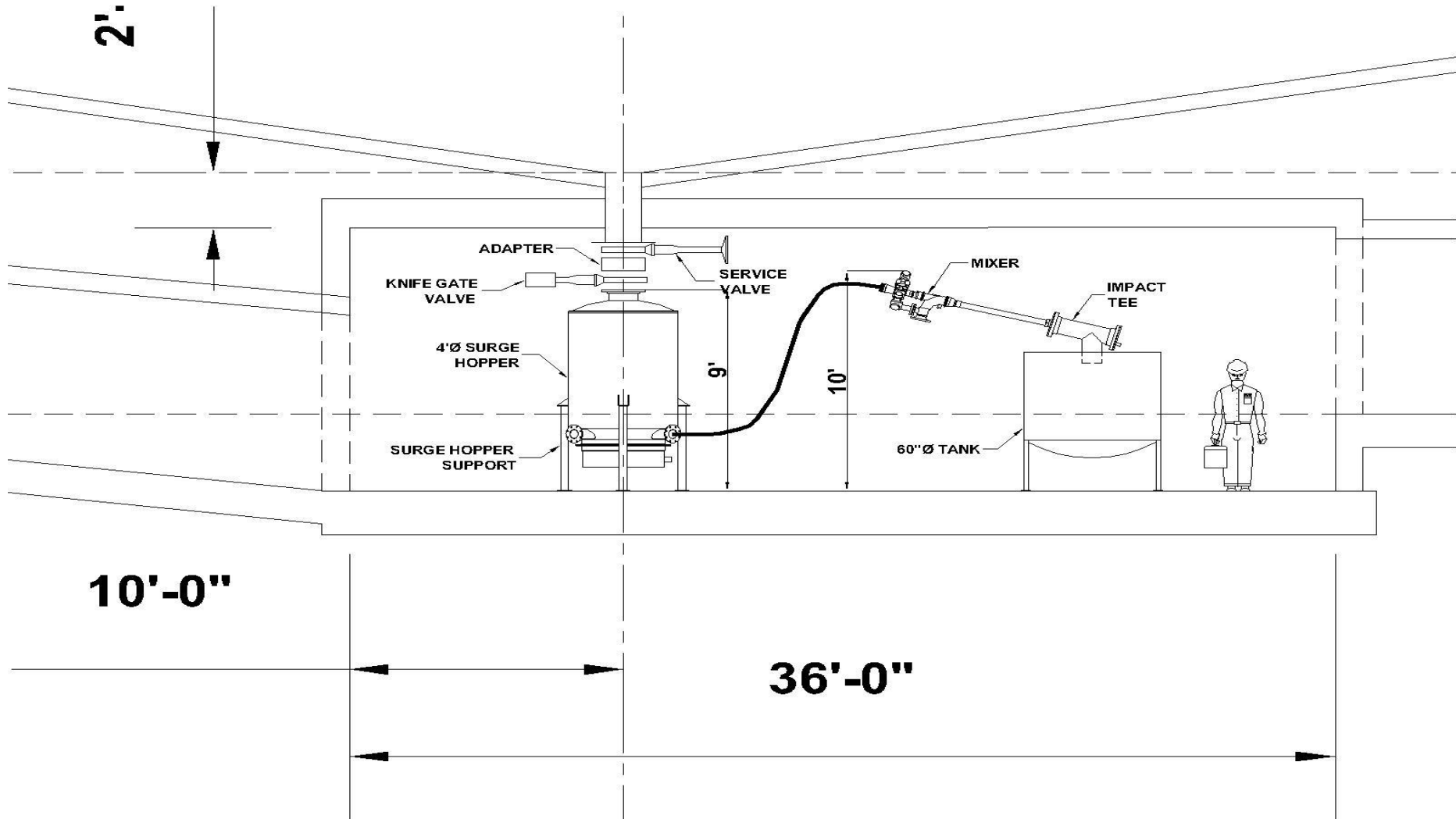
PROJECT TITLE PROJECT NO. SHEET NO.	DESIGNER CHECKED DATE	PROJECT LOCATION CLIENT	SCALE DATE
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EMISSION FLOW DIAGRAM ENCLOSED LIMESTONE STORAGE DOME MET PGO RETROFIT PROJECT UNITS 1 & 2 SINOX PLANT MHS-26A

