

Modern Portland Cement Production



Ash Grove Cement Louisville, NE

- Opened in 1929
- Produced 250,000 Barrels/yr – 50,000 tons/yr





- 143 full time employees
- Making Cement 24/7
- 1.1 Million Tons/year (2.2 Billion pounds) 44,000 truckloads!

Cement 101

Clinker

Raw Materials

- Limestone (Calcium Carbonate) – 60-67%
- Sand (Silica) – 17-25%
- Shale (Alumina) – 3-8%
- Mill Scale (Iron) -.5-6%
- + Gypsum (Sulfate) – 1-3%



Limestone



Shale



Sand



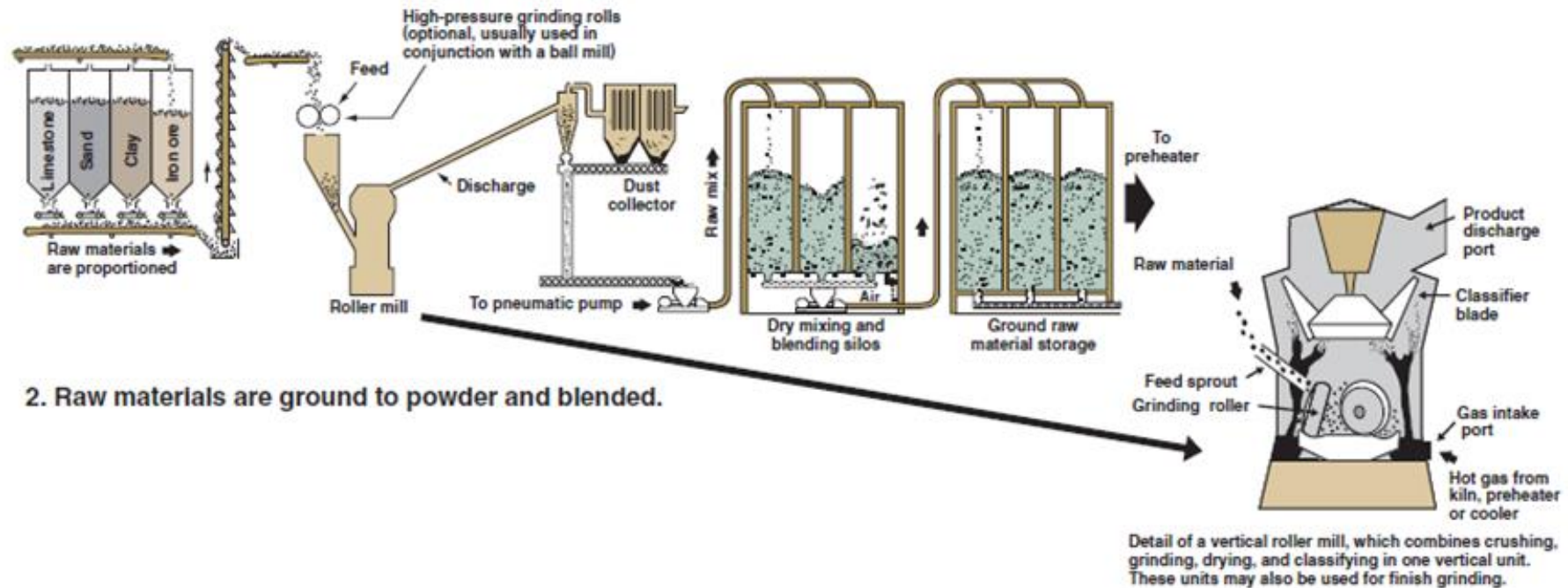
Iron Ore



Limestone is quarried, then ground up into fine powder



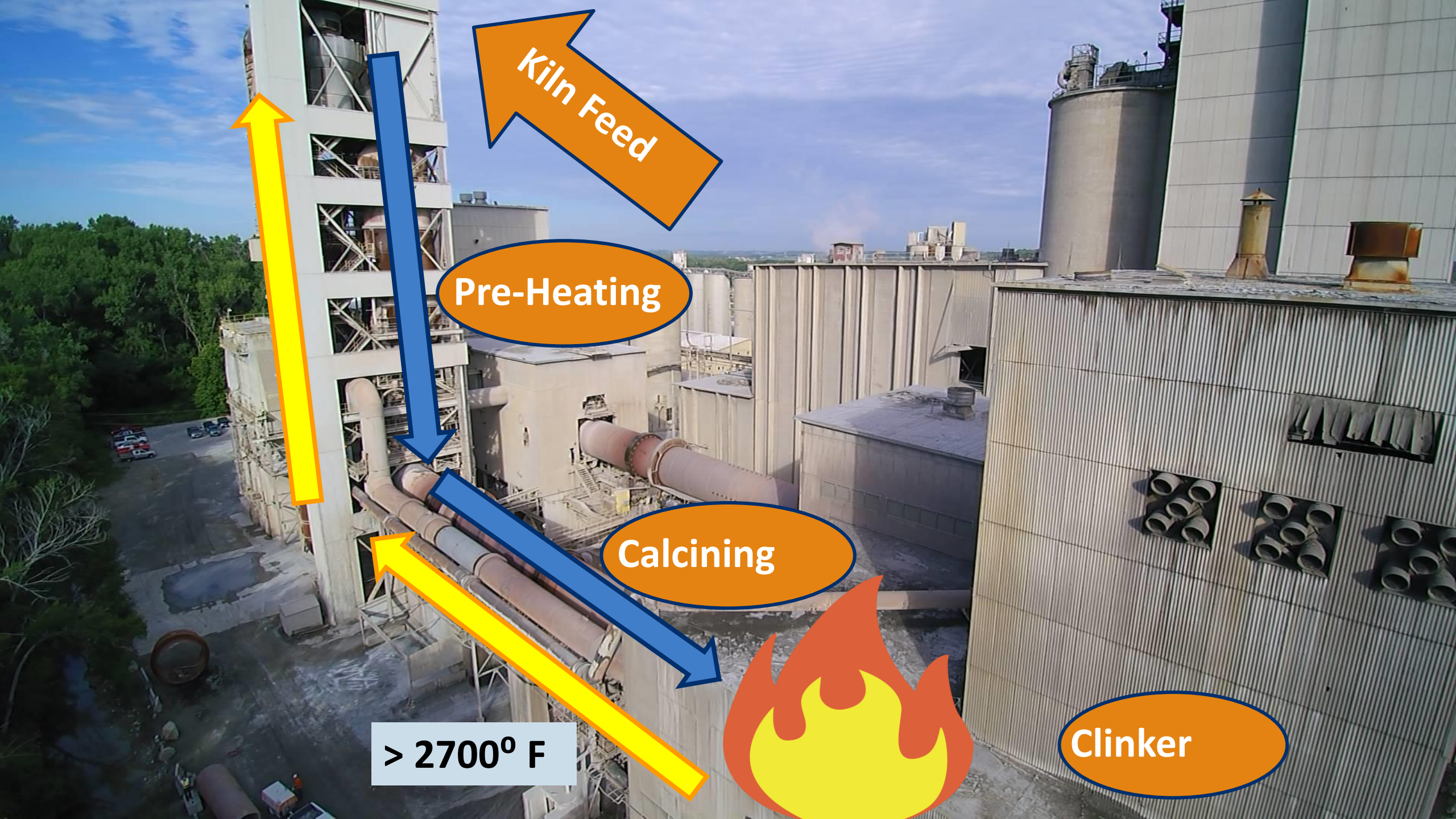
Manufacturing Process



Portland Cement

- 1950s to 1980s high demand and stricter environmental regulations
- Higher capacity kilns, better thermal efficiency, lower emissions
 - Preheaters
 - Precalciners





