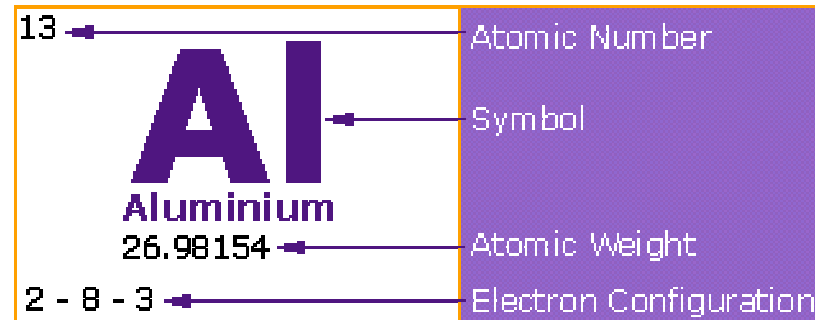
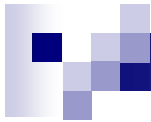


38th IMIA Conference

Engineering Exposure related to Aluminium Production

Working Group: Patrick Eyer, Swiss Re, Zurich
Gisle Melhus, If P&C, Oslo
Peter Tailby, GE Insurance Solutions, London
Milan Dinets, Ingosstrakh, Moscow (Chairman)

20 September 2005, Moscow



- **Most abundant metal in the Earth's crust**
- **Discovered and named in 1808**
- **150 years of commercial production**
- **29 tonnes produced per year (2004)**

