

# FGD Gypsum Use in Cement



# Worldwide Cement Production

- #1 China
- #2 India
- #3 United States

# US Cement Industry

- 39 Companies
- 118 Cement Plants
- 38 States
- 105 MM Metric Tons Consumed
- 25 MM Metric Tons Imported

# US Cement Industry

## ■ Announced Expansions:

–2007 2,430M metric tons

–2008 7,400M Metric tons

–2009 2,550M Metric tons

# Cement Clinker Chemistry



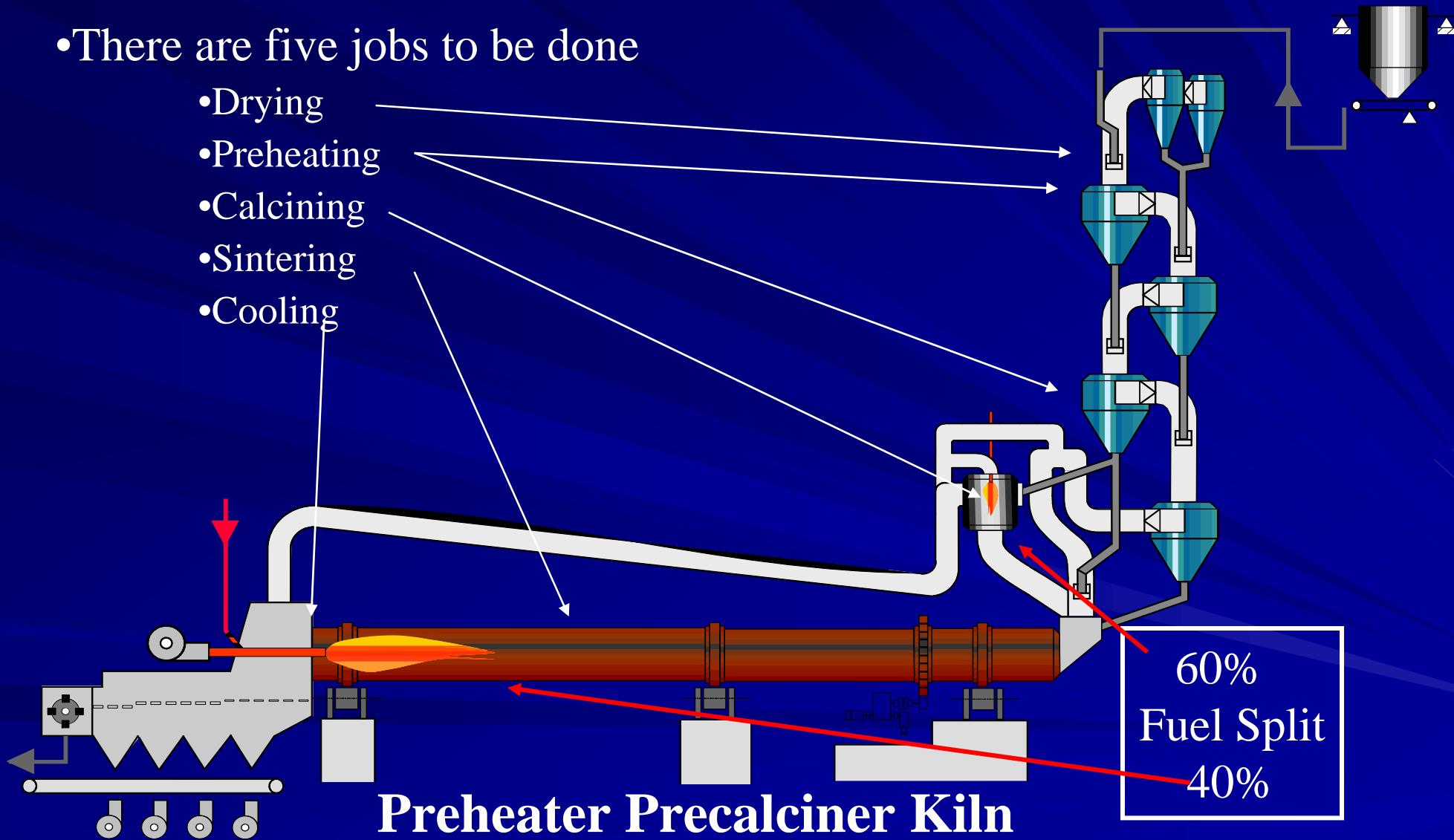
# Raw Feed Components for Cement Plant

- Calcareous Materials (providing Lime CaO)
  - Limestone
  - Lime Mud (paper industry)
- Argillaceous Materials ( $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$  and  $\text{Fe}_2\text{O}_3$ )
  - Sand
  - Fly ash (power generation)
  - Bottom ash (power generation)
  - Iron fines (steel industry)
  - Sand Blasting Waste (ship building industry)
  - Spent Catalyst (oil refining)