Kiln Feed

Pre-Heating

Calcining

Clinker

> 2700° F



Manufacture of cement clinker

View inside the kiln



Primary Reactions

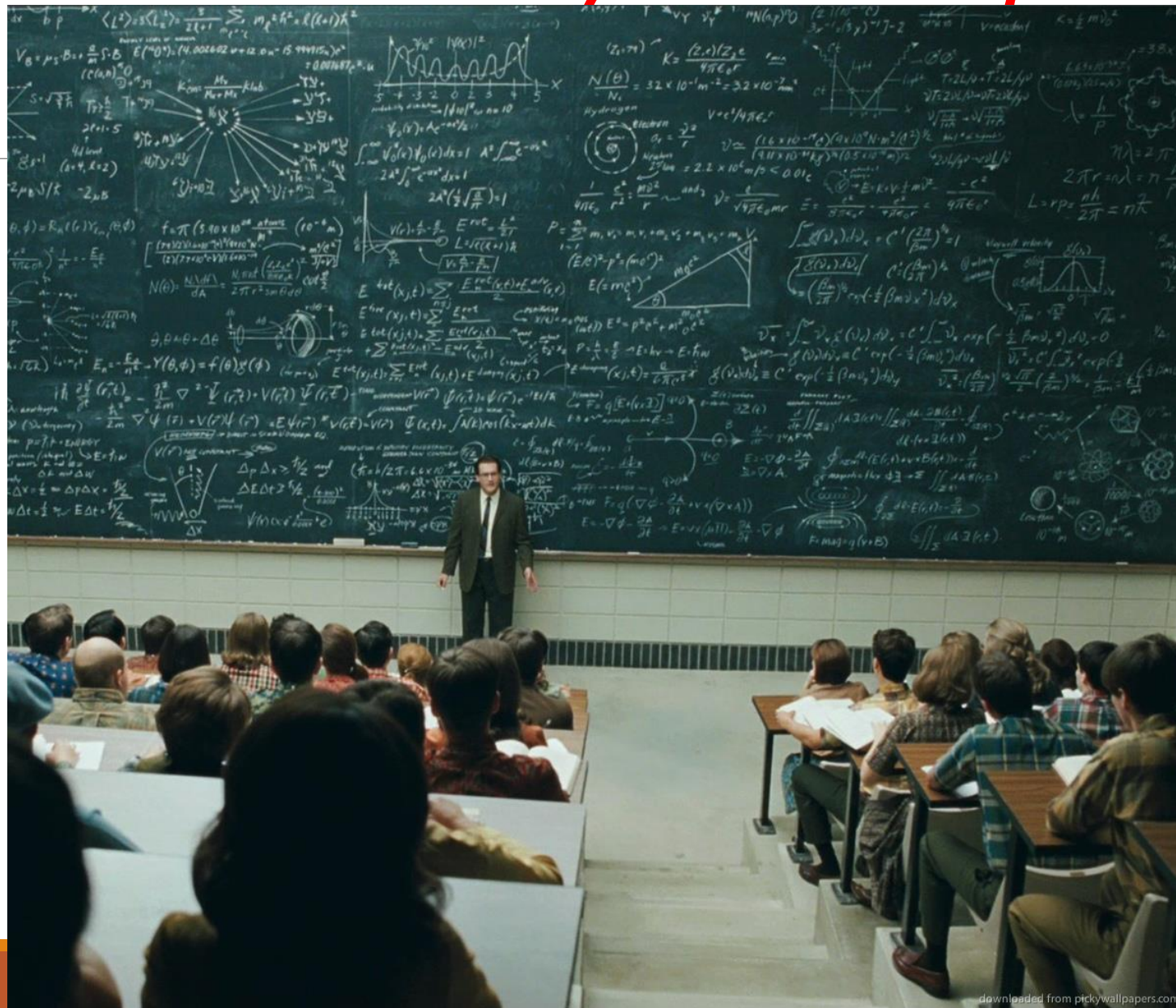
Alite Silicate: $2C_3S + 6H \rightarrow C-S-H + C-H$