Limestone Slurry System w/ Dome Storage Supply



Limestone Slurry Process in Dome Vault



VACUCAM® DUAL EJECTOR MIXER PROCESS W/ LIMESTONE SUPPLY HOPPER W/ SLURRY TRANSFER PUMP



LIMESTONE SLURRY PROCESS IN VAULT OF DOME



LIMESTONE SLURRY PROCESS IN VAULT OF DOME

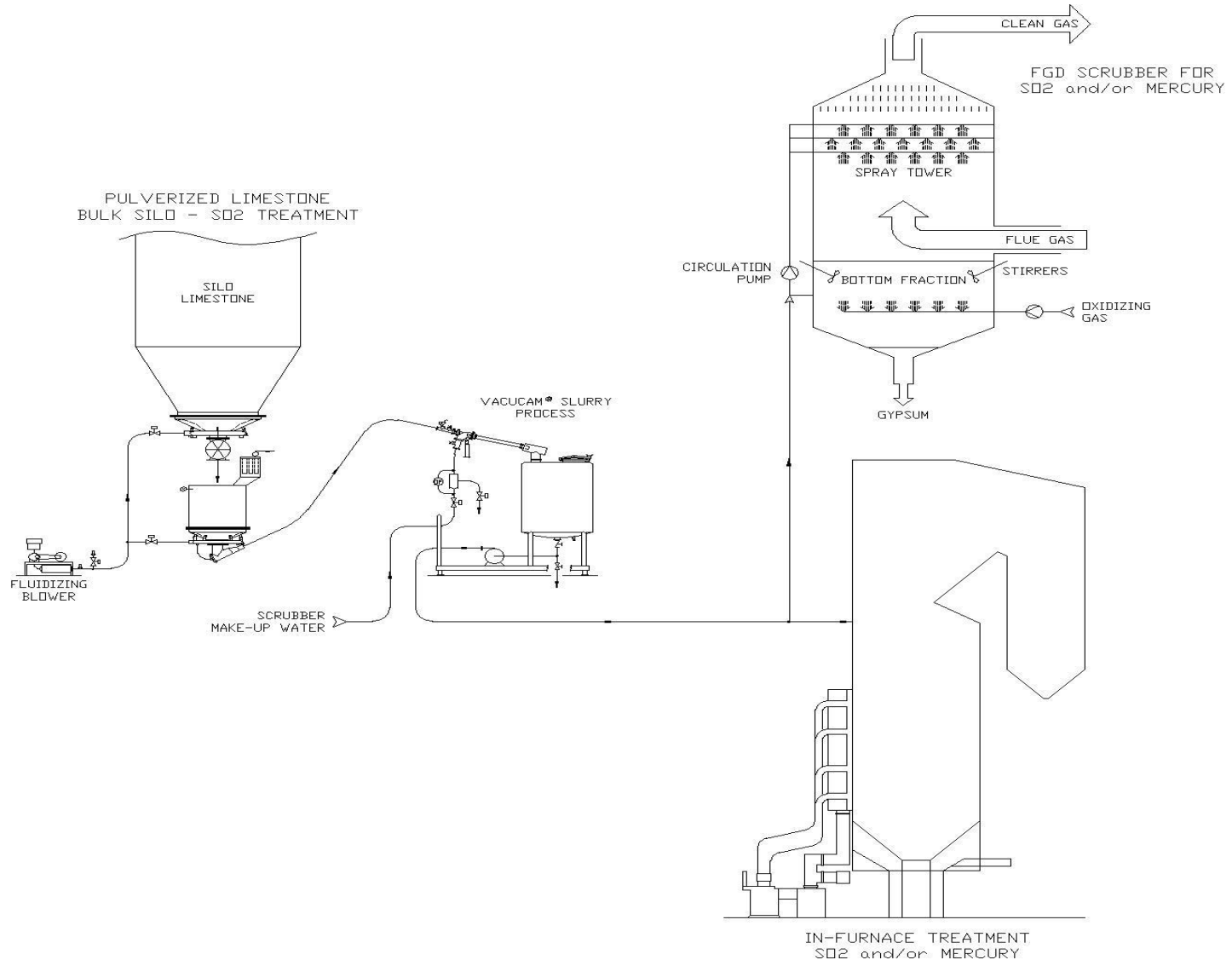


POWER PLANT

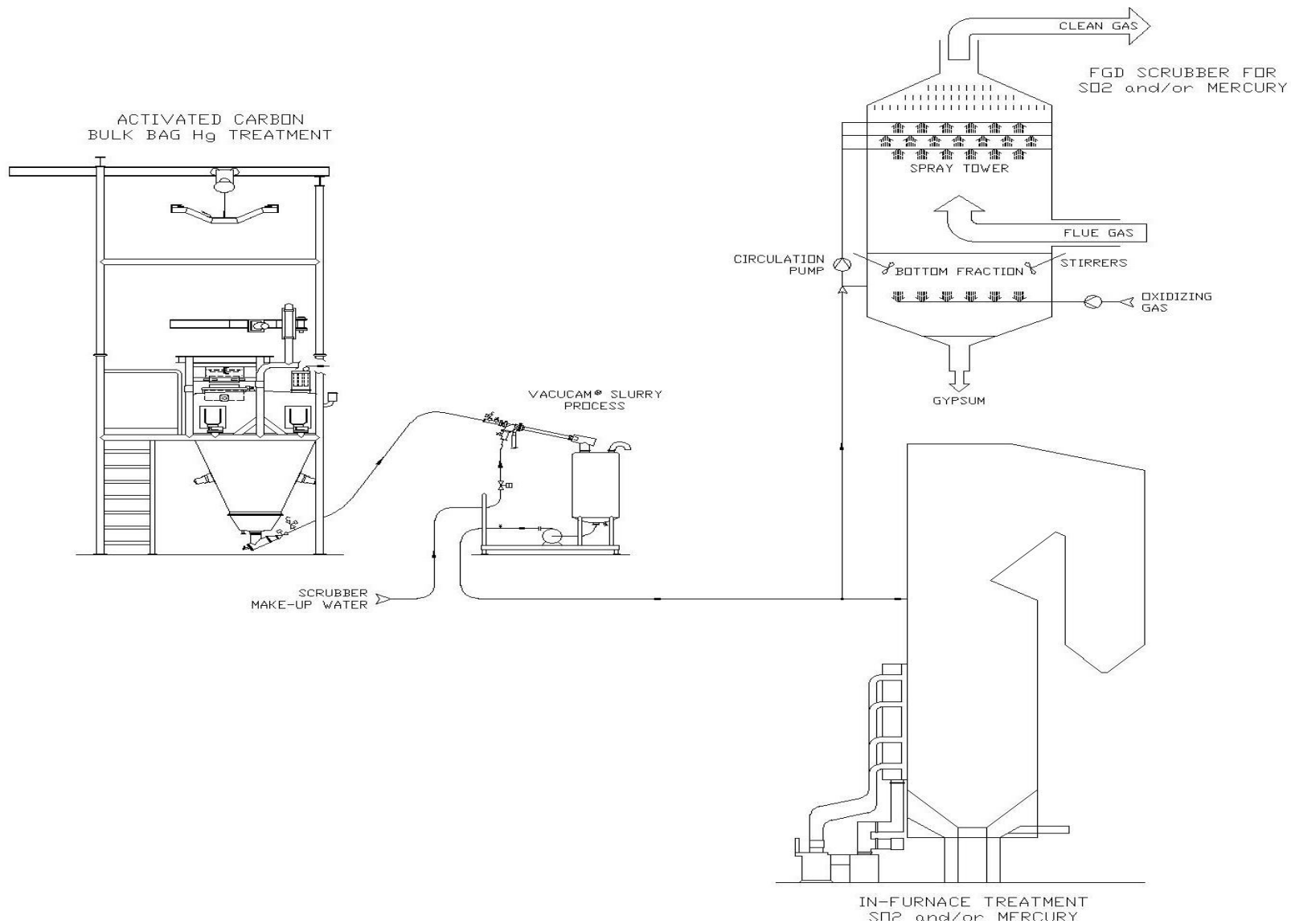
Process Options

1. Single Pass Process Direct Into Slurry Storage Tank
 2. Single Pass In-Line Process to Remote Slurry Storage Tanks
 3. **Single Pass Process for Direct Injection & Material Handling for APC**
