SOLUTIONS . PERFORMANCE . RELATIONSHIPS

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Advanced Ammonium Sulfate Wet FGD

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Proprietary Ammonia-based FGD

Ammonium Sulfate Process (AS-FGD)

Offers significant advantages over traditional flue gas scrubbing

- Economics enhanced with low cost, high sulfur fuels
- Reduces/eliminates solid and liquid waste issues/costs
- Valuable AS fertilizer provides revenue stream
- No CO_2 greenhouse gas is produced in the AS FGD unlike conventional limestone FGD (where ~0.7 ton CO_2 is released per ton SO_2 absorbed.)

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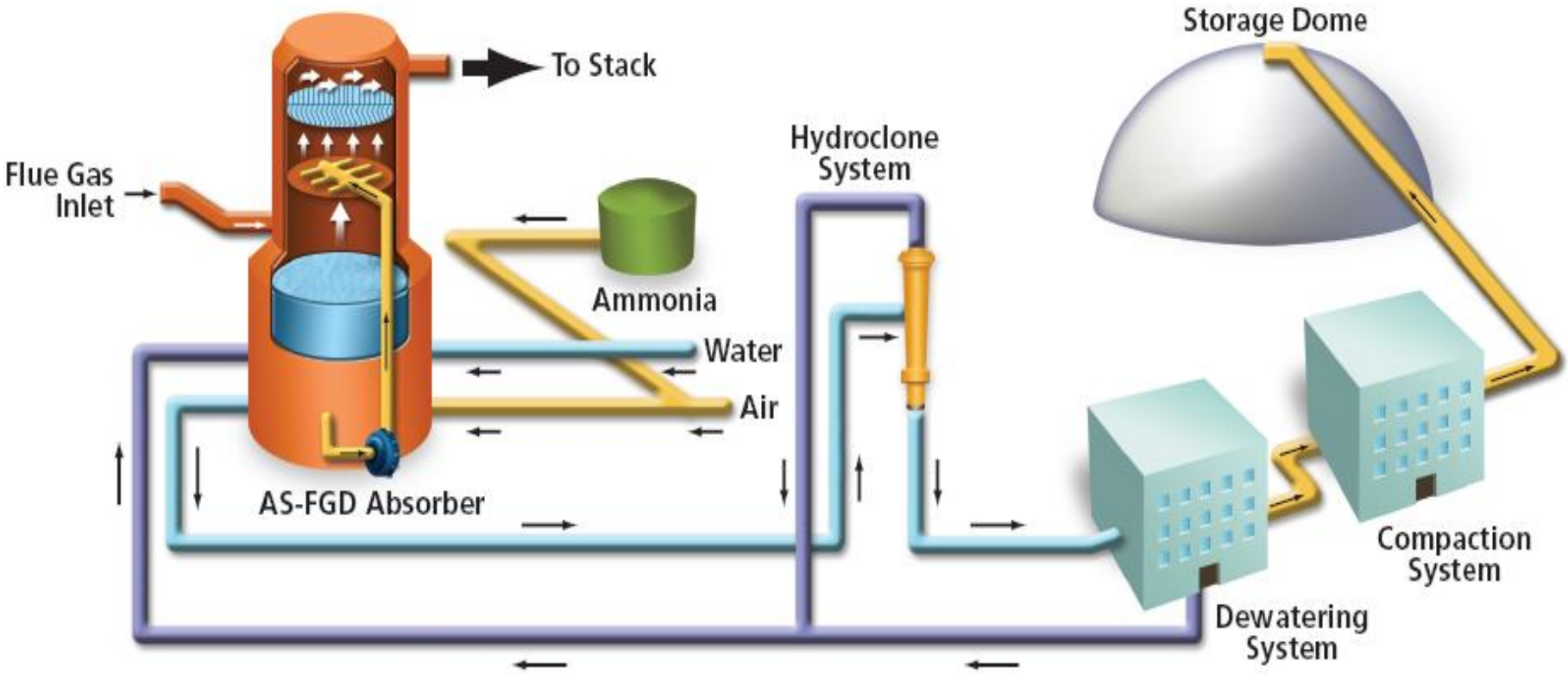
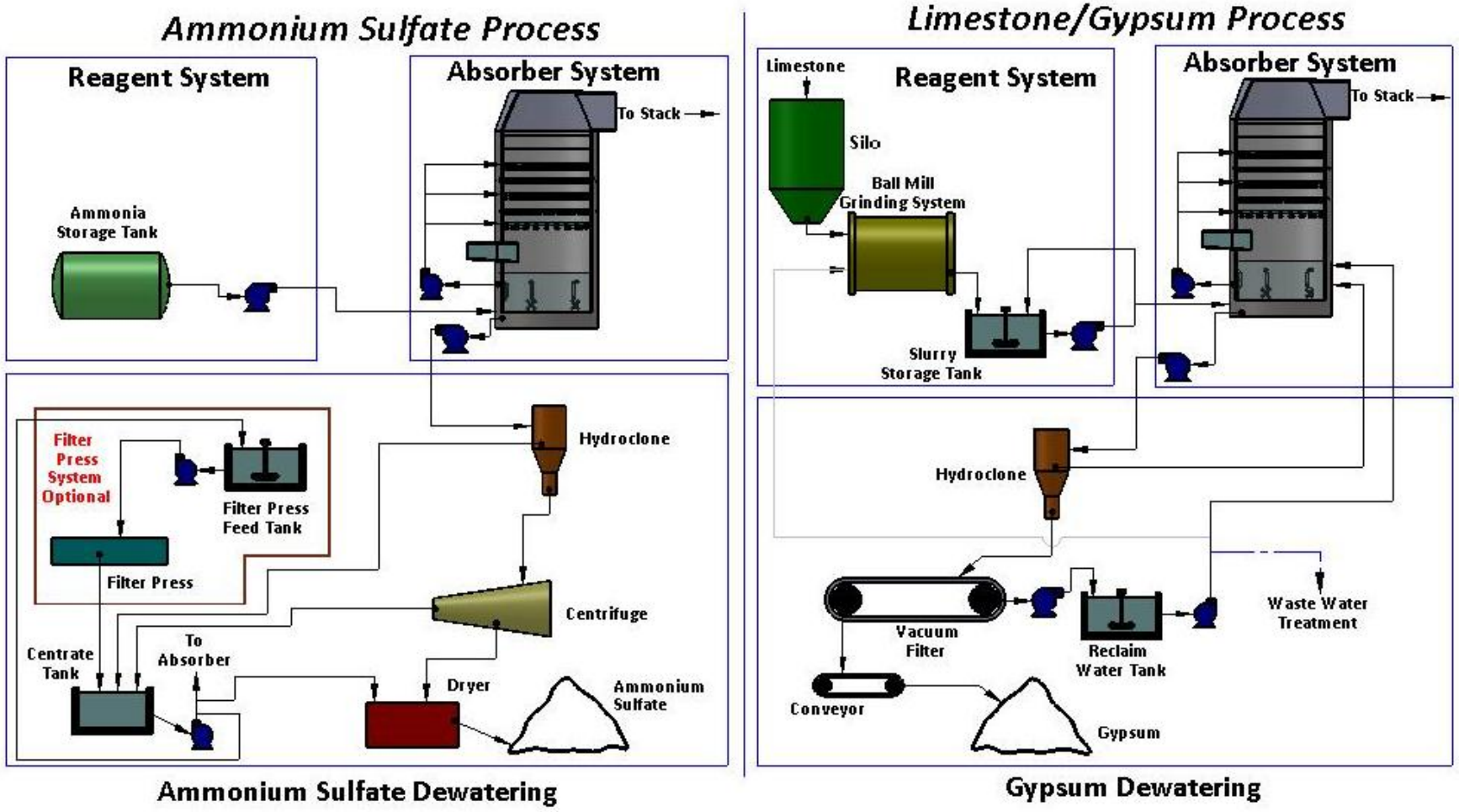
Proprietary AS-FGD