Belite Silicate: $2C_2S + 4H \rightarrow C-S-H + C-H$

Aluminate: $C_3A + \text{Gypsum} + 26H \rightarrow CASH$

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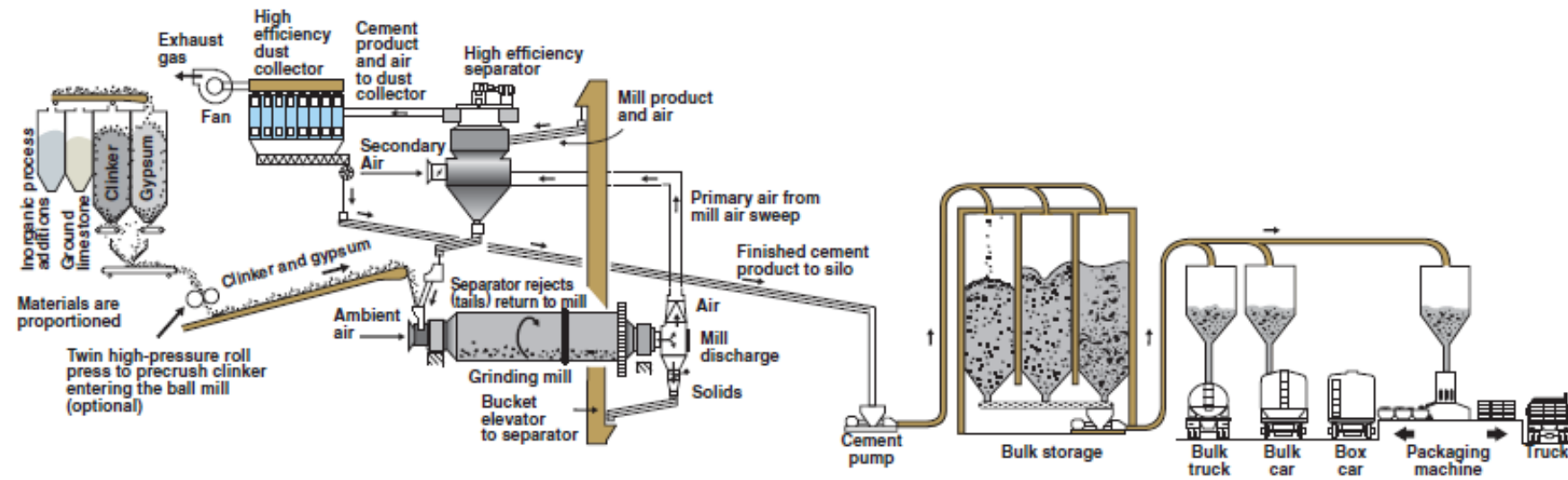
Take notes that may be on the quiz.



