

# The Bauxite Mining and Alumina Refining Process

## Bauxite Mining

Bauxite deposits are alumina rich laterite deposits that result from the weathering of parent rocks. The deposits are generally relatively shallow (less than 10 metres) and are mined by open cut methods. Apart from the aluminium minerals, from which alumina is extracted, bauxite is predominantly made up of iron and silica minerals. Other minor constituents include titanium, potassium, calcium, and gallium, plus a range of other metallic and non-metallic elements present in various mineral compounds. While topsoil is removed prior to mining for later use in mine rehabilitation, the bauxite may contain a significant organic content due to decomposed organic material, such as tree roots.

At most Australian bauxite mines, the ore is crushed and then transported by conveyor and/or railway to the refineries. The only significant difference occurs at Comalco -Weipa, where the bauxite is crushed, washed (to remove some of impurities such as clay minerals, coarser silica and organic compounds) and then dried prior to transport to the alumina refinery.

Each of the stages involved in bauxite mining has the potential to result in emissions of NPI listed substances. The major emissions are summarized in the figure:

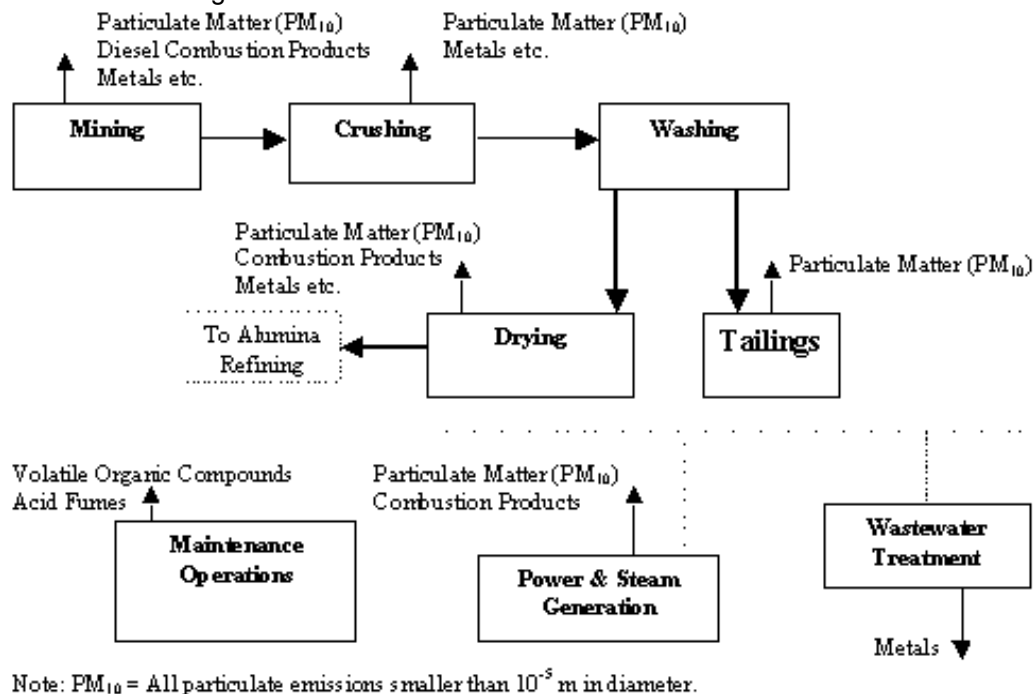


Figure: NPI Relevant Emissions from Bauxite Mining

## Alumina Refining

Alumina is the aluminium oxide extracted from bauxite by a refining process. The most common alumina refining technique is known as the Bayer Process, which is illustrated in Figure 3. Alumina refining involves four basic stages:

### Grinding & Digestion

Bauxite is ground into small particles (generally less than a millimetre in size) and then mixed with a hot caustic soda solution under pressure to dissolve the available aluminium oxide (alumina).

### Liquor Purification

Impurities, largely silica in sand form and undissolved iron oxides are settled and filtered out. The bauxite residue is washed to remove most of the caustic solution. Dissolved organic components such as oxalate and humic compounds are also removed by selective crystallisation or distillation and incineration.

