



Federal Energy Regulatory Commission

The Role of the FERC's Dam Safety Program with Small/Low Impact Hydropower Development

Hydropower developers have raised questions about how the Commission's dam safety program would be implemented within the small/low impact hydropower program. In particular, developers have raised concerns that the cost of small projects having to meet the Commission's dam safety requirements may be too expensive to allow for development of the projects.

This paper explains how the Commission's dam safety program will be implemented for small/low impact hydropower development. We emphasize that small/low impact hydropower projects which use low hazard potential dams have limited dam safety requirements.

FERC's Review Process

In accordance with the Federal Power Act (16 U.S.C. §§ 803 (c)) and the Code of Federal Regulations (18 CFR 12.1), the Commission's dam safety provisions apply to any hydropower project that has received a license or exemption from licensing, as well as any constructed, un-licensed project that requires an application for license. To change this would require an act of the United States Congress.

The safety requirements involved with small/low impact hydropower projects are, in large part, determined by the downstream hazard potential classification of the project's water retaining structures. The following explains the role of the Commission's Division of Dam Safety and Inspections (D2SI) throughout the development of a small/low impact hydropower project.

1. Before License/Exemption is Issued

Prior to the issuance of a license or exemption, D2SI conducts an inspection to assess site conditions and determine the hazard potential classification of the dam. The hazard classification has implications on the project's spillway capacity as well as post-construction requirements.

(a) Hazard Potential Classifications

There are three hazard potential classifications for dams: low, significant, and high. The classifications are defined as follows:

Low Hazard Potential. Failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses.

Significant Hazard Potential. Failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.

High Hazard Potential. Failure or mis-operation will probably result in loss of human life.

The hazard potential classification can often be determined by visual inspection. A dam will be classified as having a low hazard potential if it is evident by inspection that there are no low-lying residences, campgrounds, or other structures located downstream of the dam that would be impacted from a failure of the dam.

If there are residences, campgrounds, or structures located downstream but it is unclear if they will be impacted, a dam break study should be performed. The dam will be classified as having a high hazard potential if the dam break study indicates a significant rise in water levels from a dam failure which would result in probable loss of life. If the study indicates a rise of downstream water levels that would result in property damage but not a probable loss of life, the dam will be classified as having a significant hazard potential. If the study shows negligible rises in water levels from a dam failure, the dam will be classified as having a low hazard potential.

(b) Spillway Capacity

A dam's spillway capacity should be able to safely pass the Inflow Design Flood (IDF).¹ The IDF for significant and high hazard potential dams is based on an incremental hazard evaluation that is performed using the dam break study. The procedure for computing the IDF is explained in Chapter 2 of the Commission's Engineering Guidelines, which is found at:

<http://www.ferc.gov/industries/hydropower/safety/guidelines/eng-guide.asp>.

The maximum IDF for a dam is the Probable Maximum Flood.² However, an incremental hazard evaluation can justify an IDF much lower than the Probable Maximum Flood.

The IDF for a low hazard potential dam is selected primarily to protect against loss of the dam and its benefits should a failure occur. Low hazard potential dams should be able to pass a flood having an average return frequency of at least once in 100 years (often referred to as a 100 year flood). The Commission would give consideration to spillway capacities at lower return frequencies for small, low hazard potential dams if it can be shown the only impacts from a dam failure would be to the dam owner's property.

¹ The IDF is the flow above which the incremental increase in water surface elevation due to failure of the dam is no longer considered to present an unacceptable threat to downstream life and property.

² The Probable Maximum Flood is the flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the drainage basin under study. The process for determining a Probable Maximum Flood is explained in Chapter 8 of the Commission's Engineering Guidelines.