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SINGLE PASS LIMESTONE PROCESS FOR DIRECT PH CONTROL TO SCRUBBER &/or DIRECT LIME INJECTION IN-FURNACE FOR SO₂ /Hg REMOVAL



ACTIVATED CARBON INJECTION DIRECTLY INTO SCRUBBER AND/OR IN-FURNACE TREATMENT FOR SO₂ AND/OR H_g REMOVAL



Slurry Production Process for Inexpensive, In-furnace Mercury and SO₂ Removal

- Slurry production systems using the VACUCAM® Ejector Mixer for efficient slurry production of lime or limestone powders for slurry feed to scrubbers.
- I think the output of the VACUCAM® Ejector Mixer could be injected directly into the furnace to reduce SO₂ similar to the LIMB process. (See next slide.)
- The technology could also be used to extract pulverized coal from coal transfer pipes, mix it with water and oxidizing chemicals, and inject it into the furnace to produce halogenated, activated carbon for mercury capture.
- Because this is similar to systems that have already been proven, I believe this inexpensive technology has the potential to remove 90% of mercury and 50% of SO₂ in the flue gas.

Flue Gas Desulfurization Technologies for Coal-Fired Power Plants

Paul S. Nolan
The Babcock & Wilcox Company
Barberton, Ohio, U.S.A.
BR-1709

Presented by Michael X. Jiang at the
Coal-Tech 2000 International Conference
November 13-14, 2000
Jakarta, Indonesia

