

## Improvement of Dust Management at the Gardanne Alumina Production Plant BRDA

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### Abstract



The Gardanne alumina production plant operates a Bauxite Residue Disposal Area (BRDA) located 4 km from the plant, where red mud has been stored from the beginning of the 20th century until 1966, as a wet residue. Afterwards, during almost fifty years, red mud was sent to the 'Fosse de Cassidaigne', a trench in the Mediterranean Sea, via a 60 km pipeline to a discharge point 7 km offshore and 320 m deep. To ensure compliance to new regulations, the red mud was dehydrated using press filters as early as 2006, and this filtered residue is being stored on the historical BRDA following the successive commissioning of three press-filters installed over a period of 10 years. As it is located near residential areas, dust management represents a major challenge at the site, particularly during windy, warm and dry weather conditions that are not uncommon in southern France. In order to effectively avoid dust emissions at all times, ALTEO has adopted and implemented various solutions on the BRDA over the last few years. This was achieved using two strategic ways: working with specialized partners in dust management, employing technical solutions to affix the dust to the ground and adapting the current operating procedures.

**Keywords:** Dust, Bauxite residue, BRDA, Press filter.

### 1. Introduction

The problem related to dust emissions in the environment is not specific to the alumina industry, in the sense that it represents a major health and environmental issue, and concerns many sectors of industry. Bauxite residue dust, however, has an extremely staining character, which makes its impact on the environment particularly noticeable.

In order to better understand this problem, in the context of a BRDA, it is first necessary to understand the reasons for which the bauxite residue can have a dusty character, the associated problems and the consequences that this can have.

The bauxite residue when it is produced using press filters, generally has a moisture of around 30 %. At this stage, it is not dusty, and can be easily transported to its storage place without fear that it will generate dust. The residue will then dry in the open air, until it takes on a "cooked" appearance. When the residue is in this state, if it undergoes the slightest mechanical action, it will turn into extremely fine dust particles and becomes powdery. On the site, the main dust-generating cause is the movement of earth moving machinery used to stack the residue, which, by crushing the bulk residue, transforms it into dust. On the other hand, the bauxite residue contains traces of soda which in contact with air can be transformed into sodium bicarbonate. The appearance of this sodium bicarbonate creates a white film on the surface of storage areas, which can be very volatile.

BRDAs generally cover a fairly large area of several tens of hectares. As part of the Gardanne alumina production plant BRDA, the area of the site in operation is approximately 25 hectares.

The appearance of red dust on such surfaces can therefore have significant consequences in the event of dust emissions in the environment.

The Gardanne alumina production plant BRDA named "Mange Garri" is located in the south of France in Provence, a region well known for its prevailing wind called "Mistral". This northerly, dry and cold wind blows throughout the year approximately 100 days per year, and can reach more than 100 km/h. The less frequent East wind can also reach 90km/h in gusts. In terms of precipitation, the Mange Garri site receives an accumulation of rain of around 600 mm per year, mainly in autumn during intense Mediterranean episodes. The rest of the year rain is rather rare. With such a climate, where rain is rare, and where the wind blows all year round, the dust management on the site therefore represents a real challenge.

In April 2018, while the site was in operation for several years to store the bauxite residue produced by press filters, a strong episode of easterly wind at more than 90 km/h raised a cloud of red dust over the neighbouring village of Bouc Bel Air. This incident had a strong media impact at the local level.



**Figure 1. Dust storm over neighbouring village.**

This type of incident can be extremely detrimental to the image of a company. ALTEO, which had already implemented numerous means of combating dust, had to think about finding new solutions, in order to make the management of this risk more reliable.

## **2. Technical Solutions to Affix the Dust to the Ground**

In order to be able to fight against dust, it was first necessary to find technical solutions to treat dusty areas. Intuitively, the use of water was immediately preferred, however it was necessary on the one hand to learn how to optimize its use, and on the other hand to find alternative solutions.

### **2.1 Applying Water to the Surface**

The use of water on a powdery surface will make it possible to find a wet, almost muddy appearance, which when drying will leave a non-dusty "crust", as long as it is not subjected to mechanical action. The simple action of rain on the scale of the site is sometimes enough to eliminate any risk of dust emissions for a few days.



**Figure 8. Comparison between a satellite image (Google Earth) of ALTEO BRDA in 2018, and a drone view (ALTEO) of the site in 2021.**

The innovation and research work carried out by ALTEO in collaboration with specialized partners in dust management and experts in geo techniques made it possible to transform the site using with best available techniques of operation to minimise risk of dust emissions. All these measures, however, are effective only if they are accompanied by a robust organization that allows for anticipation and responsiveness.

#### **4. Organization**

Dust emissions in the environment can be due to the activity of the site in operation (truck traffic for example) but also due to unfavourable meteorological conditions (absence of rain, strong wind). If the first cause can be controlled simply by temporarily stopping the activity, the second cause is random. Faced with this randomness, daily monitoring of the weather quickly proved to be essential, in order to be able to assess the level of risk on a daily basis.

For this purpose, daily supervision is carried out by a person assigned to this function. The main responsibility is to assess the risk on a daily basis, taking into account the weather forecast and the activity planned for the site's operation, in order to deploy the appropriate means and take the necessary measures to avoid any dust emission. Part of this work consists in anticipating windy episodes, by preparing the surfaces in a preventive way (composting, applying binding agents, various arrangements). The other part consists in being able to intervene on the areas in operation (tracks, operated compartments) during the windy episodes, in order to reach the objective "zero dust".

In order to guarantee the presence of a driver of the mobile watering system when necessary, an on-call system has been set up, making it possible to request a watering intervention in the evening, or even on weekends.

This strong organization improved the monitoring of the risk of dust emissions throughout the year without interruption, by combining anticipation and reactivity.

## **5. Conclusions**

As a result of the level of difficulties faced in the past, ALTEO has worked closely with companies specialized in this field, to find concrete solutions to the major risk of dust emission into the environment close to the BRDA. The wide range of technical solutions now available to ALTEO, combined with a robust organization ensure effective and reliable measures to prevent dust emissions.

The daily consideration of the risk of dust emissions has become for ALTEO a real philosophy, demonstrating the priority given by the company to the consideration of environmental issues.