Ammonium Sulfate Process



Process Comparison | Limestone vs. AS-FGD

Same Proven Absorber – Different Reagent and Dewatering



MET AS-FGD

Compacted (Left) and Standard Product

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Product Quality Characteristics

Purity - 99+%

- Nitrogen - 21.0 - 21.1%
- Sulfur - 24.0 - 24.2%
- Water Insoluble Matter - < 0.1%
- Color - White to Beige
- Heavy Metals - < 10 ppm

Exceeds fertilizer specifications

Residual Moisture

- Multiple Drying Steps
- Less Than 1.0 wt% Moisture
- Coated with Anti-caking Agent

Excellent storage & handling

Particle Size

- 1.0 mm - 3.5 mm
- 240 - 275 SGN
- Uniformity Index - 45 - 50

Ideal for bulk blending & direct application

Hardness

- Demonstrated Compaction Technology
- Expertise in Product Hardening Technology
- 1 - 3% Attrition in Industry Test

Can be easily handled and transported

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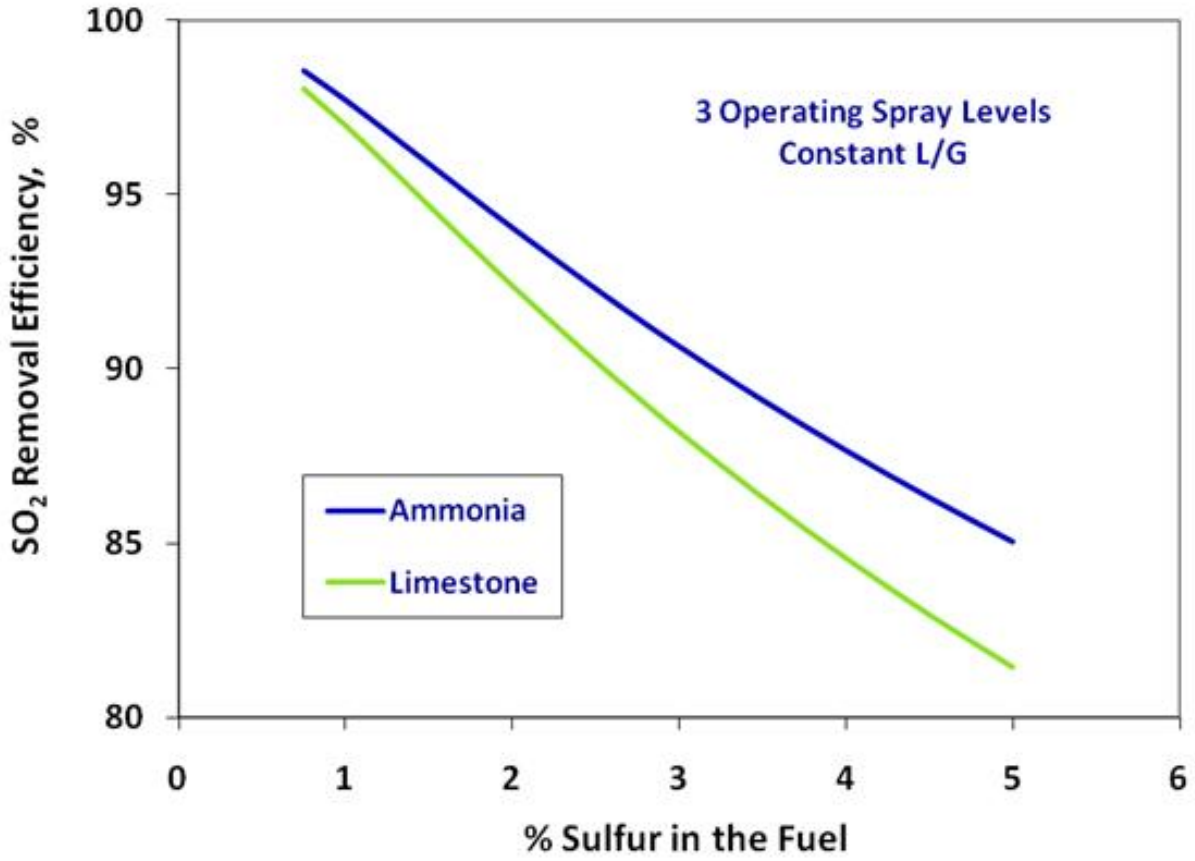
Reagent Effectiveness – Ammonia vs. Limestone



Comparison is based on open spray tower with ALRD® installations. AS-FGD requires less L/G than limestone FGD for a given removal efficiency.

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Process Chemistry

$$SO_2 + 2NH_3 + H_2O \longrightarrow (NH_4)_2SO_3 \quad (1)$$

$$(NH_4)_2SO_3 + 1/2\ O_2 \longrightarrow (NH_4)_2SO_4 \quad (2)$$

- **For every part (mass unit) of SO_2 removed:**
  One-half part Ammonia is consumed
  Two parts of Ammonium Sulfate is produced

- **One part** of Ammonia generates **four parts** of Ammonium Sulfate fertilizer

