



International Aluminium Institute



BACKGROUND INFORMATION ON TYPICAL BAUXITE RESIDUE

What is bauxite residue or “red mud”?

The process of alumina refining extracts alumina from bauxite ore, leaving bauxite residue, which comprises red mud and sand. Bauxite residue is therefore a by-product of alumina refining and is stored in special facilities. Bauxite residue is a reddish brown, non-combustible solid. Bauxite residue usually consists mostly of iron (which is why it looks red), alumina containing minerals, and silica. It also contains small proportions of other minerals.

What are the main constituents of bauxite residue?

Bauxite residue composition varies by region, but typically contains the following components, in roughly the proportions listed:

| Components | CAS# | Percent |
|--|-----------------------|---------|
| Sodalite (3Na ₂ O·3Al ₂ O ₃ ·6SiO ₂ ·Na ₂ SO ₄) | | 4 – 40 |
| Alumino-goethite | | 10 – 30 |
| Hematite (Iron oxide) | 1317-60-8 | 10 – 30 |
| Silica, crystalline & amorphous | 14808-60-7; 7631-86-9 | 5 – 20 |
| Tricalcium aluminate (3CaO·Al ₂ O ₃ ·6H ₂ O) | | 2 – 20 |
| Boehmite [Al(OH) ₃] | 1318-23-6 | 0 – 20 |
| Titanium Dioxide | 13463-67-7 | 2 – 15 |
| Muscovite (K ₂ O·3Al ₂ O ₃ ·6SiO ₂ ·2H ₂ O) | 1318-94-1 | 0 – 15 |
| Calcium carbonate | 1317-65-3 | 2 – 10 |
| Gibbsite [Al(OH) ₃] | 21645-51-2 | 0 – 5 |
| Kaolinite (Al ₂ O ₃ ·2SiO ₂ ·2H ₂ O) | 1318-74-7 | 0 – 5 |

Trace quantities of metals such as arsenic, manganese, cadmium, chromium, nickel, mercury, beryllium, lead and naturally-occurring radioactive materials, such as thorium and uranium, may be present.

The pH level is up to 13, due to alkali sodium compounds, such as sodium carbonate and sodium hydroxide. The alkali nature of bauxite residue is an important issue to consider in relation to potential health effects.

POTENTIAL HEALTH EFFECTS

- Due to the residue’s alkaline nature, direct contact can cause irritation or burns of the skin. The severity will depend on the alkalinity of the exposure, the duration of contact with the skin and the effectiveness of first aid measures. Skin effects are due to the residue’s corrosive nature, and may be delayed several hours. Pre-existing skin conditions may be made worse.

- Due to the residue's alkali nature, eye splashes can cause irritation or burns. Importantly, as with all alkali splashes, the extent of eye damage may not be apparent at first. Eye exposure may produce softening or ulcerations of the cornea. Severe injury could lead to opacity of the cornea.
- Ingestion of this material can cause corrosive effects of the mouth, throat, oesophagus and stomach. The severity would depend on the alkalinity of the exposure and the effectiveness of first aid measures. Mouth and throat pain, difficult or painful swallowing, vomiting, and chest or abdominal pain are potential early symptoms of ingestion. These effects are due to the residue's corrosive nature, and may be delayed several hours.
- Inhalation of the wet material can cause irritation of the nose and throat. The corrosive material, if it gets to the lungs, can also lead to irritation of the lower airways causing shortness of breath, chest tightness and cough, especially in people with underlying lung diseases like asthma and bronchitis.
- Heavy metals are present in bauxite residues at very low concentrations, therefore acute adverse health effects from heavy metal exposure are unlikely to occur.
- The concentrations of naturally occurring radioactive materials such as uranium and thorium are very low in bauxite residues and are not expected to cause any adverse health effects.
- Dust arising from de-watered residue can cause irritation, especially to the eyes, and if inhaled can cause irritation of the nose, throat, and lungs.

FIRST AID/IMMEDIATE MEDICAL MANAGEMENT (PRE-HOSPITAL CARE)

People required to remain in affected areas (e.g. security and emergency response personnel) are advised to avoid direct skin contact with bauxite residue and to use appropriate personal protective equipment (see below).

Respiratory Protection: N95 (or equivalent) respirator; alternatively, a half-face or full-face respirator with particulate filters.

Skin Protection: Impervious, chemical-protective (alkali-resistant) clothing and footwear and gloves.

Eye Protection: Tight-fitting goggles (or full-face respirator).

SKIN: Brush/irrigate any solid material from clothes, skin, or hair while protecting the individual's eyes. Remove contaminated clothing and flush exposed areas with water for at least 20 minutes. Irrigation should occur as soon as possible after skin contamination (seconds count).

Diphoterine[®] is a safe and efficacious solution for initial decontamination of eye and skin chemical splashes. If available, Diphoterine[®] spray [PREVOR - France] can be used. However immediate use of water is preferable to any delay in obtaining Diphoterine[®]. Double-bag contaminated clothing and personal belongings.

EYES: Flush exposed or irritated eyes with plain water or saline or Diphoterine[®] for at least 20 minutes. Start this irrigation immediately (seconds count). The eyelids should be held apart during irrigation. Remove contact lenses if easily removable without additional trauma to the eye. Medical assessment should follow these first aid measures without delay.

INGESTION: In cases of ingestion, do not induce vomiting. Do not administer activated charcoal or attempt to neutralize stomach contents. The material should be diluted by giving conscious individuals water, normal saline, or milk (120ml for children; 240ml for adults). Medical assessment should follow these first aid measures without delay.

INHALATION: Remove to fresh air. Check for clear airway and breathing. Medical assessment should occur without delay.

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