2. Before Construction

A licensee/exemptee typically hires an engineer to design the project and a contractor to construct the project. Several construction documents are prepared during this process. These include the following:

- *Plans and Specifications* - describe how the project shall be constructed.
- *Supporting Design Report* - describes the design basis for the major project features.
- *Quality Control and Inspection Program (QCIP)* - describes the oversight and quality control/assurance measures, including material testing, that will take place during construction to ensure the project is constructed in accordance with the design intent and the plans and specifications. The construction contractor cannot be responsible for the QCIP.
- *Soil Erosion and Sediment Control Plan* - describes the measures that will be taken to prevent erosion and other environmental hazards during construction.
- *Cofferdam/Deep Excavation Design* - describes how cofferdams will be constructed.
- *Temporary Construction Emergency Action Plan* - describes how construction workers will be warned and evacuated if a temporary cofferdam or bulkhead is in danger of failing.

These documents are submitted to the D2SI-Regional Engineer for review and comment at least 60 days prior to start of construction. The reason we require these documents be submitted is to ensure measures are being taken so the project will be constructed safely and in accordance with engineering standards.

The level of detail in these documents depends on the size and complexity of the project. For example, a project that utilizes an existing pressure reducing station at a water supply conduit to generate power would not require a cofferdam and the construction materials would consist of pipes, valves, and a generating unit housed in a small building. For such a project, the only items that would be submitted for D2SI review are the plans and specifications and soil erosion and control plan. The soil erosion and control plan could be as simple as a drawing showing the location of erosion control measures around the construction site.

For other small, non-complex projects, a licensee/exemptee may decide to design and construct the project with no outside help. For example, a developer may construct a small pressurized pipe from a water source to a generating unit, all of which is located on their land. If no contractor was needed for this work, there may be no specifications. D2SI would still review the design drawings and provide comments.

If an existing dam, canal or conduit that is used for the project is part of a federal project (e.g., owned by the U.S. Army Corps of Engineers or U.S. Bureau of

Reclamation), the construction and operation of the development must be approved by the dam owner agency. The licensee/exemptee is also responsible for obtaining all necessary permits from pertinent federal, state, and local agencies. D2SI will authorize start of construction once the necessary permits and approvals from other agencies have been issued and D2SI has completed its review of the pre-construction documents.

The only way the review of construction documents would add any additional cost to the licensee/exemptee is if D2SI does not believe the proposed project will be constructed in a safe manner or in accordance with general engineering principles. For these cases, it may be necessary to modify the design.

3. During Construction

The licensee/exemptee and its contractor and engineer ensure the project is constructed in accordance with the design intent and the plans and specifications through the oversight and testing described in the Quality Control and Inspection Program.

During construction, the licensee/exemptee is responsible for submitting periodic construction reports to the Regional Office describing the progress of work. Also, the D2SI-Regional Office will perform periodic inspections during construction. If a project is constructed in accordance with the design documents reviewed by D2SI, this process should add no cost to the project.

4. After Construction

D2SI's role following construction will depend on the dam's hazard potential classification. The following describes the typical inspection schedule and requirements for FERC projects:

- *Low Hazard Potential*
 - Regional Office inspects every three years.
 - Annual gate test is required, if applicable.
 - May require public safety warning and safety devices.

- *Significant Hazard Potential*
 - Regional Office inspects annually.
 - Emergency Action Plan and low-level exercises are required.
 - Annual gate test is required, if applicable.
 - Potential Failure Mode Analysis is required.
 - May require public safety warning and safety devices.
 - May require Annual Surveillance and Monitoring Report.
 - May require 5 Year Independent Consultant's Safety Inspection depending on height and storage of the dam.
 - May require Security Assessment and Security Plan.

- *High Hazard Potential*
 - Regional Office inspects annually.

- Emergency Action Plan and exercises are required.
- Annual gate test is required, if applicable
- Annual Surveillance and Monitoring Report is required.
- 5 Year Independent Consultant's Safety Inspection, including Potential Failure Mode Analysis, is required.
- May require periodic full height gate tests/inspections, if applicable.
- May require public safety warning and safety devices.
- May require Security/Vulnerability Assessment and Security Plan

As described above, the post-construction requirements for low hazard potential dams are minimal. The requirements increase as the hazard potential increases. Of the requirements listed, the Independent Consultant's Safety Inspection is likely the most costly. However, the inspection is required to be done once every five years and the cost of the inspection varies greatly depending on the complexity of the project.