

What Dam Owners need to know

All dams pose some level of risk to persons, property and the environment in downstream areas. The risks are tolerated because of the considerable economic and social benefits that dams bring to society. However, it is because of these risks that all dam owners need to be aware of the responsibilities that ownership imposes. Ultimately, the owner is responsible for the safety of a dam.

The impacts of a dam failure may be far reaching and can include loss of life, environmental damage, economic loss, and property destruction. Lessons learned from historic incidents of dam failures have indicated that most of the incidents could have been avoided if appropriate planning, design, construction, surveillance and maintenance procedures had been adopted.

One of the key responsibilities of owning and operating a dam, regardless of its size, is a commitment to maintaining it. When minor problems are identified during an inspection, they should be prioritized in terms of urgency, and dealt with in a timely manner to avoid development of a more serious condition or increased safety concern. If a dam is left to deteriorate, failure could eventually result.

The design of a dam falls within the definition of professional engineering and therefore must be carried out by a professional engineer experienced in work on dams and/or under the direct supervision of other experienced dam engineers, licensed in the province or territory in which the dam is located. The overall design of a dam usually involves several different disciplines of engineers and geoscientists working in the geological, geotechnical, hydrotechnical, hydrological, structural, mechanical, and electrical fields. Some of the significant considerations in the design of a dam are outlined below.

Environmental issues - The construction and operation of a dam may cause habitat loss, limit the mobility of fish and disrupt the migration of other wildlife. Siltation and erosion are major concerns during both construction and operation.

Social Impacts - In some cases, primarily in large scale developments, construction of a dam may impact or flood archeological or cultural sites and may even require relocation of impacted populations. Construction of a dam may also impact local recreational use.

Hydraulic Regime - The introduction of a dam on a watercourse may be beneficial by mitigating floods at certain times of the year and regulating flow during low flow periods. Other impacts may include changes in flow regime, river channel processes, water chemistry and temperature.

Dam Failure - Flooding as a result of dam failure is the most severe potential impact from a dam on a watercourse. Dam failure may be caused by a number of factors including extreme weather, inadequate spillway capacity, seismic events, design error, inadequate quality control during construction, internal erosion, foundation instability, or poor maintenance. No two dams

or dam sites are alike, which necessitates careful and systematic selection of design parameters. Design of new dams, and even the rehabilitation of existing structures, should be carried out by experienced qualified professional engineers, regardless of the size or type of dam. Construction should be carried out by experienced contractors and adequately supervised by persons experienced in the construction of dams.

The dam owner should develop operational procedures for the dam, and ensure that they are followed. The procedures should not be in conflict with the current design capacity of the dam and its associated structures. The procedures should be updated whenever there are changes to the structures, flow control equipment, operating ranges or conditions, and should be reviewed regularly to ensure that the information is kept up to date. A training program for the dam operators should be developed and implemented.

Depending on the dam classification and regulatory requirements, periodic dam safety reviews should be carried out to ensure that the dam can still be considered safe. Knowledge and standards may differ from when the dam was originally constructed, and physical conditions may change over time.

Public safety around a facility must also be considered in the design and operation of a dam. This is important during regular operation, and not just extreme events. Small dams and low head dams may pose greater danger to the public than large dams, in part because the hazards are not as obvious and do not command as much respect from the general public.

Emergency preparedness and response plans should be prepared and maintained for the dams, in collaboration with the relevant municipal or government agencies, in order to reduce the consequences of dam failure or other incidents.

The Canadian Dam Association (CDA) was established with the goal of advancing knowledge and practices related to dams, consistent with social and environmental values. It seeks to provide guidance on all aspects of dams including design, construction, operation and maintenance. CDA members include dam owners, operators, regulators, engineering consultants and suppliers, who interact in a collegial atmosphere to share and promote excellence in dam engineering, construction and operation.

CDA's *Dam Safety Guidelines* and Technical Bulletins have become important reference documents for guiding good practice of dams in Canada and internationally. Further information is available on the CDA website <http://www.cda.ca>.