# Dry Process Preheater/Precalciner System

- There are five jobs to be done

- Drying
- Preheating
- Calcining
- Sintering
- Cooling



**Preheater Precalciner Kiln**

60%  
Fuel Split  
40%

# Rotary Kiln

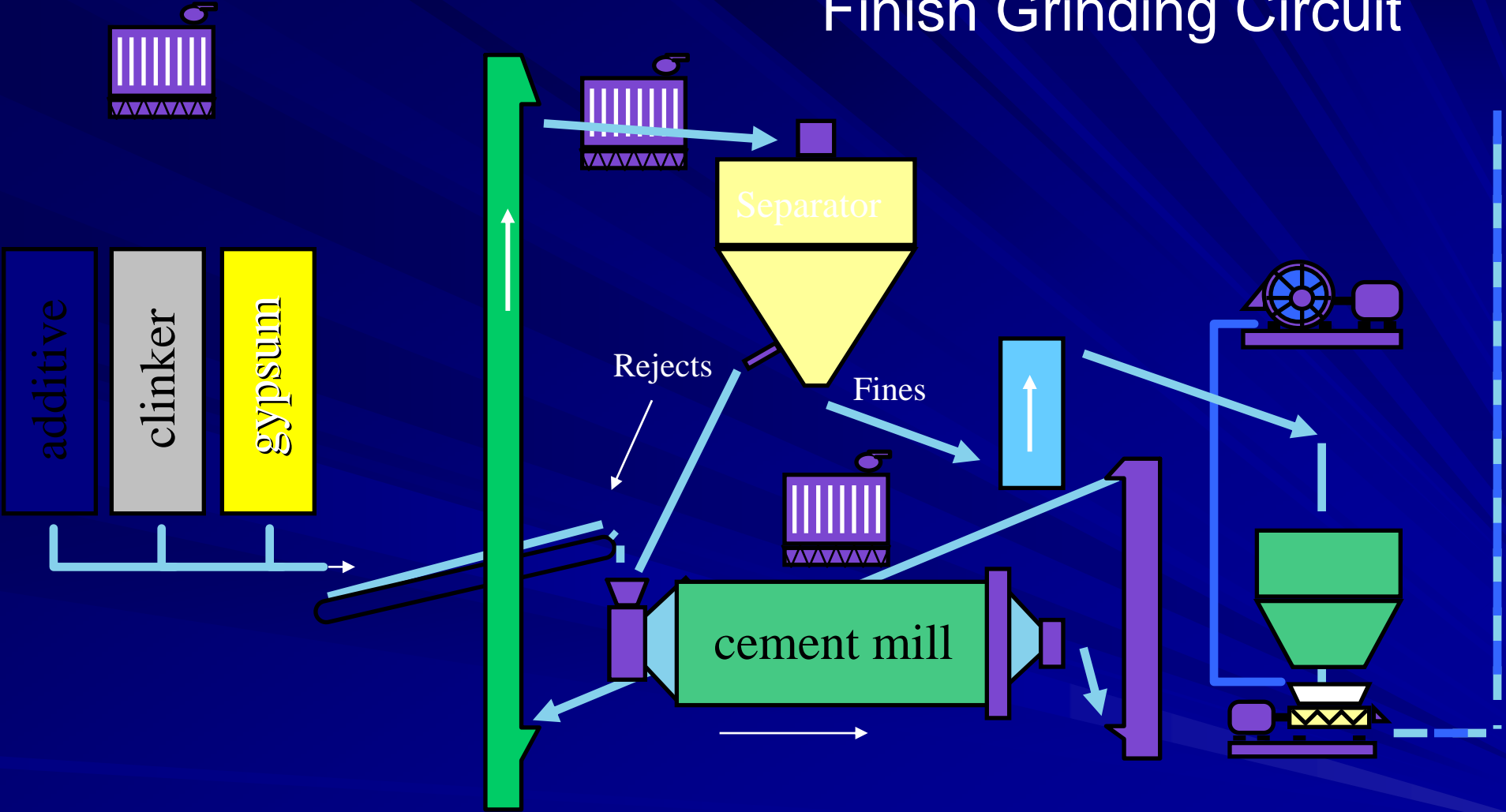




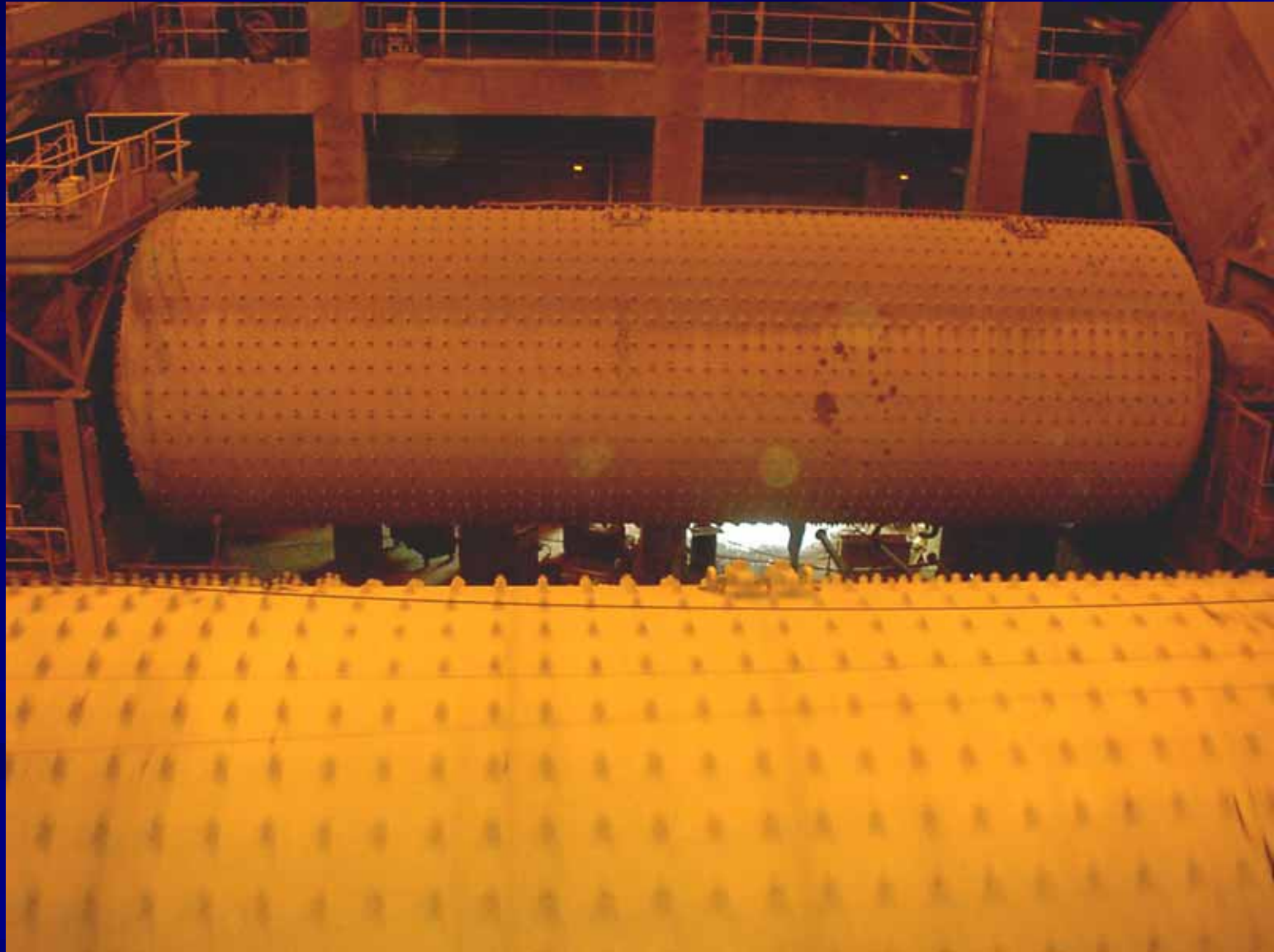
# Hot “Clinker” Inside Kiln



# Finish Grinding Circuit



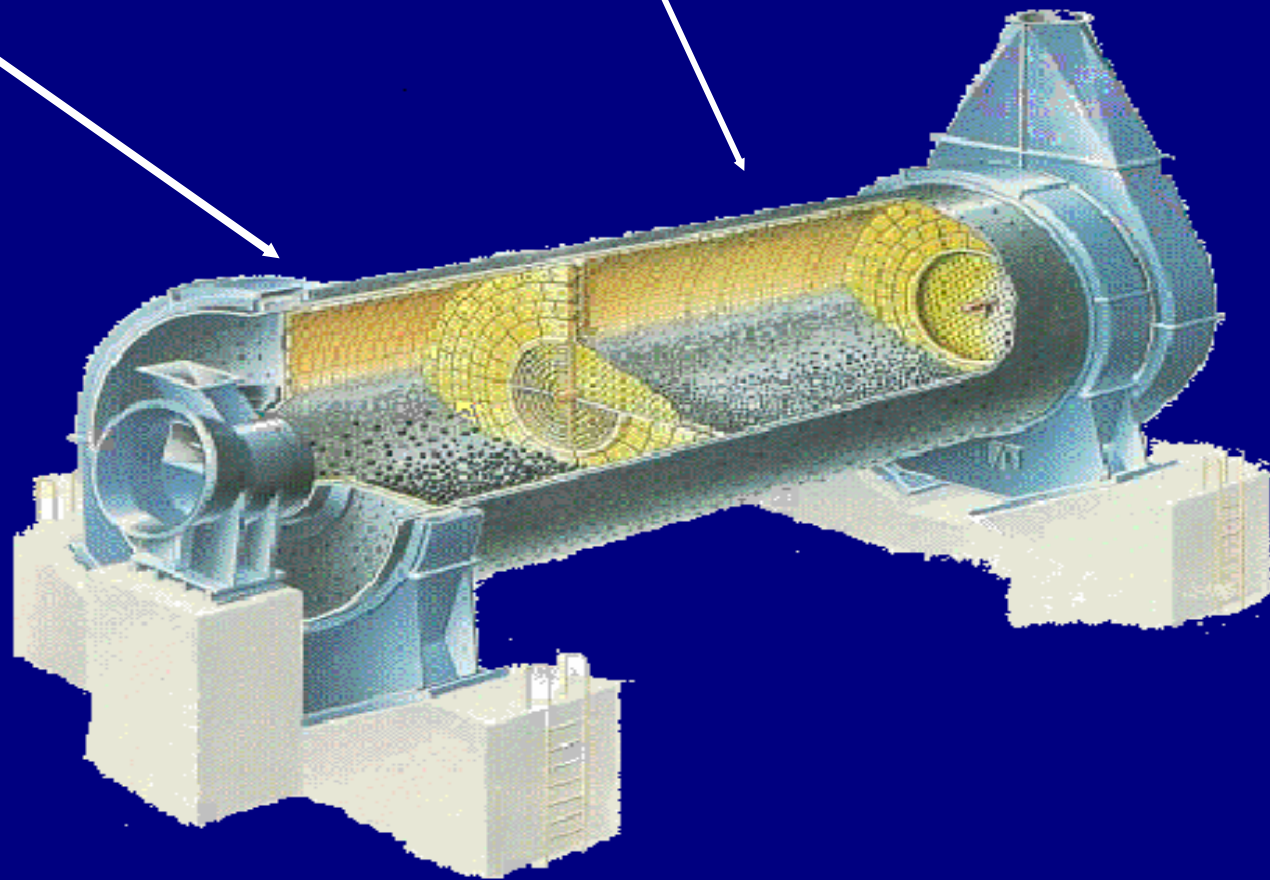
# Finish Grinding Mills (Cement Mill)



# Ball Mill

Second Compartment  
Used to grind clinker

First Compartment  
Used to crush clinker.



# Gypsum

- Gypsum Added to Control Setting
- Set Time Increases as Gyp Increases
- Various Cement and Masonry Products Have a Range of  $\text{SO}_3$  Content
- $\text{SO}_3$  at 3.5% is a Typical Value

# Gypsum

- “a product composed essentially of calcium sulfate in any hydration state...”
- $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
- $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$
- $\text{CaSO}_4$

# Gypsum Handling

- Natural Gypsum Generally Handles Easily
- FGD Gypsum Generally More Difficult
  - Slurry to Filter Cake
  - Moisture
  - Sticky

# Gypsum Handling

- Avoid Bucket Elevators
- Mass Flow Cone Silo Bottoms
- Materials of Construction
- Reclaim Auger Assemblies
- Reclaim Arm Assemblies



# Marine Silos



# Cement Barge