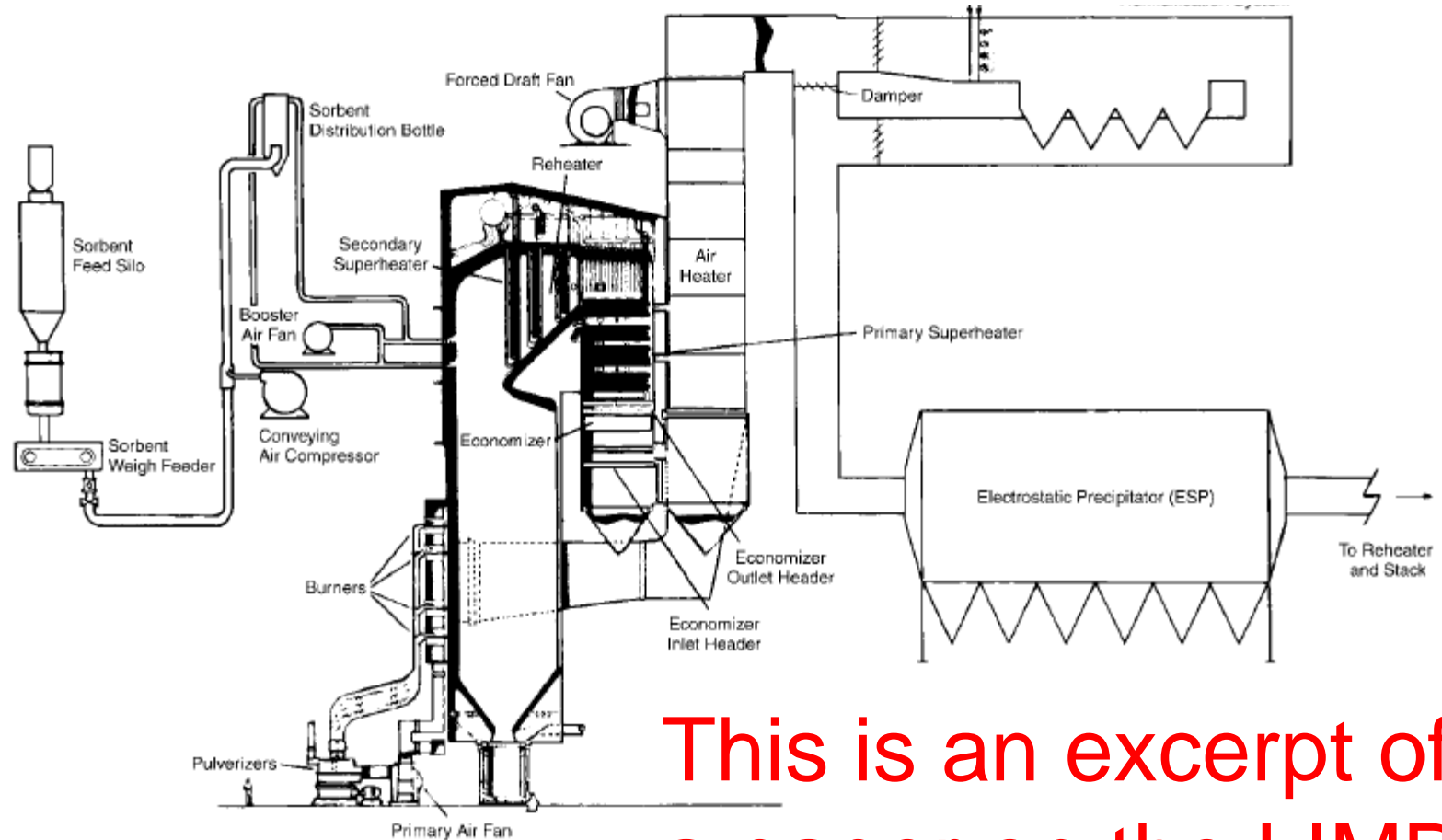


Figure 4 The LIMB process at the Edgewater Station.

