Project description:

Background

There are a number of abandoned sites from the surface exploitation of bauxite ores in the wider Mt. Parnassus area in Greece. The environment would benefit from the filling and rehabilitation of these mines. Red mud is a by-product of the Bayer process for the refining of bauxite to smelting grade alumina for the production of aluminium. It is produced during the digestion of bauxite with sodium hydroxide solution and is mainly composed of fine particles of silica, aluminium, iron, calcium, and titanium oxides and hydroxides. Red mud is a highly alkaline slurry with 15-30 percent solids and has to be appropriately disposed of in the environment. Aluminium of Greece is the only aluminium refinery in Greece, located in Agios Nikolaos, Viotia. It produces 900 kg of red mud (dry weight) per tonne of produced alumina, which amounts to 680,000 tonnes annually. The residue is piped into the sea 2,800 m from the coastline from where underwater streams transfer it to the centre of the Corinthian Gulf, at a depth of 800 m below sea level. This process contributes significantly to the overall cost of alumina production and also results in pollution of surface and underground water.

Objectives

The Refill project aimed to develop and apply an innovative and cost-effective
method of refilling open pit mines with red mud. This would be done in a way aiming to achieve the double environmental benefit of rehabilitating abandoned open pit mines and eliminating red mud pollution of the sea. The project foresaw tests to identify the optimum use of dried red mud and waste rock for the rehabilitation of abandoned bauxite surface mines. It would use a local disused mine as a demonstration application of the filling process in action using the red mud produced by the refinery of Aluminium of Greece. This aimed to demonstrate an easily transferable dry disposal system for red mud. Tests would also be made with other wastes such as sewage sludge to find the optimum performance in helping the re-vegetation of the rehabilitated site in a transferable way.

Results

The project succeeded in developing a full design for the refilling of abandoned open pit mines with red mud. Its tests showed the success and potential environmental benefits of this innovative dry disposal system of red mud as a way of both rehabilitating disused pits and reducing pollution of the sea. The project examined the geotechnical and geochemical properties of bauxite residues and found that, when dried to the optimum moisture content, bauxite residues have low hydraulic conductivity. Extensive pilot field tests at an abandoned mine at Prosorema, Viotia demonstrated that the amount of water infiltrating through bauxite residues and released to the environment is minimal – around three percent of annual precipitation. This results in a very low risk of groundwater contamination from the disposal of bauxite residues in abandoned mines. The tests provided the necessary technical and economic information to allow for the design of a full demonstration application. This design involved a compacted bauxite residue layer, capped with waste rock or treated bauxite residues, and a cover of vegetation. The design included water deviation works to restrict surface water access to the disposal site and trenches to collect and remove run-off water from the disposal area. Experiments on the surface found that the mixing of waste rock with sewage sludge, and of bauxite residues with gypsum, sewage sludge and calcium oxyphosphate were both effective in supporting the growth of a cover of vegetation. Plants and grasses were developed on both substrates and the metal uptake values were found to be very low, reducing the risk to wildlife. Analysis carried out by the beneficiary shows that the process is economic and therefore sustainable in the aluminium industry. The beneficiary is continuing to work towards implementing the foreseen demonstration application at the 14,150m² Kleisoura abandoned mine after the end of the project. This will show the environmental effectiveness of this new, promising application, which should be easily transferred to similar or other types of hydrometallurgical industries across Europe.
Environmental issues addressed:

Themes

Industry-Production - Mining - Quarrying
Risk management - Site rehabilitation - Decontamination

Keywords

abandoned industrial site, site rehabilitation, mine

Natura 2000 sites

Not applicable

Beneficiaries:

Coordinator  ALUMINIUM OF GREECE SA
Type of organisation  International enterprise
Description  Aluminium of Greece SA was founded in 1960 to exploit Greece's important bauxite deposits for the production of alumina and aluminium. It is now part of the Mytilineos Group, one of the world’s biggest industrial groups active in metallurgy, energy, and defence.

Partners  None

Administrative data:

Project reference  LIFE03 ENV/GR/000213
Duration  01-SEP-2003 to 31-AUG -2006
Total budget  1,910,000.00 €
EU contribution  750,000.00 €
Project location  Sterea Ellada(Ellas)
### Project web site
Website of the project

### Publication: Layman report
Title: Layman report (EN) Year: 2006 No of pages: 10

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**Project description**  
**Environmental issues**  
**Beneficiaries**  
**Administrative data**

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