- Ammonium Sulfate Production -
100 tpy per % Sulfur per MW

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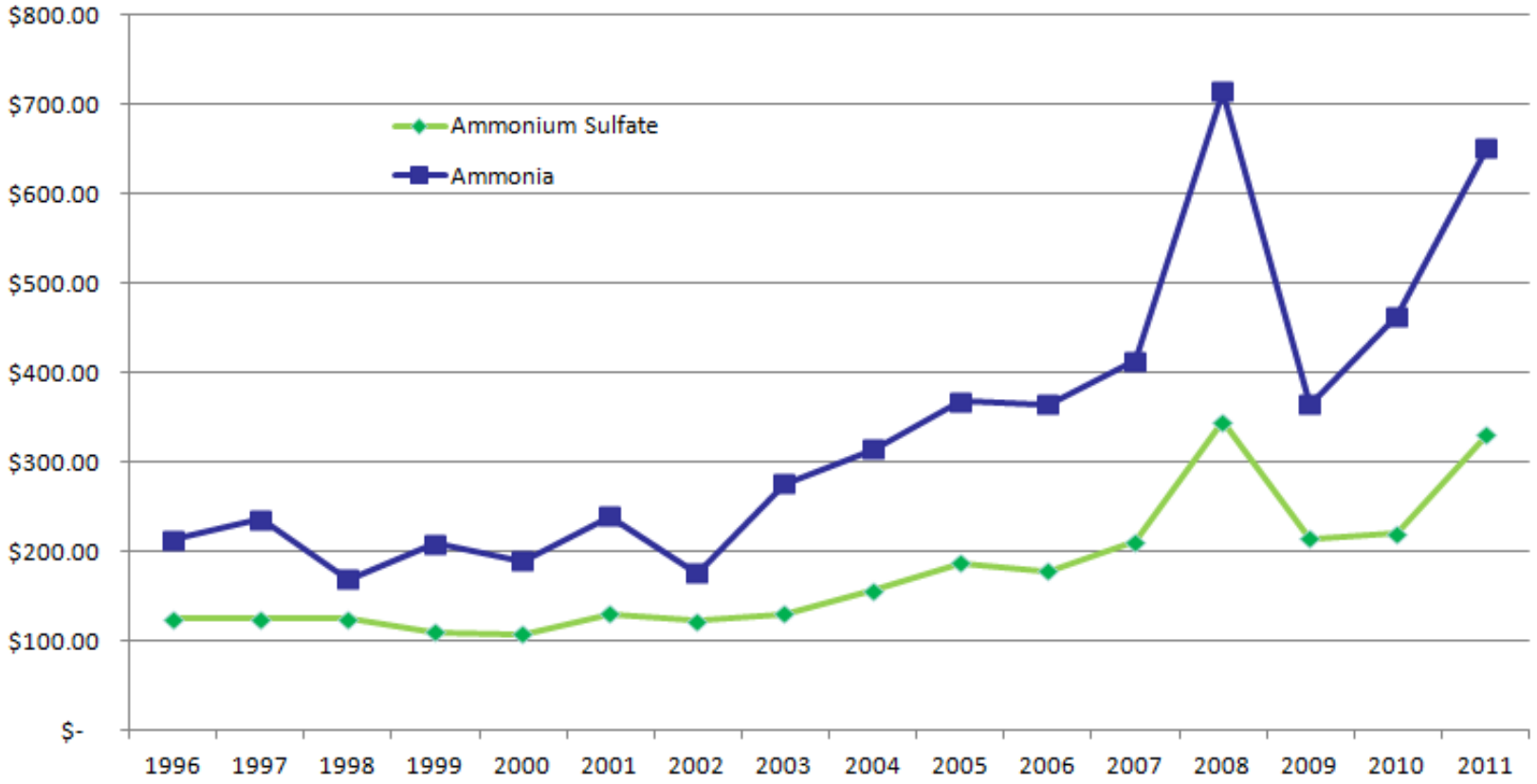
Reagent and Product Historical Price Trend in the United States



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Income Potential

A 600 MW Unit's Ammonium Sulfate Production
50,000 tpy per % Percent Fuel Sulfur

- Assume NH_3 and AS market pricing results in a positive differential of $100/ton average of AS produced:
  - = $10MM/year for 2% sulfur fuel
  - = $20MM/year for 4% sulfur fuel

Site-specific factors such as actual source/cost NH_3 , market price of AS, unit load factor, fuel costs, transportation, etc., need to be factored.

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Dakota Gasification Company

350 MWe | Ammonium Sulfate WFGD

DGC is a subsidiary of Basin Electric and was a partner in the first commercial application of MET's patented ammonium sulfate FGD technology. DGC selected the MET process over conventional limestone scrubbing.

