

# **Dam safety in Sweden**

**Sweden's contribution on dam legislation to the ICOLD European Club,  
prepared by Svenska kraftnät 2015-08-20**

**SECTION 1: Basic Legal Framework**

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## **SECTION 1: Basic Legal Framework**

Sweden has no specific law concerning dam safety. Rather, several different statutes are applicable to dams and dam safety issues. The most important regulations are found in the Environmental Code and the Civil Protection Act.

The central principle in the Environmental Code is that the owner of an enterprise shall continuously plan and monitor the operations through self-regulation in order to prevent or counteract harm to human health or the environment. The owner is obliged to acquire the required knowledge, investigate and evaluate the risks related to the enterprise, draw up and follow routines for self-regulation, as well as to take the measures required and have preparedness in order to avoid damage. The owner is obliged to maintain the dam and in doing this he shall use the best available technology and the precautionary principle. Should a dam failure nevertheless occur, then the owner is liable for damage caused by the dam failure. Within this set of rules and regulations there are also government ordinances concerning owners' self-regulation and the role of supervisory authorities.

In 2014 new legal requirements on dam safety was introduced in the Environmental Code and a Dam Safety Ordinance was enacted. The main revisions include the introduction of a consequence classification system, with dam safety classes A, B and C, for dams based on an assessment of the societal consequences of a dam failure. (Dam safety class A – severe national consequences, B - severe regional and local consequences, C – severe local consequences from a societal point of view in the event of a dam failure.) Furthermore the owners of classified dams are required to establish and work according to a safety management system, to conduct safety reviews and to submit annual dam safety reports and to pay an annual fee to the supervisory authority.

The aim with the Civil Protection Act is to give equal protection against accidents for people's life and health as well as for property and environment in the whole country, taking local circumstances into consideration. Dams and other facilities where an accident may result in serious damage to people or the environment are classified as dangerous activities, with special demands on emergency preparedness.

The power industry and the mining industry have drawn up technical guidelines for dam safety. The guidelines address design, construction, operation, maintenance, surveillance and emergency preparedness planning for dams. Guidance on dam safety and dam safety management are set in relation to the assessed consequences of a dam failure.

## **SECTION 2: Basic Information**

### **A. Dams subjected to regulation**

The Environmental Code applies to all dams irrespective of size, purpose and consequences in case of dam failure. In 2014 new requirements were introduced for dams with a minimum height of 5 m and/or dams where a dam failure would result in the release of 100.000 m<sup>3</sup> of water, tailings etc. For these the owner should give an assessment of the consequences of failure to the supervisory authority, who should decide if the dam should have a dam safety class or not.

Classification of existing dams is currently an ongoing process 2015-2018. Additional requirements in the Dam Safety Ordinance apply to classified dams. Svenska kraftnät (the national authority for dam safety) has issued regulations and guidance on consequence assessment and classification, and will issue regulations and guidance on the new requirements on classified dams.

In total there are some 10 000 dams in Sweden. For about 500 dam facilities a dam failure would result in significant damages such as loss of human life and health and/or serious damage to the environment, infrastructure or services vital to society and/or major economic damage. These dams will be assigned a dam safety class A, B or C. A large majority of these dams where a dam failure could result in major consequences belong to enterprises within the hydropower and mining industries.

According to the Civil Protection Act special requirements are imposed on establishments where the activity implies a risk that an accident will result in serious damage to people or the environment (dangerous activities). About 100 dam facilities (with one or more dams) are classified as such.

### **B. Entities concerned**

#### **a) Administrative organisation**

The entities concerned with the supervision of dam safety in Sweden:

- Svenska kraftnät (Swedish National Grid) has the function as a national authority for dam safety. The tasks include promoting dam safety in Sweden, acting for research, development and capacity building, and acting for emergency preparedness for dam failure and floods in regulated rivers. The role is also to provide supervision guidance on issues related to dam safety to the regional supervisory authorities - the county administrative boards. In practice supervisory guidance includes development of uniform routines for dam safety supervision, to coordinate, follow-up and evaluate the supervision as well as to provide advice and support to the regional supervisory authorities.
- The 21 county administrative boards are the operative supervisory authority for water operations, according to the Environmental Code, and dams and dam safety are part of this. The supervision comprises among other things to check that the regulatory framework and the terms of permits allotted by the Environmental Court are adhered to, that actions are taken by the owner/operator when necessary to improve safety. The county administrative boards are also assigned to supervise the compliance of the municipalities with the Civil Protection Act.
- The approx. 290 municipalities are responsible for planning for and providing rescue service for example concerning flood situations caused by dam failure or heavy rainfall. The municipalities are responsible for supervision of the dam owner's compliance with the Civil Protection Act for dams classified as dangerous facilities.

