

DAM OWNER'S PERSPECTIVE TO THE DAM SAFETY LEGISLATION IN FINLAND

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ABSTRACT

Finnish dam safety legislation was enacted in 1984. The dam safety legislation was presented in the act, the decree and the guidelines. However the dam safety practices described in the guidelines had not any legislative ground. Therefore Finnish dam safety legislation was renewed and the practices were included in the Dam Safety Act (429/2009) and in Government Decree on Dam Safety (319/2010). The Ministry of Agriculture and Forestry is responsible of general dam safety development and the dam safety authority is given to the competent Centre for Economic Development, Transport and the Environment. The dams are classified in three consequence classes based on the hazard, where the Class 1 dam (highest) in the event of an accident causes danger to human life and health or considerable danger to environment and property. The design flood is determined by the frequency analysis and the return period of 5'000-10'000 years is applied for high consequence class-1 dams. The dam safety hazard analysis and the emergency action plan have to be updated for consequence class 1-dams. The rescue authorities prepare a rescue service plans based on these two documents. Each dam has a monitoring program, which is approved by the dam safety authority. The annual dam inspection is carried out more comprehensive way in every fifth year (periodic inspection). The dam owner arranges this periodic inspection. The dam safety authority and the rescue authority (Class 1-dams) are invited to the inspection. The dam safety documentation and the changes in the conditions are reviewed. Most of the issues above were included in the previous dam safety legislation. However new issues were also introduced e.g. the safety arrangements and safe operations to avoid danger to third person. This paper describes the requirements and the responsibilities of Finnish dam safety legislation on the private dam owner's perspective.

Keywords: dam safety legislation, dam owner.

INTRODUCTION

First hydropower plant (240 kW) in Finland was constructed in year 1891. The hydropower construction was strongest after the II World War and about half of the present capacity (80 HPPs with an installed capacity of 1570 MW) was developed during the years 1945-65. The installed hydropower capacity in Finland is about 3050 MW and the average annual energy production is about 13 TWh. There are 56 large dams in operation, comprising 43 embankment dams and 13 concrete dams.

Finnish dam safety legislation was enacted in 1984. The dam safety legislation was presented in the act, the decree and the guidelines. However the dam safety practices described in the guidelines had not any legislative ground. Therefore Finnish dam safety legislation was renewed and the practices were included in the Dam Safety Act (429/2009) and in Government Decree on Dam Safety (319/2010).

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This paper includes a short description of Finnish dam safety legislation and discusses new sections in the Act e.g. the safety arrangements and safe operations to avoid danger to third person, which have an influence to the private dam owner.



Figure 1. Imatra spillway dam with a roller gates. The construction of the dam was completed in 1929. The hydropower plant has a capacity of 178 MW.

THE CONTENT OF FINNISH DAM SAFETY LEGISLATION

Dam Safety Act (494/2009) comprises 7 chapters:

- **General provisions** (objective, scope of application, relationship with other legislation, definitions, authorities, competence requirements),
- **Planning, design and construction of dam,**
- **Classification of a dam and dam safety documents** (classification obligation, classification of a dam, dam break hazard analysis and emergency action plan, monitoring program, classification decision and approval of documents),
- **Maintenance, operation and monitoring of a dam** (maintenance obligation, operation of a dam, monitoring, annual inspection, periodic inspection, updating a dam break hazard analysis, change of class, alteration and repair works, dam decommissioning),
- **Preparing for accidents and action in the event of accidents** (preventing accidents, rescue service plans, rescue activity, emergency call and notice of an exceptional situation as regards safety),
- **Control and coercive measures** (communication, right of inspection, remedying an infringement or neglect, order to remedy, penalty payment and threat of interruption and of having action taken at defaulter's expense) and
- **Miscellaneous provisions** (information systems, environmental offense and offenses involving public danger, dam safety offense, entry into force and transitional provisions).

The objective of the Dam Safety Act is to ensure safety in the construction, maintenance and operation of a dam and reduce the hazard that may be caused by a dam. Even the flood embankments are included inside the Act. The Ministry of Agriculture and Forestry is responsible of general dam safety development and the dam safety authority is given to the competent Centre for Economic Development, Transport and the Environment. The Rescue Act (468/2003) and the services of the Rescue Authorities are connected into the Dam Safety Act.