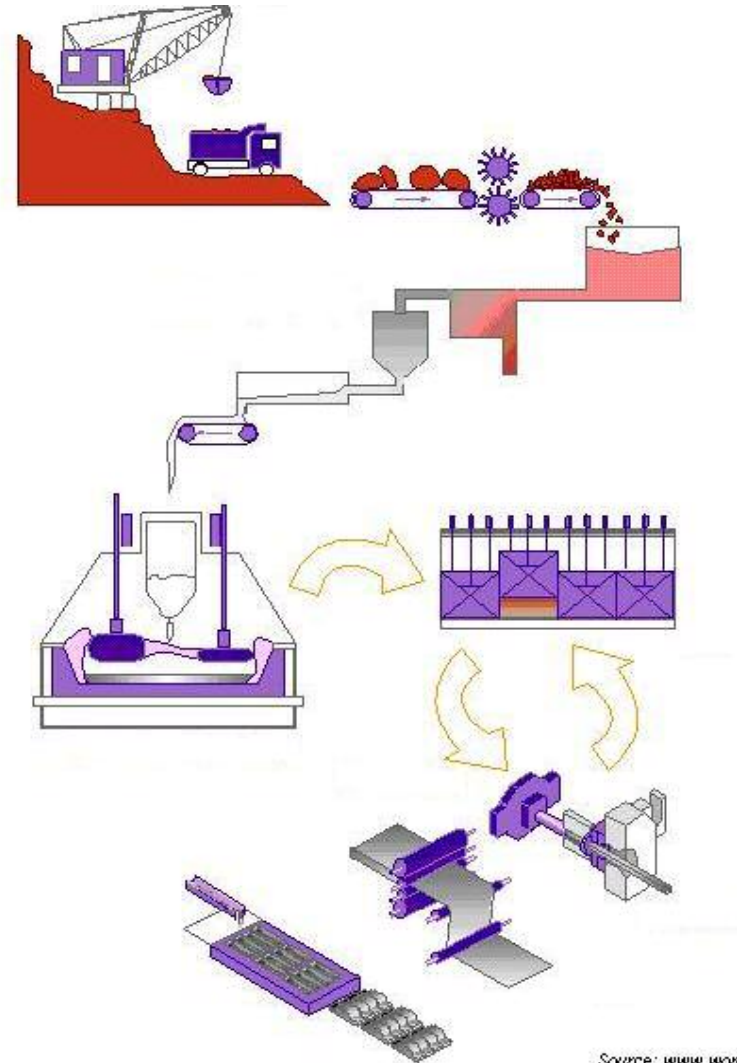
Production of Aluminium

Bauxite mining

Alumina refining

Aluminium smelting

Processing



Source: www.world-aluminium.org

Alumina Refining



Engineering Exposure related to Aluminium Production

The Bayer Process

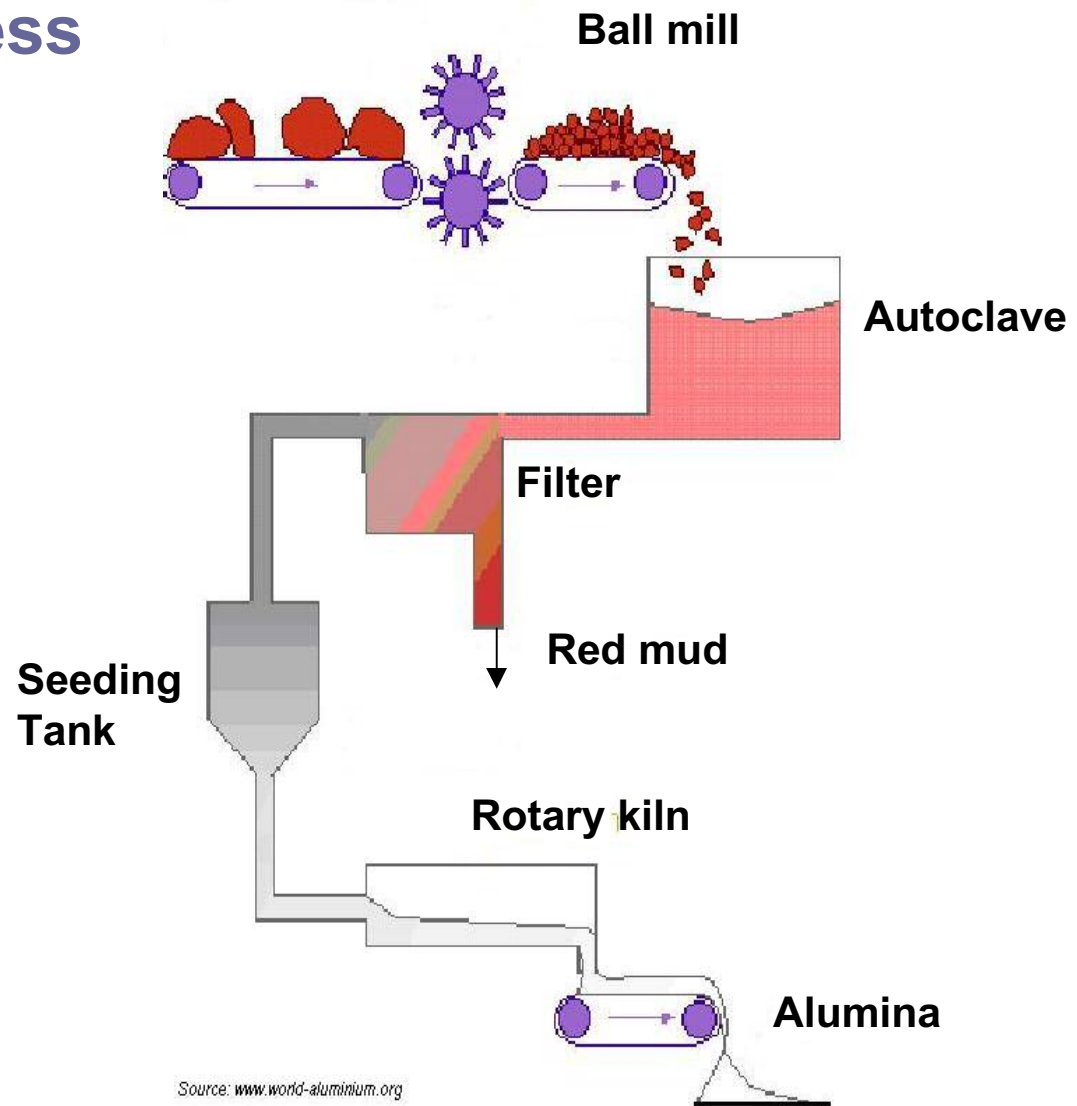
Bauxite crushing

Digestion

Clarification

Decomposition

Calcination





Exposures related to Alumina Refining

- Overpressure of a digester vessel
- Failure of an agitator motor
- Heat damage (deformation) of rotary kilns

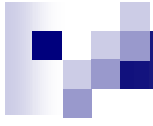


Rotary kilns



Exposures related to Alumina Refining

- Overpressure of a digester vessel
- Failure of an agitator motor
- Heat damage (deformation) of rotary kilns
- mechanical breakdown of heavy duty machinery, conveyor systems
- electrical breakdown of large motors transformers and switches

