



European Union Civil Protection Mechanism

ACTION PLAN

following the industrial accident at AJKA alumina factory

October 18th, 2010

This analysis is based on field observations and on the information that was submitted to and assembled by the EU Civil Protection (EU-CP) expert team between October 11th and October 14th. It includes a series of measures that could further enhance the on-going activities coordinated by the Hungarian Government. The team would like to thank the Hungarian authorities for all the support provided during the mission, and for the fruitful discussions.

1- PROTECTION MEASURES

a) Minimizing further spread of red mud

- **Priority measures for limiting its spread via air**
- **Further prevention measures are needed to stop the formation and spreading of dust through the air.** This could be accomplished by:
 - Reducing the sludge covered surface area by selective excavation of areas that are covered only by a thinner layer of sludge. These excavated materials could be stored temporarily at the location of excavation, with measures to prevent dusting. (e.g. by covering)
 - As before, keep affected surfaces wet.
 - Covering the contaminated area temporarily by spraying film-forming materials. The choice of the agent should be evaluated for preventing undesired secondary effects on the environment.
- **Priority measures for limiting its spread via Torna creek**
- Diverting the creek upstream the sludge reservoirs on a different route (after feasibility study), so that it does not cross the affected areas and there is no risk anymore of carrying the remaining red mud.
- In the downstream section of the creek - on top of the previously constructed 7 underwater weirs on Marcal - it is recommended to install an extra catchment area for suspended solids. Sedimentation can also be accelerated by the addition of flocculants.
- Further efforts are needed to prevent the spreading of contaminated materials from other existing canals and ditches that are branching off the Torna Creek.
- **Additional measures**
- The aim is to further reduce the spread of red mud to an extended area, caused by vehicles crossing and leaving the affected areas, by, for example, installing wheel washers for cars and trucks.

b) Assessing the risks for human health and mitigating them

- The air-quality monitoring system should be reinforced in the impacted area and linked to analytical capacities, including an early warning system.
- **Continue assessing the risks to human health in a comprehensive way**, according to age, on the basis of the detailed air quality measurements.
- As the population is returning to its homes the adequate mitigation measures must be sustained, further developed and applied for the risks already identified. Such measures should include:
 - Minimizing aerosol formation due to cleaning activities, such as for instance the use of high-pressure jets. The roads should be cleaned with suction machines, rather than with water jets.
 - Continue providing practical advice to the citizens returning to their homes on protection measures that each should obey. For instance, when entering buildings (public buildings included), shoes should be rinsed for removing the red mud. This could be done by installing available shoe washing equipment, or alternatively by using disposable plastic shoe covers.

c) Assessing the risk for further damage

- Performing a thorough inspection of the current status of all existing dikes of all sludge reservoirs in Ajka,
- Investigating the impact of the bentonite barriers that surround the sludge reservoirs on the local geo-hydrology and on the stability of the dikes.

2- IMPROVEMENT OF THE RESPONSE

a) Minimizing the environmental impact of the response activities

- **Consider using alternative additives to reduce the pH of the surface waters.** Gypsum, calcium nitrate, magnesium nitrate increase the salinity of the surface water and also of the groundwater. Attention must be taken on gypsum quality as between natural mined gypsum and gypsum as industrial waste product, the latter to be avoided, as a possible source of unwanted secondary contamination. Nitrates may enhance eutrophication of receiving surface waters. Acetic acid has the undesired effect of increasing the BOD of the surface water.
A reagent for neutralization may be carbon dioxide gas. This is available in bulk quantities (liquefied) from industrial gas suppliers. The latter have specialized equipment to dissolve the carbon dioxide gas in the surface water (e.g. injection nozzles or venture pumps).
- Find further safe storage solution with sufficient volume for all contaminated materials.

b) Monitoring

- The application of the continuous air quality monitoring system should be reinforced in the impacted area and the surrounding, linked to analytical capacities and including an early warning system. This program should build

on coordinated data collection mechanism and include long distance monitoring.

3- REMEDIATION AND REVITALIZATION

a) Sustain the integrated command system in the rehabilitation strategy

- Sustain the integrated project management (civil and Environment-Health & Safety) in the development of the comprehensive rehabilitation strategy.

b) Medium term measures

- Continue removal of the contaminated materials in the necessary quantities from
 - Sediments in surface waters (in the downstream section of the Torna Creek, in the upstream section of the Marcal River), including
 - Sewage systems
 - Ditches (for rain) of settlements
- Remove sludge and contaminated soil from contaminated land according to specific criteria of the site that will be monitored during excavation.
 - Excavate according to depth of impact and technical feasibility with measures to minimize the spreading of dust. Store excavated contaminated soil in a first stage separately from pure red mud wastes until it has been characterized. Contaminated soil might be cleaned, e.g. by soil washing. One should be careful not to remove more soil than necessary because this may generate problems with finding sufficient storage capacity for excavated materials (taking into consideration the restart of MAL's production and the storage of red mud previously stored in the damaged reservoir X.).
 - Selective excavation is desirable, with separation of soil saturated with sludge and sand contaminated by infiltration.
- Land use changes may be considered.
 - Valuable agriculture land should be conserved as much as possible where removal of sludge is feasible
 - Where the sludge formed a thicker layer or where removal of contaminated soil is difficult, land use changes may be considered, e.g. grow energy crops.

c) Further needs and studies

- Long-term solutions for the red mud in the reservoirs should be found and improved process conditions should be evaluated that generate less hazardous waste.

- Develop a program and targets for the long-term restoration of the ecosystem (water bodies, soil, vegetation).

d) EU Civil Protection Mechanism further support

The remediation of a contaminated site is a long-term action that currently cannot be comprehensively drafted on the bases of the actual information that is available. The Mechanism can provide an expertise to advise in the design and the management of such a plan, under condition that the experts concerned are regularly furnished with all the monitored information (see par 2b).

A contact with the team of EU experts might be envisaged in February 2011 with the scientific committee in charge of this remediation plan for a continuous exchange of expertise and experience: review of data that have been collected about the contamination of soil, groundwater, surface water and air. Evaluation of remedial actions taking into accounts these new data.

This kind of action would helpfully be renewed in October 2011 (one year later).