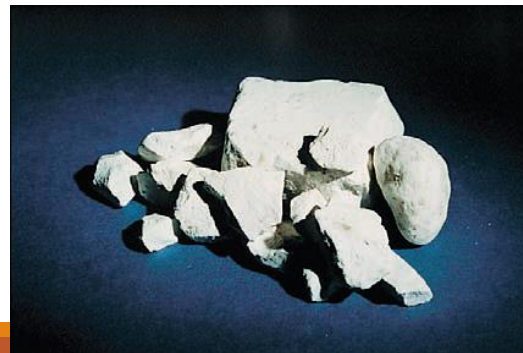
Clinker



Mill Grinding



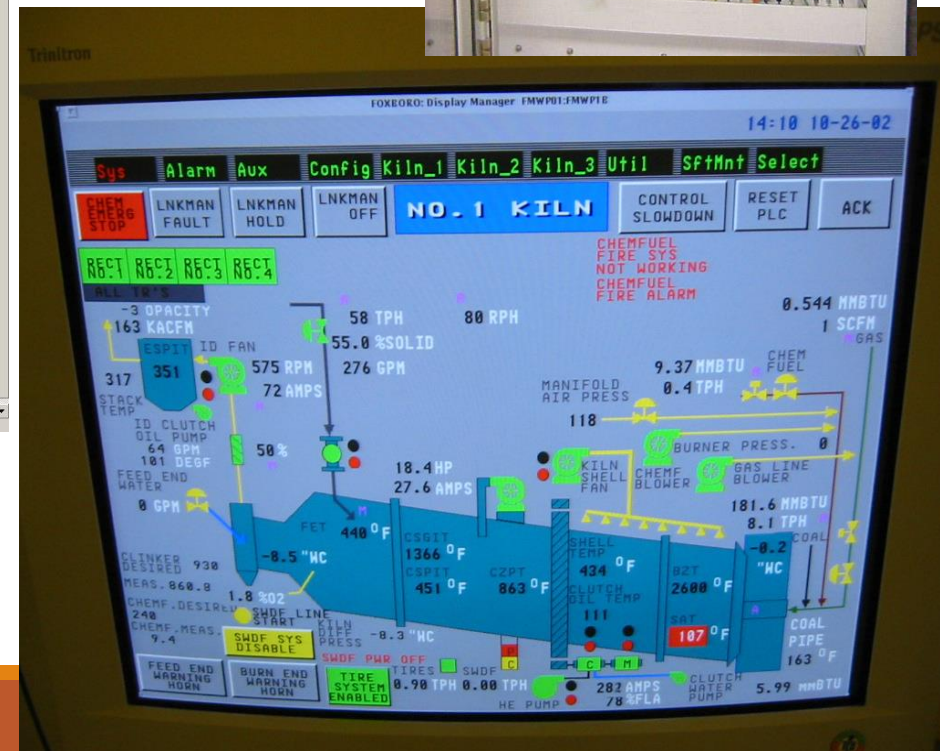
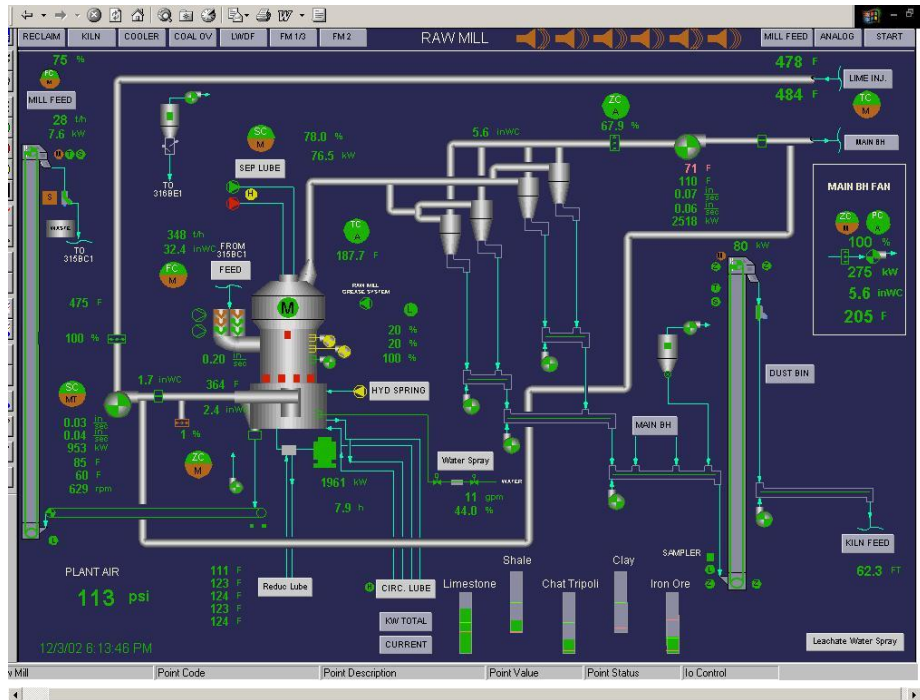
4. Clinker with gypsum is ground into portland cement and shipped.





Control room

Advanced Process Control Technology



PLC / DCS / Computers and networking are all used for controlling equipment

On Line Analyzers are Used



- X-Rays take Chemical readings 5 times a minute
- Every 5 minutes averaged and feed bin rates are optimized.