River groups constitute a regional network for regulated rivers, linking all organizations involved in or affected by water regulation and floods. The main participants are the county administrative boards, municipalities, water regulating enterprises, dam owners, emergency service centres, the National Road and Rail Administrations, Swedish Meteorological and Hydrological Institute etc.

They constitute an important element in the development of regional networks, information exchange and competence in respect of floods, dam safety and emergency preparedness.

#### **b) Owners**

The owners have overall responsibility for their dams including a liability for consequences of dam failure. The main dam owners in Sweden are hydropower companies. Mining companies are also important dam owners. The trade organisations SwedEnergy (power industry) and SveMin (mining industry) have important roles in supporting their member companies with guidelines, research and development, education etc.

#### **c) Civil engineers**

There is no formal authorization for engineers dealing with dams. According to the industry guidelines for dam safety the dam owner should appoint a dam safety engineer with appropriate theoretical and practical education, as well as experience from working with dams, for each dam. In the guidelines appropriate education and experience is also specified for e.g. consultants appointed to carry out surveillance activities such as inspections and periodic dam safety reviews.

### **C. Dam projects**

The Environmental Code and the Civil Protection Act contains no detailed requirements for the design, construction and upgrading of dams.

Construction of structures in water needs a permit issued by an Environmental Court. Most of the large dams in Sweden have been examined under the old Water Act from 1918 by the former Water Court. There were no specific regulations about dam safety in that legislation. The main structure and layout was normally described in the application to the Water Court, but it was left to the dam owner to take responsibility for the detailed aspects of design and construction of their dams. Most of the Swedish dams are consequently designed and constructed without intervention by the authorities on technical aspects.

For new dams a permit (by an Environmental Court which has replaced the former Water Court) must be obtained for water operations within the framework of the Environmental Code. A judgement granting a permit for an activity shall, where appropriate, include provisions concerning among other things the purpose, location, scope, safety and technical design of the activity as well as supervision, inspections and checks.

The planning and construction act and the corresponding ordinance are to some part applicable also to dams. All constructions erected or changed shall adhere to essential technical requirements on their physical properties such as load-bearing capacity, stability and durability, during their economically reasonable life span.

The industry guidelines on dam safety comprises, among other things, guidance on dam design and construction including determination of design loads and detailed requirements on embankment dams, concrete dams and discharge facilities.

Guidelines for the determination of design floods for dams have been issued by the national authority and the industry organisations in co-operation. Dams are classified in design flood categories based on their potential failure consequences during a flood.

### **D. Construction and first filling**

In Sweden, there are no special requirements from the authorities regarding construction or first filling, unless specified in the court permit.

## **E. Dam operation**

The Environmental Code includes government ordinances concerning owners' self-regulation. The owner must continuously analyse the risks and shall have the necessary knowledge to establish and follow routines for self-regulation and surveillance of the dam. The routines and the findings should be documented. The owner must also have knowledge of the consequences that may occur in case of failure and use the best available technology to avoid damage to others. Nevertheless should a dam failure occur the owner is fully liable for the consequences.

The Dam Safety Ordinance includes requirements for owners with dams classified in a dam safety class to establish and work in accordance to a safety management system and to perform an overall dam safety assessment every 10 years. The system should among other things describe the operational responsibilities and the routines for operation, surveillance and maintenance.

For tailings dams classified as risk facilities ("Category A facility" according to the EU directive on mining waste) corresponding requirements on safety management systems are in place through the Ordinance on Mining Waste.

The industry guidelines on dam safety comprise among other things guidance on operation, maintenance and surveillance. The dam safety work should follow documented routines, which should be available in an OMS-manual for each dam facility. The guidelines include guidance on basic surveillance including visual inspections, monitoring of dam performance, functional tests, periodic detailed inspections and dam safety reviews on certain intervals.