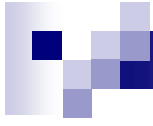


Motors for crushers

Smelting

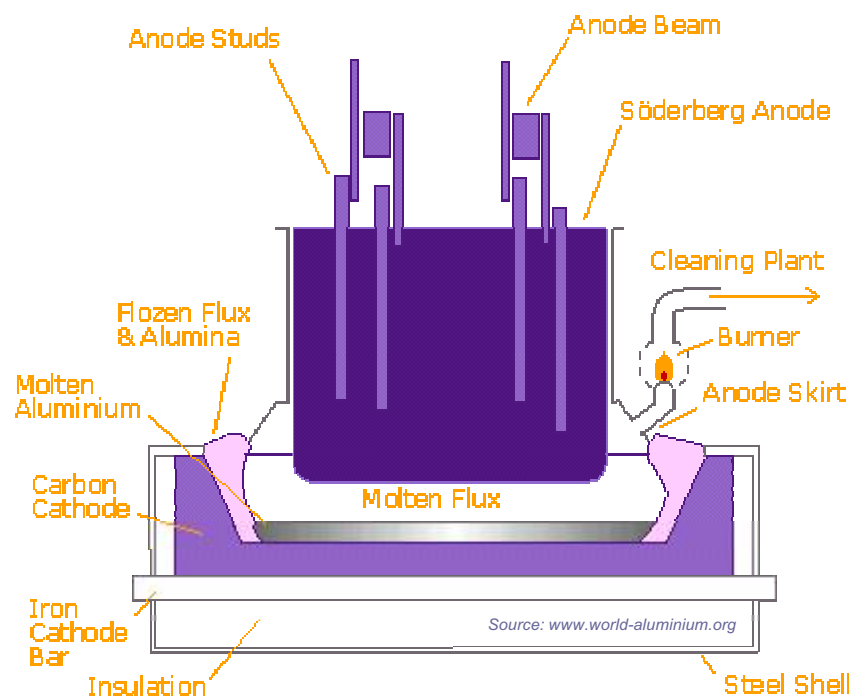


Engineering Exposure related to Aluminium Production

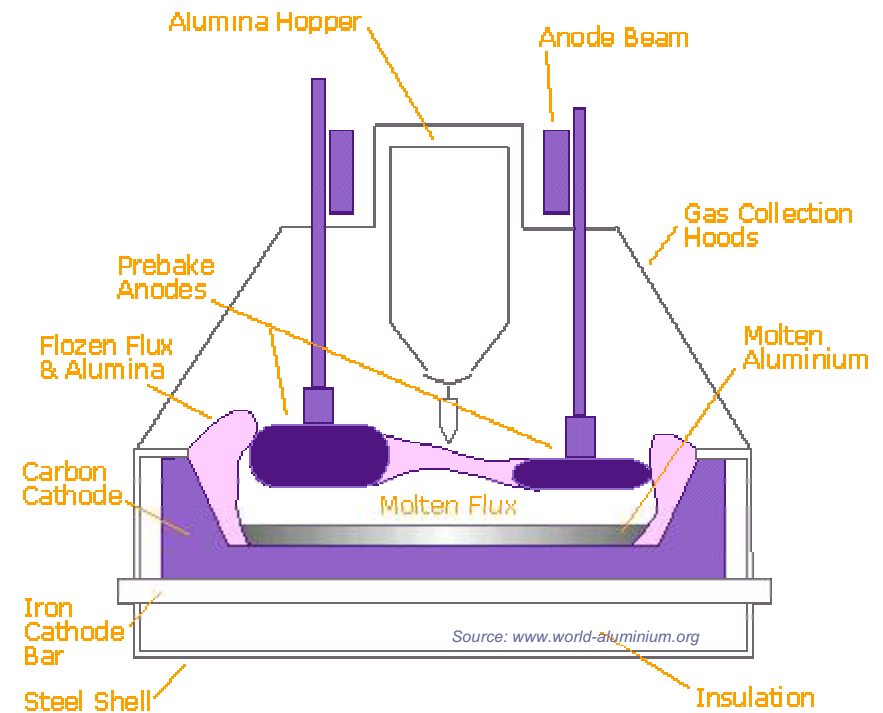


Pot (electrolytic cell)

Söderberg Anode



Pre-Baked Anode



Potline



Engineering Exposure related to Aluminium Production



Exposures related to Smelting Plants

- Pot freezing
- Only 3-6 h of power supply interruption
- Loss of production
- Damage to the pot lining
- Remaining pot life reduced
- Up to several months to restore a pot line
- Significant business interruption loss



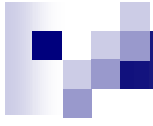
Secure Power Supply System shall mean

- dual supplies from the grid
- surplus generating capacity
- connection to the grid by two or more transmission lines
- duplication of line transformers and other major equipment in the switchgear yard;
- dual circuit connections to pot lines within the plant;
- separation of transformers and rectifiers
- installation of spare power transformers and one spare rectifiers



Emergency Steps in case of Power Failure

- to siphon off molten metal
- to lower anodes
- to shift a pot line into hibernation mode



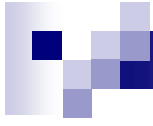
Anode Production



Exposures related to Anode Production

Fire and explosions risk because of

- large quantities of combustible materials (pitch and coke)
- coke grinding dust
- hot oil heat exchange system
- volatile combustible gases and vapours



Casting



Engineering Exposure related to Aluminium Production



Exposures related to Casting Plants

- molten aluminium spill
- explosion due to molten metal-water contact
- explosion due to molten metal-rust contact
- fire caused by ignition of hydraulic oils