



## ICOLD bulletin on internal erosion of existing dams, levees and dikes and their foundations

### Why is guidance needed?

Internal erosion is a major cause of embankment failure, albeit that such failure is quite rare. In the UK incidents involving internal erosion are usually well managed but awareness of the issues involved is important. When constructing new dams, protection against internal erosion is provided by zoning and by providing filters, however many existing dams are not adequately zoned and do not have filters and may therefore be vulnerable to internal erosion. Others have filters not designed and/or constructed to modern standards and they too may be vulnerable to internal erosion.

### What is the issue?

Internal erosion occurs when soil particles within an embankment dam or foundation are carried downstream by seepage flow. It starts when the erosive forces imposed by the hydraulic loads exceed the resistance of the materials in the dam to erosion. The erosive forces are directly related to reservoir water level.

### What does the bulletin cover?

The International Commission on Large Dams (ICOLD) plan to issue a bulletin on internal erosion at dams in two volumes. Volume 2 will give details of internal erosion investigations, and appropriate testing, monitoring and detection, and remediation. It will also give case histories

Volume 1 is now available in draft form at the ICOLD web site and is available for review and comment prior to formal ratification and publishing. It discusses the internal erosion processes and outlines various methods for assessing the potential vulnerability of a dam to failure or damage by internal erosion. It gives a brief oversight of monitoring for and detection of internal erosion and remediation to protect dams against internal erosion. It includes a comprehensive listing of the Terminology used in internal erosion. Many references are also given, including links to many from an ICOLD internal erosion webpage.

It also gives a statement of the problem, explaining why internal erosion is a threat to existing dams and the

importance of assessing the vulnerability of individual dams to it. It then goes through the overall process of erosion from initiation, through continuation (or arrest) of erosion, through progression, and on to breach, unless erosion is detected early enough by appropriate monitoring systems, to allow timely intervention to halt or slow the development of a breach and failure. For example it demonstrates the value of regular monitoring to enable intervention and how this can significantly reduce the risk of dam failure.

Quantitative risk assessment methods proposed to date are briefly described and discussed but without specific recommendations. It notes that such methods may be used in the case of high hazard dams and high remediation costs to confirm and justify the need for and the scale of the proposed remediation.

### Who should use this information?

The objective of the bulletin is to give practical guidance for dam owners, dam engineers and regulators on dealing with the threat of internal erosion at existing dams. The guidance also applies to the foundations of concrete and masonry dams. New embankment dams would normally be carefully protected against erosion by filters. The bulletin therefore includes modern filter design rules, including recent modifications to the Sherard rules.

### Contact details

ICOLD aims to disseminate information as quickly as possible. Both Volume 1 and Volume 2 are now available as drafts from the Embankment Dams Technical Committee's sharespace on the ICOLD website ([www.icold-cigb.net](http://www.icold-cigb.net)). You will need your ICOLD number to enter the website and a second password for the committee's sharespace – both are available from Tim Fuller at the Institution of Civil Engineers (ICE): [Tim.Fuller@ice.org.uk](mailto:Tim.Fuller@ice.org.uk).

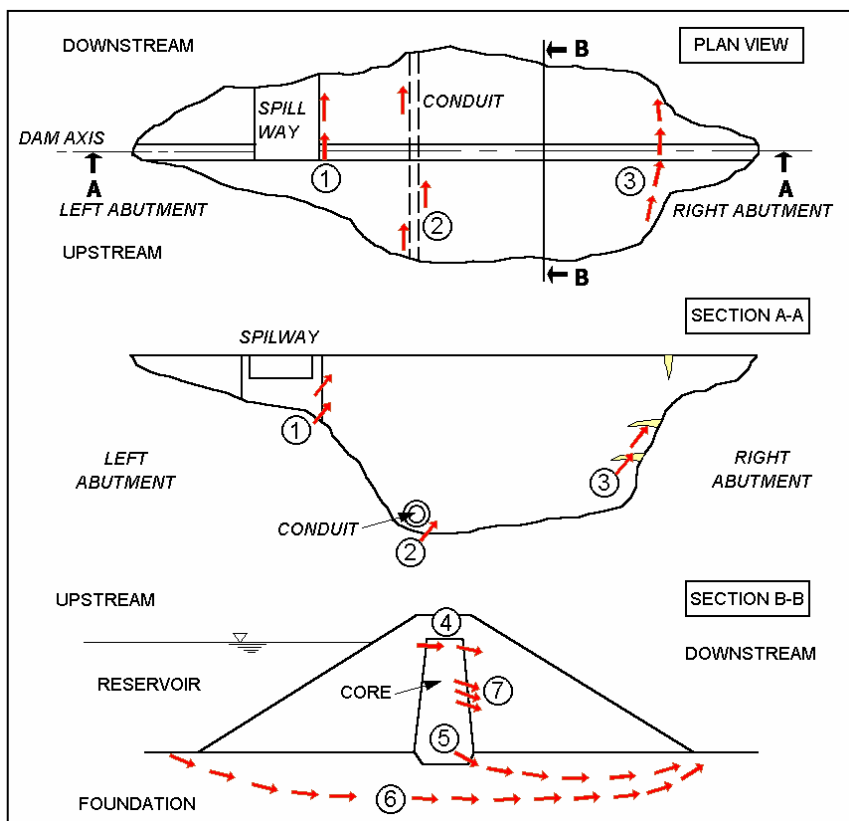
May 2013

**Internal Status:** Released to all regions  
**External Status:** Publicly available

**Environment Agency contact** Dave Hart, Evidence Directorate  
 Email: [fcrm.evidence@environment-agency.gov.uk](mailto:fcrm.evidence@environment-agency.gov.uk).

Further copies of this summary are available from our publications catalogue: <http://publications.environment-agency.gov.uk> or our National Customer Contact Centre: T: 08708 506506  
 E: [enquiries@environment-agency.gov.uk](mailto:enquiries@environment-agency.gov.uk).

© Environment Agency.



1. Spillway wall interface
2. Adjacent to conduit
3. Crack associated with steep abutment profile
4. Desiccation on top of core
5. Embankment to foundation
6. Foundation (if the foundation is soil or erodible rock)
7. Embankment through poorly compacted layer or crack (or by backward erosion if the core is cohesionless)

**Possible locations of initiation of internal erosion**

Source: Fell, R. and Fry, J.-J. (2007). *Internal Erosion of Dams and their Foundations*. Taylor & Francis, London.