Earlier the consequence classification and the design flood requirement were presented in the dam safety guidelines (Dam Safety Code of Practice) and now they are raised in the Act and in Government Decree, respectively. The dams are classified in three consequence classes based on the hazard, where the Class 1 dam (highest) in the event of an accident causes danger to human life and health or considerable danger to environment and property. The design flood is determined by the frequency analysis and the return period of 5'000-10'000 years is applied for high consequence class-1 dams.

The dam safety hazard analysis and the emergency action plan have to be updated for consequence class 1-dams according. The rescue authorities prepare a rescue service plans based on these two documents. Each dam has a monitoring program, which is approved by the dam safety authority. The annual dam inspection is carried out more comprehensive way in every fifth year (periodic inspection). The dam owner arranges this periodic inspection. The dam safety authority and the rescue authority (Class 1-dams) are invited to the inspection. The dam safety documentation and the changes in the conditions are reviewed. These issues were included in the previous dam safety legislation.

The General safety requirement of a dam (Section 4 and 5 of Government Decree) specifies e.g. that the spillway gates must be functioning **reliable** and the embankment dams must have accessible also during the emergency situations.

New issues in the Act and in the Government Decree are e.g.

- The competence requirement for the dam designer and the operation and maintenance personnel (Section 6 of the Act and Section 1 of Government Decree).
- The safety arrangements (Section 16 of the Act and Section 5 of Government Decree).
- The preparation of the condition study, if the safety cannot be stated in the periodical inspection (Section 19).
- The changes in the dam construction and repair works are notified to dam safety authorities (Section 22).
- The notification of the dam safety authorities of the exceptional situations without delay (Section 27).
- The strengthened of the dam safety authority's role by control and coercive measures (Chapter 6 and 7).

DAM OWNER'S DUTIES AND RESPONSIBILITIES BASED ON NEW FINNISH DAM SAFETY LEGISLATION

New dam safety legislation puts new requirements and responsibilities for the dam owner.

All the documentation related to the dams (specifications, drawings, test results during the construction period, etc.) and the dam safety (inspection reports, monitoring data, etc.) was collected and analyzed after the issuing first dam safety act in 1980's. Also additional studies and reports e.g. analysis of the design flood and spillway capacity, dam break flood wave analysis and emergency preparedness plans were done. This documentation has to be reviewed and updated.

General safety requirement of a dam

The wording in the Section Clause "the spillway gates must be functioning reliable" puts high requirement to the dam owner. The electrical and mechanical equipments have a probability for the

failure. In this respect how this reliability requirement should be considered? Presently the maintenance of the lifting equipment is carried out every year before the flood period.

In addition there are small embankment dams with narrow crest width. These embankment dams have to be upgraded to fulfill the requirements of the dam safety legislation.



Figure 2. A small embankment with narrow crest width and a trees on the upstream slope.

Competence requirement for the dam designer and O&M personnel

The competence requirement is quite generally specified in Section 1 of Government Decree. The dam designer must have appropriate education and sufficient expertise and experience in the design of similar structures. O&M personnel must have sufficient knowledge and expertise on the site condition and the safety systems, which have an impact to dam safety.

The requirement does not change much the current practices. The dam design and its repair is special work and competent and experienced engineers are used. The dam safety issues are introduced to the O&M personnel in internal and external training sessions and discussions. The lists of the trainings and the trained personnel are introduced to the dam safety documentation systems.

Safety arrangements

The safety arrangements are described in Section 16 of the Act:

"A dam shall be operated in such a way that it causes no danger to human life and health. Sufficient safety arrangements shall be in place for class 1 and 2 dams to ensure the safety of the operation of the dam. Further provisions on the safety arrangements are issued by Government Decree."

and in Section 9 of Government Decree:

"The safety of a class 1 and 2 dam must be ensured by means of:

- The safety arrangements to ensure the use of the dam in case of disturbances,

- warning and other arrangements concerning the draining of a watercourse dam to prevent danger to those above or below the dam and
- where necessary, arrangements to prevent damage caused by sabotage or vandalism."

This requirement increases the dam owner's responsibility to third person. A person may attend to the area, where the unalarmed gate spill may be dangerous. The safe gate operations to third person shall be ensured. Fortum carried out the study of the safety arrangements in two phases: the existing safety arrangements and its condition were mapped in the first phase. The risks were evaluated and the improvement proposals were presented. The additional safety measures are implemented and documented in the second phase. The documentation is submitted to the dam safety authority. The condition of the safety measures is reviewed during the annual inspections (instruction).



Figure 3. Safety arrangements i.e. signs, fences, rails, the arrangements of the gate openings (e.g. sirens) and the risks were reviewed during the site visits.