FGD Gypsum in Wallboard and Other Products
FGD Gypsum
Wallboard and Other Markets

• Key commercial properties of gypsum
• Use in wallboard
• Other manufactured gypsum products
• Challenges for increased usage
Gypsum
Key Commercial Properties

• Safe and non-toxic mineral
• Relatively abundant and low cost to mine
  – Over 100 million tons mined globally
  – Large deposits close to the surface
• Common by-product from sulfur processing
  – FGD Gypsum
  – Phosphogypsum
  – HF, TiO2, Lactic Acid, Citric Acid, other waste H2SO4 streams
Gypsum

Key Commercial Properties

• Source of Calcium and Sulfate
  – Agriculture
  – Cement
Gypsum
Key Commercial Properties

• Can be calcined at low temperatures forming Hemihydrate or Anhydrite
  – Provides fire resistance
  – Produces a low cost inorganic binder

CaSO$_4$$\cdot$2H$_2$O $\rightarrow$ CaSO$_4$$\cdot$$\frac{1}{2}$H$_2$O + $\frac{3}{2}$H$_2$O (Stucco or Plaster of Paris)

250 F

CaSO$_4$$\cdot$$\frac{1}{2}$H$_2$O $\rightarrow$ CaSO$_4$ (Anhydrite)

Heat
Stucco - CaSO₄*1/2H₂O

- Reacts with water to reform rock

\[
\text{CaSO}_4*\frac{1}{2}\text{H}_2\text{O} + \frac{3}{2}\text{H}_2\text{O} \rightarrow \text{CaSO}_4*2\text{H}_2\text{O}
\]

- Fast reaction (<30 minutes)

- Strong, fire resistant casts (10,000 psi possible)
FGD Gypsum in Wallboard
Simplified Flow Diagram of FGD Gypsum
used for Wallboard Production

FGD Gypsum → Dryer → Calciner → Storage
CaSO₄•2H₂O → Land Plaster → Plaster of Paris (Stucco)
CaSO₄•2H₂O → CaSO₄•½H₂O

Mill

Board Plant

CaSO₄•2H₂O → Forming Line

Product Board

Drying Kiln

Additives

Mixing

H₂O
FGD Gypsum vs Rock Gypsum

• Gypsum is Gypsum – FGD or Rock

• FGD and Rock Gypsum have similar major impurities
  – Limestone, Salts

• FGD is a moist cake (10%) versus dry rock
  – Freight penalty due to water
  – Energy costs to dry
  – Added capital costs to handle and dry
FGD Gypsum in Wallboard Current Usage

- 63% of all FGD Gypsum produced is recovered into wallboard (ACAA)
- Over 27% of wallboard produced from FGD Gypsum
- 12 new wallboard lines built to handle FGD Gypsum
- 4 new lines announced
Wallboard Industry
Synthetic Gypsum Usage, tons

Based on Gypsum Association Data
WALLBOARD INDUSTRY

Synthetic Gypsum Growth

Based on Gypsum Association Data

United States Gypsum Company – October 23, 2007
New Wallboard Lines
Designed for Synthetic Gypsum

16 New Lines
30% of 2006 Capacity
FGD Gypsum
Wallboard Market Fundamentals

- **Location, Location, Location**
  - Markets are near metropolitan areas and growth areas
  - Wallboard plants located near major markets or near low cost mines
    - East Coast supplied from Nova Scotia
    - West Coast supplied from Mexico
Wallboard Shipments by State

Based on Gypsum Association Data

United States Gypsum Company – October 23, 2007
Projected Emissions of Sulfur Dioxide Under the Interstate Air Quality Rule

- Current Programs in 2010
- Interstate Air Quality Rule in 2010
- Interstate Air Quality Rule in 2015
Potential FGD Gypsum Growth

Production, tpy

Year

2005 2006 2007 2008 2009 2010 2011 2012 2013
Wallboard Market Growth

Based on Gypsum Association Data

United States Gypsum Company – October 23, 2007
FGD Gypsum in Wallboard
Future Challenges

• FGD Gypsum expected to grow in the next 10 yrs.
  – Primarily in the Midwest
    • Limited new capacity needed in Midwest
  – Supply to exceed demand in the near future

• No scrubbers planned in key markets
  – West Coast
  – Northeast
Other Industrial Products
FGD Gypsum

- Plasters
- Fillers
- Gypsum Fiber Board
Plaster Products

- Building Plasters
- Industrial Plasters
- Environmental Binders
Building Plasters

Veneer Plasters
Fire proofing
Flooring
Industrial Plasters

- Molding Plaster
  - Arts & Crafts
- Non ferrous casting
- Ceramic slip casting
  - Statuary
  - China
  - Sanitary
  - Lamps
- Machinable casts
- Tool manufacturing
- Fireproof fill
- Dental
- Medical Implants
Environmental Binder

- Spray Applied
- Dust Control
- Stop Erosion
- Reclaim slopes
Gypsum Fillers

- Food & Pharmaceutical
- Plastics
- Paper
- Better properties than limestone
  - Lower density
  - Less abrasive
  - pH neutral
  - Alternate crystal shapes and sizes
Multiple Products and Formulations
USG Specialty Products Division
(www.gypsumsolutions.com)
New Products for FGD Gypsum
Gypsum Fiber Board
Gypsum Fiber Board (FIBEROCK®)

- 95% Recycled content – Green Cross Certified
- Consumes over 200,000 tpy of FGD Gypsum
- Made with recycled paper
- Easy to cut, staple, nail or screw
- Mold resistant, fire resistant
- Used as a floor underlayment
- Sheathing and roofing applications
Further Growth

• Location & transportation
• Low costs
• Consistent Quality
  – Color
  – Particle Size
  – Purity
• R&D for new applications
FGD Gypsum Summary

• Current success in wallboard
  – High utilization rates
  – Growing Industry acceptance

• Challenge for the Future
  – Large supply coming
  – Locations that are not near markets

• Potential for Growth
  – Continued Growth in Wallboard
  – Acceptance in other gypsum products
  – New Products