This is an excerpt of
a paper on the LIMB
Process

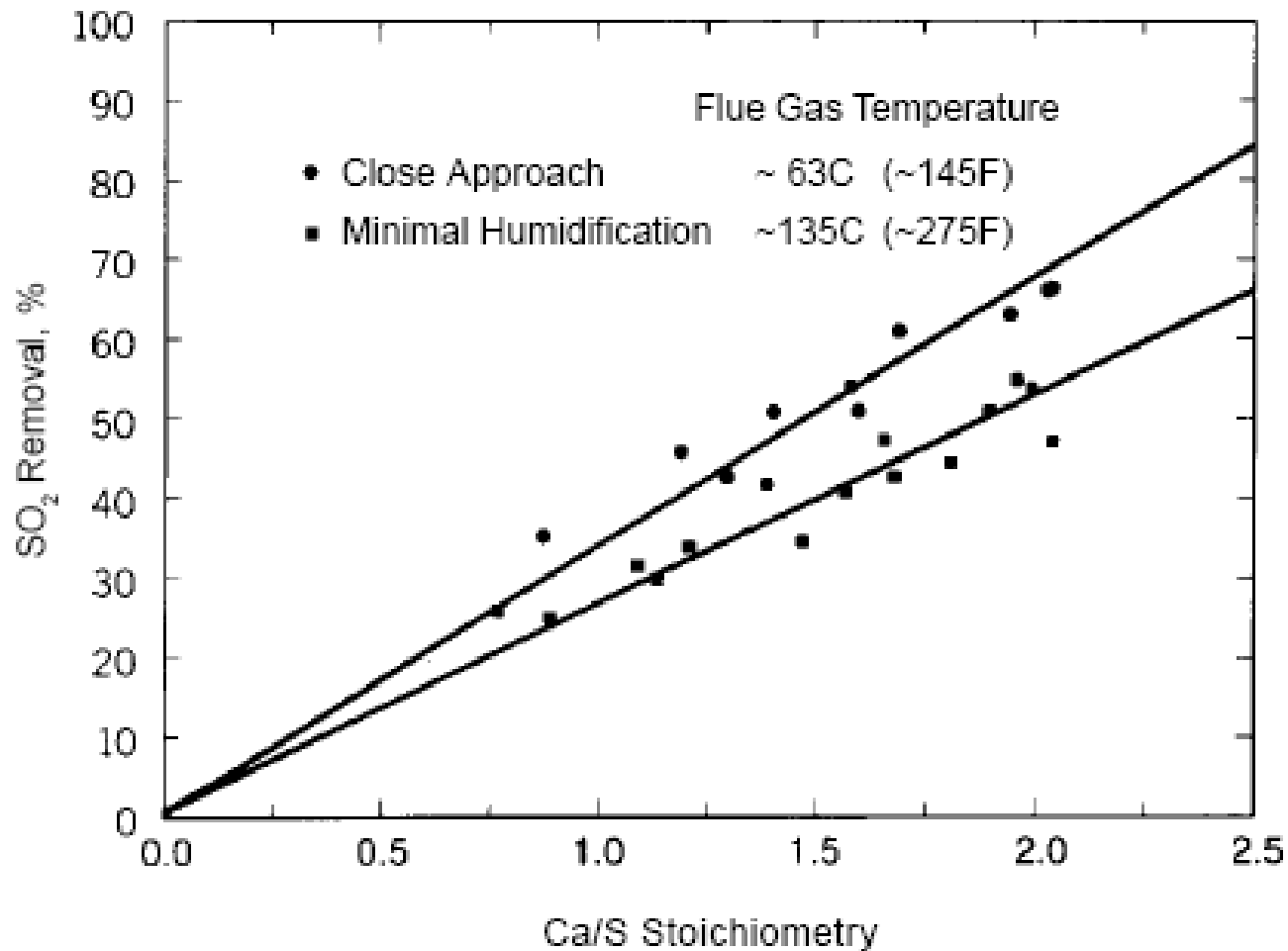
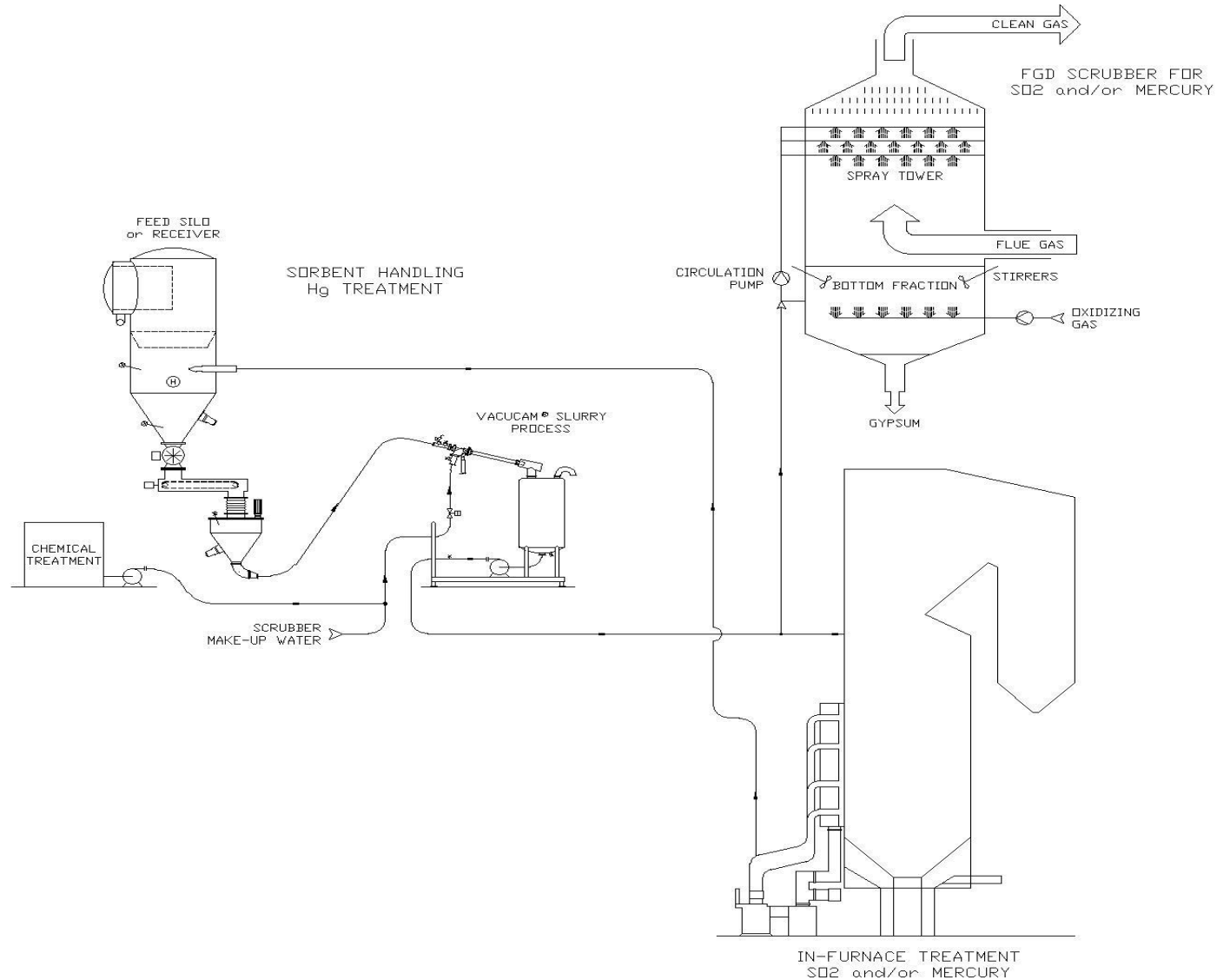