Dakota Gasification Company
North Dakota

Fuel:	**Heavy Residue**
% Sulfur:	**5.0% Design**
Inlet Gas Volume: (acfm)	**1,187,000**
Reagent:	**Ammonia**
Design AS Production (Ton/year):	**145,000**
SO_2 Removal Efficiency:	**98%**
Absorber Type:	**Spray Tower**
AS-FGD Start-up	**1996**

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MET AS-FGD

DGC Tested Performance vs. Guarantee Level

Design Parameter	Units	Guarantee	Performance
SO_2 Removal Efficiency	%	93	95-98+
Ammonia Slip	ppmv, wet	<10	3-10
AS Product Purity	wt %	≥99.0	99.5
AS Product Moisture Content	wt %	<1.0	<0.1
AS Product Hardness	%	<5	1-2
Size Guide Number	-	240-290	250-280

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Dakota Gasification Company

DakSul 45® Specification

DakSul 45® AS product specification can be located http://www.dakotagas.com/

Syncrude UE-1 Upgrade Complex

315 MWe | Ammonium Sulfate WFGD

UE-1 Expansion Plant
Alberta, Canada

Source:	**Coker/CO boiler offgas**
Scope:	**Ammonia FGD & fertilizer plant**
Inlet Gas Volume: (acfm)	**1,300,000**
Byproduct:	**109,000 te/yr granular AS fertilizer**
Absorber Type:	**Spray Tower**
SO_2 Removal Efficiency:	**95+%**
Startup Date:	**2006**

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Proprietary Ammonium Sulfate FGD

Syncrude Performance vs. Guarantees

Design Parameter	Units	Guarantee	Performance
SO_2 Removal Efficiency	%	93	95-98+
Ammonia Slip	ppmv, wet	<10	3-7
Opacity	%	<4% from NH3	0% from NH3
Pressure Drop	inches w.c.	< 11	7 - 8
AS Product Purity	wt %	> 99.0	99.5
AS Product Moisture	wt %	< 1.0	< 0.1
Size Guide Number	-	240-290	240-260

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SINOPEC - Qilu

2 x 200 MW | Ammonium Sulfate WFGD

Qilu Thermal Plants
Shandong Province, China

Fuel:	**Coal**
Scope:	**EPC**
Inlet Gas Volume: (acfm)	**1,162,547 Kg/Hr**
Absorber Type:	**Open Spray Tower**
SO_2 Removal Efficiency:	**98%**
Startup Date:	**Unit 2: Jul '09** **Unit 1: Sep '09**
Byproduct:	**Standard Grade Ammonium Sulfate**

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Zaklady Azotowe Pulawy

300 MW

Combined Heating and Power Plant | Pulawy, Poland

Source:	**Coal-Fired Boilers**
Scope:	**Technology, engineering, key components and field services**
Inlet Gas Volume: (acfm)	**1,365,000**
Byproduct:	**Ammonium Sulfate Fertilizer**
Absorber Type:	**Open Spray Tower**
SO_2 Removal Efficiency:	**>93.5%**
Scheduled Startup Date:	**2012**

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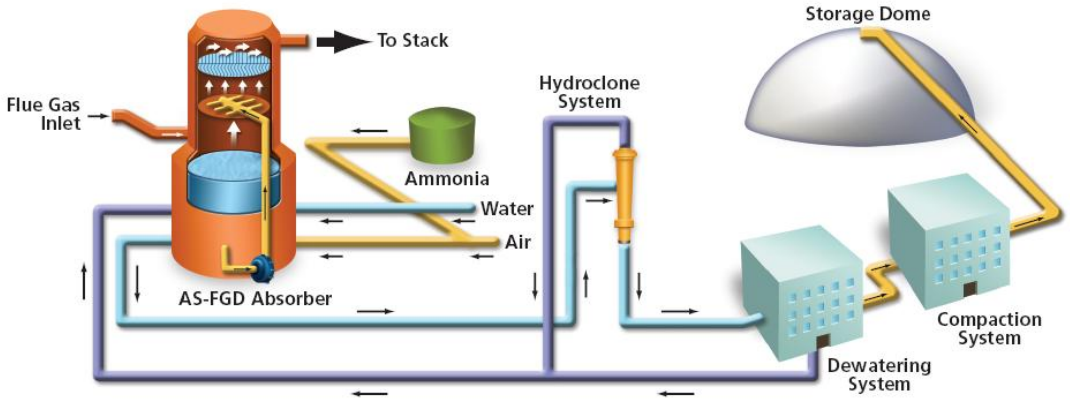
Proprietary Ammonium Sulfate FGD

Summary of Environmental Solutions

Advantages of MET Ammonium Sulfate Process

- Commercially proven for over a decade
- Site specific economics including offset of operating costs, potentially lower fuel costs, lower capital costs
- Ammonia scrubber typically does not generate a purge stream to WWT
- Ammonia scrubber produces high value byproduct versus low value gypsum or sulfite waste sludge



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