

Jean-Robert Courivaud

Learning lessons from dam failures provides an incomparable contribution to the efforts produced to improve and optimize dam maintenance. Two major objectives can be targeted with learning lessons from dam failures: (i) highlighting the main conditions leading to a dam failure, (ii) eventually showing that for some types of dams / types of loading conditions, some conservatism could be reduced in the criteria used in the stability analysis. Electricité de France (EDF) operates about 500 dams and 500km of hydropower canals in France and has to ensure a high level of safety together with a lean maintenance of these structures. In order to help reaching these objectives, EDF Hydro Engineering Centre has started an effort of learning more from dam failures by a study limited at first to static slope instability in embankment dams. The major physical processes caused by this failure mode are slope sliding of the upstream or downstream fill of the dam. Despite these processes are the best known by embankment dam engineers among all embankment dam failure modes, very few has been published so far on the lessons learnt from failures or near failures of that type. This study, which is limited to embankment dams and canals and excludes levees, has had to define firstly three types of incidents: (i) failures, defined as an uncontrolled release of the water stored in the reservoir, (ii) near-failures, defined as incidents where an uncontrolled release of the water stored in the reservoir did not happen by chance, but could have happened, (iii) incidents with high damages on the dam structure but where an uncontrolled release of the water stored in the reservoir was impossible (i.e. incidents happening during construction before the first reservoir filling). This exercise should be as comprehensive as possible and an extensive search of real case studies was performed. Even if it is impossible to miss none real case study, it is hoped that no major failure or near-failure has been missed in the scope of this study. After this compilation work, case studies were classified in one of the three categories presented above. Inside each category, the conditions of each failure have been studied (construction and failure dates, dam design and construction method, characteristics of foundation and embankment materials, hydraulic loading conditions...) and a synthesis of the main elements which led to a static slope instability-type failure, near-failure or an incident is presented.