Figure 7 Effect of humidification on SO₂ removal.

Another excerpt from the same paper

In-Furnace Hg Capture

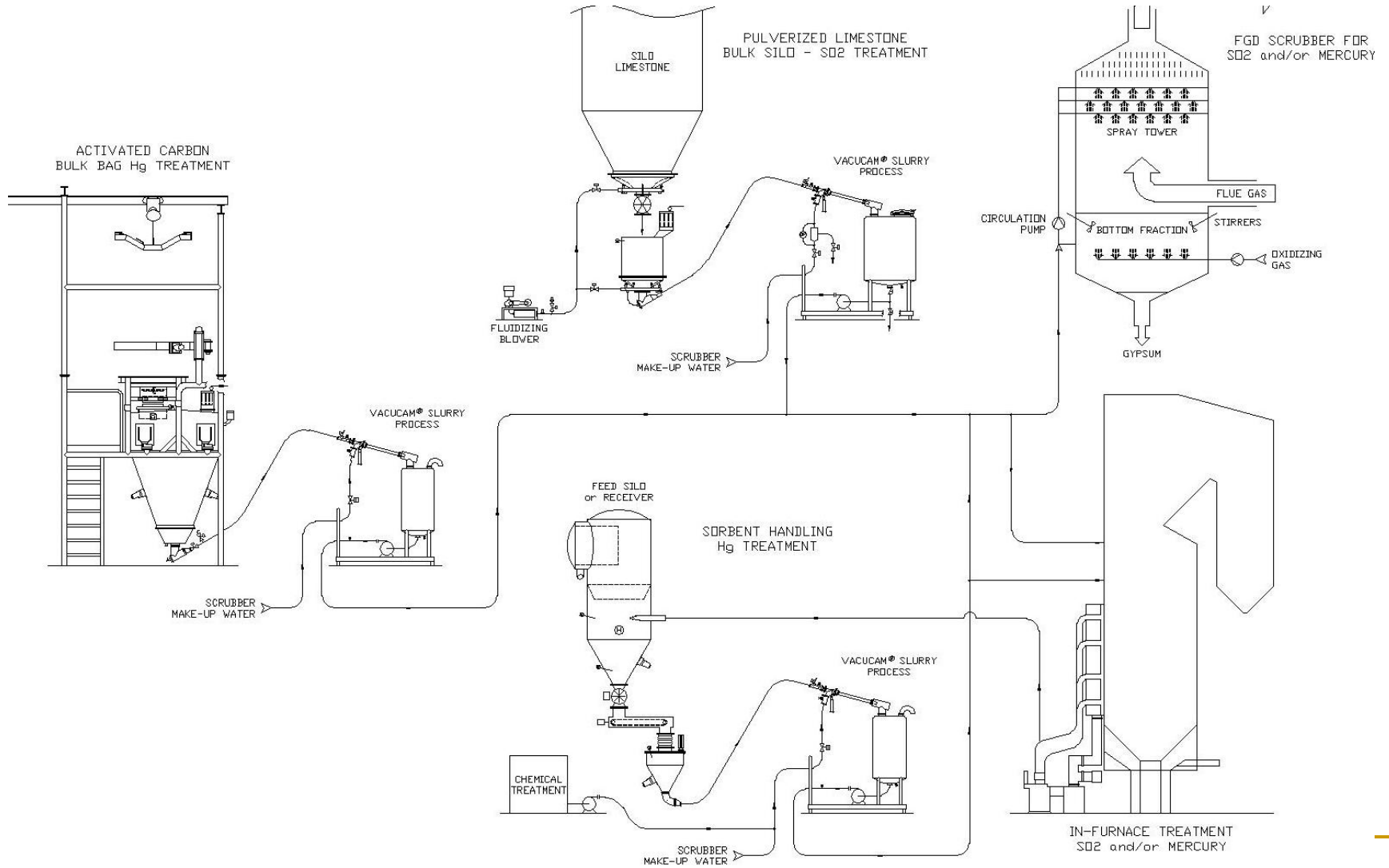
w/ Activated Carbon Produced In-Situ from Pulverized Coal and Mixing with Water and Oxidizing Chemicals



Process Options for Handling and DSI Treatments Addressing APC

- Advantages:
 - The VACUCAM® Mixing Systems has no moving parts, therefore maintenance would be low.
 - The activated carbon is produced in-situ, so there is no capital cost for storage or injection systems.
 - The cost of activated carbon would be very low, since it is the cost of coal plus the energy to pulverize it.
 - The footprint of the system would be very low.
 - The system could be fine-tuned on-line to optimize lime, carbon, and halogen feed based on feedback from on-line analyzers.

MATRIX OF DRY SORBENT HANDLING AND INJECTION TREATMENT OPTIONS FOR APC



FEATURES*****BENEFITS

OF THE VACUCAM® SLURRY MIXING PROCESS

- Direct In-Line single pass mixing. No moving parts.
 - Produces high quality slurry mix w/ rapid and maximum surface area contact to maximize reaction
 - Direct Injection – no slurry storage required.
 - Totally enclosed mixing system –NO dust
 - Small footprint required
 - Minimal maintenance—very reliable—no scheduled maintenance downtime required
 - High quality slurry mix provides maximum contact and reaction rate while maximizing process yield.
 - Very low energy usage-save 50-90%
 - Minimal dust control required
 - Minimize real estate requirements
 - Easily automated and fine tuned to optimize chemical [lime, carbon, halogen] additions with direct feedback from on-line analyzers
-

Questions and Answers

Thank you
