

8 Deficiencies, Incidents, Failures and Remedial Action

8.1 Introduction

There are a number of situations that may require remedial action at a dam. These situations can vary from a minor deficiency in the dam, to a major incident or even dam failure.

A deficiency threatens the safety of a dam and may be detected by surveillance inspections and evaluations or dam safety reviews. Deficiencies include:

- inappropriate or deficient design or construction
- changes to design criteria
- changes in the failure impact rating of the dam (for example an increase from a category 1 failure rating to a category 2 failure impact rating)
- time based deterioration or breakdown of material;
- maintenance related problems
- deficiencies in the dam safety management program
- inappropriate operating techniques
- inadequate surveillance procedures
- damage to dam (eg landslides, erosion, earthquake etc).

An incident is an event, which could deteriorate to a very serious situation or endanger the dam.

Examples of incidents include:

- rapid change in seepage
- overtopping of earth embankment
- excessive beaching
- excessive embankment erosion
- spillway or bywash erosion or blockage
- excessive cracking or displacement in concrete dams and spillways
- sliding, rotation or settlement of the dam
- malfunction of gates or crest bags.

The failure of a referable dam means the physical collapse of all or part of the dam or the uncontrolled release of any of its contents. Causes of failure include:

- overtopping of embankment dams
- collapse or erosion of spillways
- internal erosion or piping through earth embankments or abutments
- failure of release conduits
- overturning of concrete dams
- deterioration of maintenance deficiencies.

8.2 The need for remedial action

Remedial action is required in response to a deficiency, incident or dam failure. The type of remedial action required and its urgency is determined by the nature of the event.

Remedial action may include:

- preventative measures to stop situations worsening;
- short term actions such as activation of Emergency Action Plans (including evacuations), installation and operation of warning systems, modification of operating procedures including lowering of reservoir levels by controlled release and increased surveillance;
- long term actions such as structural changes to a dam;
- changes to operating procedures;
- decommissioning of a dam.

In life threatening situations, remedial actions may involve short-term actions including the removal of persons at risk, modification to operations, controlled release of storage, increased surveillance and provision of alarm systems.

8.3 Remedial action review

There may be a number of remedial actions which can be undertaken in response to an incident, deficiency or failure. A Remedial Action Review should be undertaken which methodically evaluates the various options.

The Remedial Action Review should include:

- determination of the risk of failure of the dam
- preparation of a failure impact assessment to determine the current population at risk and a consequence assessment to determine other consequences such as economic and environmental damage
- development of possible solutions
- quantitative risk analysis
- estimation of the benefits and implementation costs of each solution
- justification for the adoption of the preferred remedial action.

8.4 Communication of incidents and failures

All dam incidents and failures, either actual or suspected, should be documented. If the dam owner is not already aware of the incidents and failures, such information should be conveyed by the dam operator (or consultants) to the dam owner for consideration and action⁷. Dam owners should ensure that permanent records of such events are kept in the dam safety inspection and evaluation reports.

⁷ Information on dam deficiencies is provided to the dam owner as a part of periodic and comprehensive inspections.