The Cement Lab - QC

Run by Chief Chemist

Control the raw mix

Crucial to quality

>50 samples analyzed
per day

Quality starts in Quarry,
monitored thru Cement



Portland Blended Cement

- 1995 – Type IP
- I-29 SB Pottawattamie County



Portland Blended Cement

- 1994 – Type IS Test Section
 - US 63 Bremer County
- 1995 – Linn IA 100
 - 35% Blended on project



Portland Limestone Cement

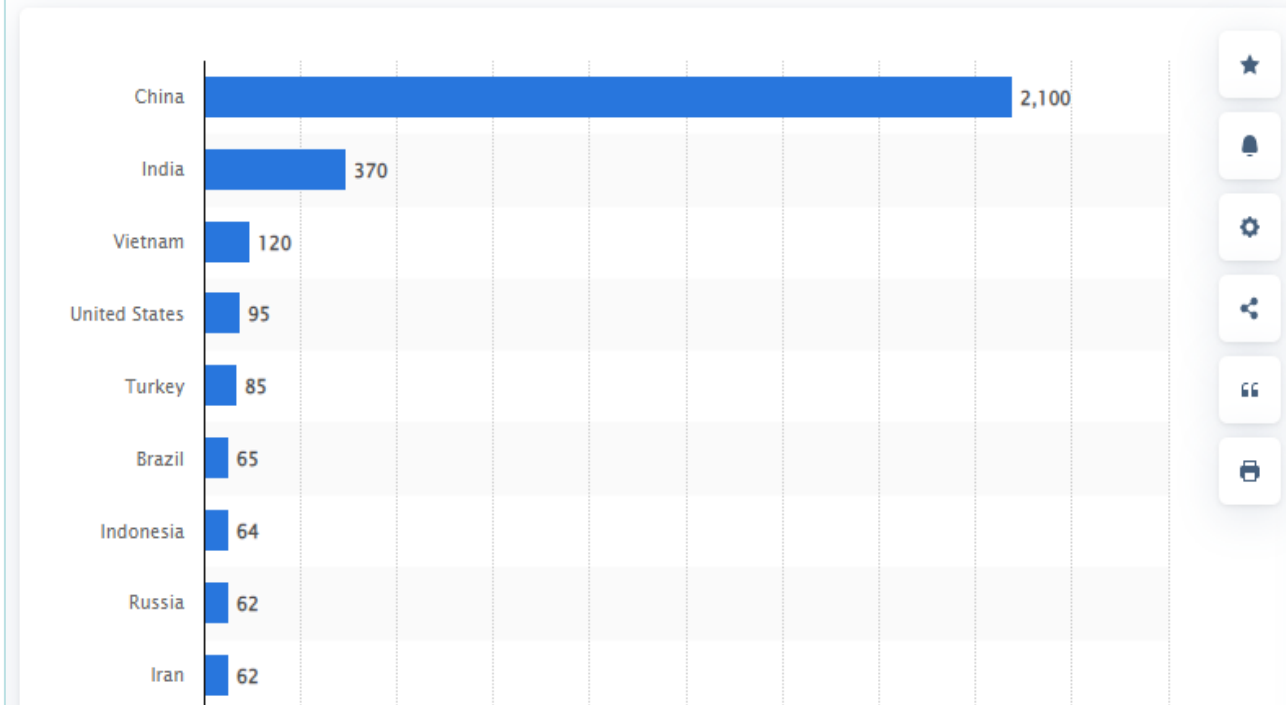
- 2013 – 1st project utilizing Type IL
 - Story Co. US 30
- 2022 – Type IL replaced Type I/II Cements



Portland Cement Today

- 2022 US now 4th in production
- China produces 60% of world's cement
- 2011-2013 - In 3 years China surpassed US production for entire 20th century

Major countries in worldwide cement production in 2022
(in million metric tons)



Thank You!



PORTLAND CEMENT

This industry was born in the Lehigh Valley. David O. Saylor first made portland cement at Coplay in 1871. Here also was the first use of the rotary kiln process commercially Nov. 8, 1889. This region has continued to lead in the industry.

PENNSYLVANIA HISTORICAL AND HERITAGE COMMISSION