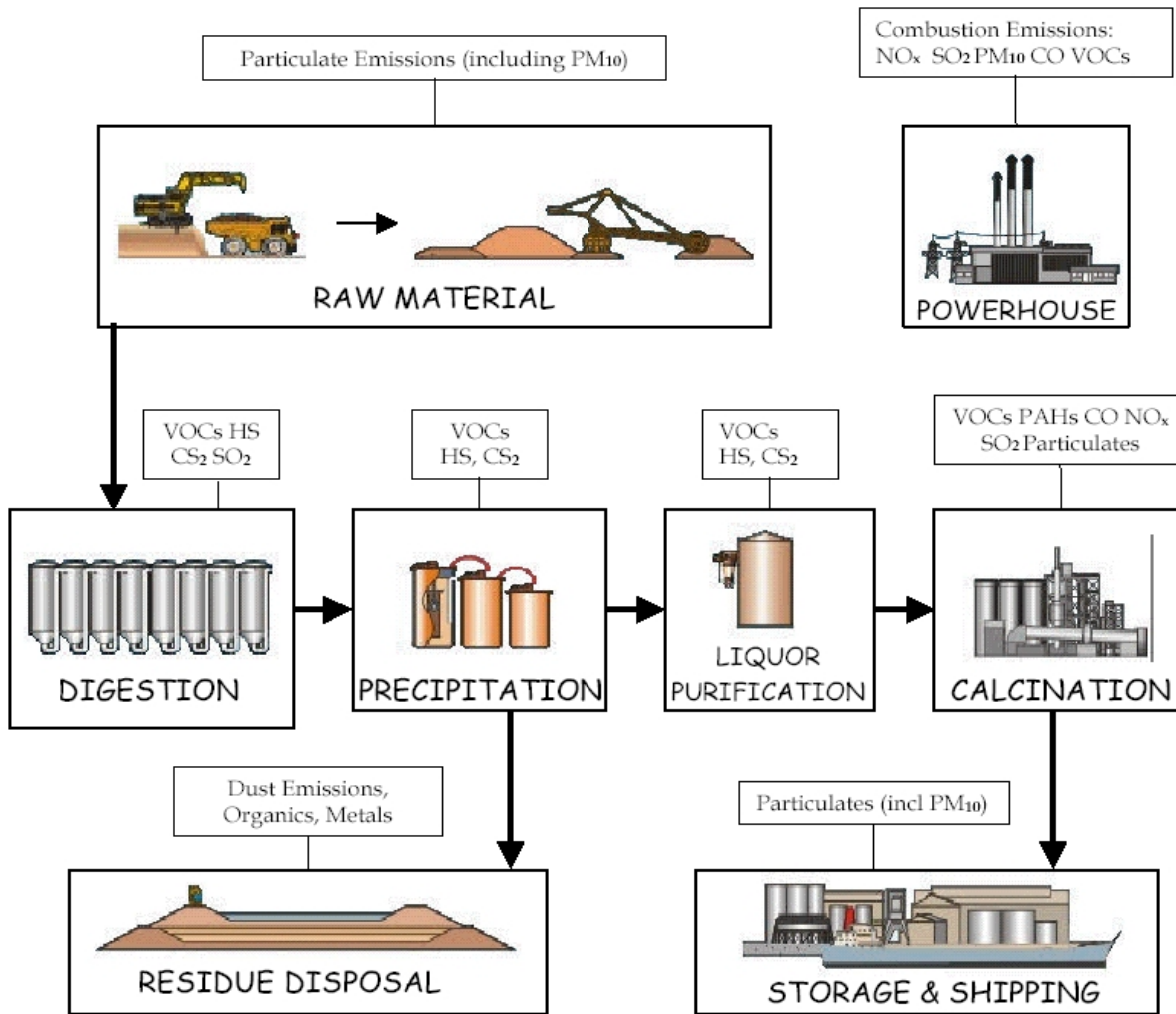
### Precipitation

The hot liquor is cooled and fine alumina hydrate added as 'seed'. Alumina hydrate in solution crystallises out onto the seed. The 'spent' liquor is then recycled to digestion. Hydrate is alumina bonded to water (Al<sub>2</sub>O<sub>3</sub>.3H<sub>2</sub>O), and in this form is the feedstock for most alumina chemicals.

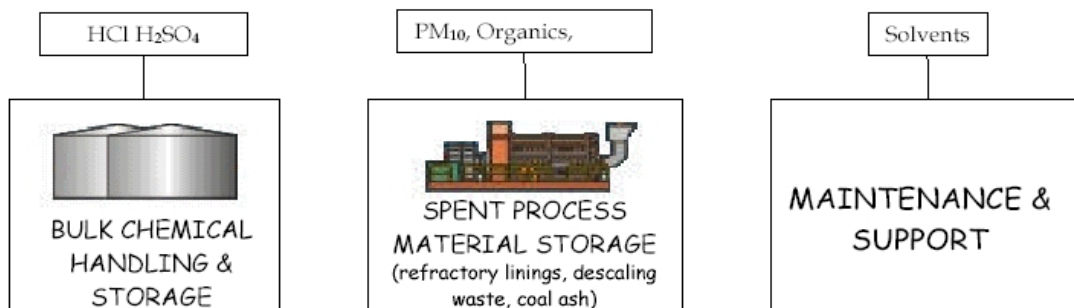
### Drying and Calcining

The alumina hydrate crystals are washed and dried and calcined in fluid bed or rotary kilns at around 1000 °C to drive off the chemically combined water. The final product is aluminium oxide (Al<sub>2</sub>O<sub>3</sub>) which is the feedstock for aluminium smelters. While most alumina production is calcined alumina for smelting, some alumina hydrate is sold for other uses such as water treatment and chemicals manufacture.

# ALUMINA REFINERY PROCESS FLOW DIAGRAM



## OTHER RELEVANT PROCESSES



Process emissions listed above are to be used as a guide only. Actual emissions may vary from site

Reference:

<http://www.aluminium.org.au>