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Reported tailings dam failures

A review of the European incidents in the worldwide context

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Abstract

A detailed search and re-evaluation of the known historical cases of tailings dam failure was carried out. A corpus of 147 cases of worldwide tailings dam disasters, from which 26 located in Europe, was compiled in a database. This contains six sections, including dam location, its physical and constructive characteristics, actual and putative failure cause, sludge hydrodynamics, socio-economical consequences and environmental impacts. Europe ranks in second place in reported accidents (18%), more than one third of them in dams 10–20 m high. In Europe, the most common cause of failure is related to unusual rain, whereas there is a lack of occurrences associated with seismic liquefaction, which is the second cause of tailings dam breakage elsewhere in the world. Moreover, over 90% of incidents occurred in active mines, and only 10% refer to abandoned ponds. The results reached by this preliminary analysis show an urgent need for EU regulations regarding technical standards of tailings disposal.

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1. Introduction

Tailings dams are supposed to last forever, but past experience shows that minor and major spills pose a serious environmental threat that stay behind when the mine closes. A number of singular characteristics makes tailings dams more vulnerable than other type of retention structures (e.g. water retention type of dams), namely (1) embankments formed by locally collected fills (soil, coarse waste, overburden from mining operations and tailings); (2) dams subsequently raised as solid material coupled with a severe increase in effluent (plus runoff from precipitation); (3) lack of regulations on specific design criteria; (4) lack of dam stability requirements regarding continuous monitoring and control during emplacement, construction and operation; (5) high cost of maintenance works for tailings dams after closure of mining activities.

In Europe, public concern on the risk and potential impacts of the existing (in operation, inactive and abandoned) tailings

dams has been growing since recent incidents occurred: the Aznalcóllar large scale sulphide tailings dam spill on April 25th, 1998 [1–3], the Baia Mare (Romania) cyanide contaminated water released in January 2000 [4], the Baia Borsa (Romania) tailings contaminated by heavy minerals spill in March 2000 [5] and Aitik mine (Sweden) contaminated water released in September 2000 [6,7]. These and other past experiences show that emphasis should be put on prevention rather than reacting after the fact. By anticipating potential risk considerations, environmental impact can be minimised and true costs optimised.

Several investigations have attempted to summarise the causes of major tailings dam failures throughout the world. The most recent and comprehensive synthesis was performed by the International Commission on Large Dams (ICOLD) [8] (221 tailings dam incidents), based on the previous database by the U.S. Commission on Large Dams (USCOLD) [9], gathering a large amount of information on incidents in the USA (185 tailings dam incidents) that occurred during the period 1917–1989. This database was supplemented by the U.S. Environmental Protection Agency [10] with recent damage cases in USA, and by the United Nations Environmental Programme [11] (last updated on the 4th of March 2006), referring to the compilation of a selection

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