## **F. The repair of dams**

The owner is responsible for maintenance of the dam. When the dam owner undertakes significant alterations or repairs of a dam a permit by an Environmental Court must be obtained within the framework of the Environmental Code. In urgent cases, if necessary due to occurred damage or to prevent damage, work may commence without prior permission. However, the owner shall as soon as possible submit an application for approval of the measures.

The industry guidelines and the guideline for the determination of design floods for dams include new demands and demands that in many cases are stricter than those of the time when the majority of the dams were constructed (before 1980). In many cases the guidelines have triggered and still trigger dam safety measures and major upgrading of high consequence dams.

## **G. Particular rules for the protection of the population**

The Dam Safety Ordinance includes requirements for owners with dams classified in a dam safety class to establish and work in accordance to a safety management system. The system should among other things include routines for identifying risks that can lead to dam failure and emergency preparedness planning.

According to the Civil Protection Act special requirements are put on establishments where the activity implies a risk that an accident will result in serious damage to people or the environment (dangerous activities). At such establishments the owner or the undertaker of the activities at the establishment is obliged to keep or pay for preparedness with personnel and property to a reasonable extent and take other measures necessary to prevent or mitigate such damage. The one pursuing the activities is obliged to analyse the risks for such accidents.

According to the Civil Protection Act the owner of a high consequence dam shall keep or pay for emergency preparedness to complement the resources of the local rescue authority, and take what other measures necessary to prevent or mitigate damage to people or the environment. The owner and the municipality must determine what measures that are needed for an effective rescue.

The industry guidelines on dam safety comprise guidance on emergency preparedness for the dam owner.

#### **H. Dam decommissioning**

A permit from the environmental court is needed before a dam can be decommissioned. The owner applies for the permit.

## **SECTION 3: Main Documents**

### **SWEDEN**

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- A. *Dams subjected to Regulation*
- B. *Entities concerned*
- C. *Dam Projects*
  - a) *General Directions*
  - b) *Technical Rules*
- D. *Construction - First Filling*
- E. *Operation*
- F. *Repair – Rehabilitation*
- G. *Protection of the population (Emergency action plan, Emergency management, etc.)*
- H. *Decommissioning*

### **I - Laws** (*Legal Obligations*)

1. 1999, “The Swedish Environmental Code” (Miljöbalken, SFS 1998:808)  
Synopsis  
A general set of rules and regulations for activities, which may have environmental consequences. The Environmental Code also governs water rights and dam safety. In 2014 new legal requirements on dam safety were added.
  
2. 2003, “The Civil Protection Act” (Lag om skydd mot olyckor, SFS 2003:778)  
Synopsis  
The aim with the Civil Protection Act is to give equal protection against accidents for people’s life and health as well as for property and environment in the whole country, taking local circumstances into consideration.

### **II - Other Legal Directions – Regulations** (*lower hierarchic level than Laws; in case of discrepancies with a Law, the Law prevails*)

1. 1998, “The ordinance about owners’ self-regulation” (Förordning om verksamhetsutövares egenkontroll, SFS 1998:901)
2. 2014, “The Dam Safety Ordinance” (Förordning om dammsäkerhet, SFS 2014:214)
3. 2003, “The ordinance about civil protection” (Förordning om skydd mot olyckor, SFS 2003:789)

### **III - Guidelines** (*guidelines are not binding from a legal point of view*)

1. 2012, “RIDAS, The hydropower industries guidelines for dam safety” (Kraftföretagens riktlinjer för dammsäkerhet), provided by SwedEnergy.  
Synopsis  
Dam safety guidelines drawn up by the hydropower industry, first published in 1997. RIDAS comprises guidance on consequence classification, organisation, competence and documentation, dam design and construction, operation, surveillance and monitoring, maintenance, emergency preparedness and dam safety audits (by SwedEnergy).
2. 2012, “GruvRIDAS, dam safety guidelines of the mining industry” (Gruvindustrins riktlinjer för dammsäkerhet), provided by SveMin.  
Synopsis  
The mining industry’s version of RIDAS, first published in 2007.
3. 2015, “Swedish Guidelines for Design Flood Determination for Dams” (Riktlinjer för bestämning av dimensionerande flöden för dammar). Guidelines drawn up by Svenska kraftnät, SwedEnergy and SveMin.  
Synopsis  
The guideline on design flood for dams was first published in 1990. It specifies design criteria for design floods in relation to consequences of a dam failure during a flood event, and is primarily directed to dam owners and consultants who carry out design flood calculations.