Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000

FEDERAL ENERGY REGULATORY COMMISSION
Office of Energy Projects
Division of Dam Safety and Inspections
888 First Street, NE Routing Code: PJ-13
Washington, DC 20426
(202) 502-6734 Office – (202) 219-2731 Facsimile

PCWA-L-246

DEC 14 2005
Dec 14, 2005

In reply refer to: P-2079-CA
NATDAM #CA00856 and CA00857

Mr. Stephen J. Jones
Power System Manager
Placer County Water Agency
24625 Harrison St. – P.O. Box 667
Foresthill, CA 95631

Dear Mr. Jones:

By letter dated December 5, 2005, you proposed Mr. Richard C. Harlan as the independent consultant to be responsible for the eighth Part 12 safety inspections of the French Meadows and Hell Hole developments of the Middle Fork American River Project. Mr. Harlan's resume confirms that he meets the Commission's independent consultant qualifications specified in Section 12.31(a) of the regulations. Mr. Harlan is therefore approved as the independent consultant for these inspections. In accordance with Part 12, Subpart D, the approved independent consultant must either personally inspect the projects or be present during the inspections to supervise those individuals that conduct the inspections. You are also reminded to instruct your consultant that should any condition be discovered that requires emergency corrective measures, he must immediately notify you, since you are required to submit a report to the Regional Engineer in accordance with Section 12.36.

Three copies of each inspection report must be filed with the D2SI-San Francisco Regional Engineer by November 1, 2006. The consultant's reports must be formatted in accordance with Enclosure 1, Part 12D Safety Inspection Report Outline (revised July 1, 2005). You should remind your consultant that it is important to submit reports that are formatted in accordance with the Outline and which adequately address all the information requested. The inspections and project features analyses are to include a thorough evaluation of all dam safety aspects of the project in accordance with the Commission's Part 12D Dam Safety Regulations consistent with the requirements covered in the Commission's Engineering Guidelines.

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



You as the Licensee are responsible for preparing the Supporting Technical Information (STI) document or having it prepared for you. The STI replaces Appendix D of the Part 12D report and will be submitted with the Part 12D Report. Enclosure 2 contains the outline for the STI document. Appendix I of Chapter 14, Dam Safety and Performance Monitoring Program of the Engineering Guidelines for the Evaluation of Hydropower Projects includes the STI outline, guidance on what is to be included in the STI, and examples of the document. Much of the information required for the STI was previously asked for in Appendix D of the Part 12D report. A Part 12D report submitted that has an incomplete, significantly deficient, or unreadable STI will be returned to you as an unresponsive report.

A new feature of the Commission Dam Safety Program is the Dam Safety Performance Monitoring Program (DSPMP). A complete description of this program may be found in Chapter 14 of the Engineering Guidelines. An important part of the DSPMP is the Potential Failure Modes Analysis (PFMA). The PFMA formally identifies potential failure modes of structures at the project(s). An item of utmost importance in conducting the PFMA is the need for a person to fulfill the responsibilities of a facilitator. The facilitator will oversee and direct the potential failure modes analysis process and PFMA report preparation by the independent consultant.

The PFMA facilitator should be a civil engineer with a broad background and experience in dam safety engineering and experience in performing a PFMA similar to that described in the guidance in Chapter 14, Dam Safety and Performance Monitoring Program. A basic recommended qualification for the facilitator is that the proposed facilitator for a project should have participated in an actual PFMA of the nature described in these guidelines.

Qualifying experience for a facilitator is participation as a core team member of a PFMA or actually facilitating a PFMA. This ensures that the person leading the PFMA process knows not only how the process is carried out, but is also aware of what can be accomplished. This is especially critical if the other core team members have not been through a PFMA, which may often be the case. As an alternative to actual experience participating in or facilitating a PFMA, the proposed facilitator should have attended a FERC sponsored Dam Safety Performance Monitoring Training Workshop. FERC will periodically provide training workshops to help develop facilitators, especially during the implementation phase of this new program.

It is important to understand that if the PFMA facilitator does not accomplish the goals of the PFMA, which is identifying and obtaining a clear

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



understanding of each dam site's specific potential failure modes, we may require that the PFMA be supplemented or redone entirely.

If a PFMA has not been conducted for the project(s) prior to the preparation of the Part 12D report, the sections of the Outline that address the PFMA are to include a brief statement that the PFMA has not yet been conducted for the project(s). If you have any questions concerning the requirements of the Outline, please address your questions to Mr. James Evans at telephone number (202) 502-8716. Your consultant should be prepared to submit, if requested, diskettes containing programs with documentation and input files for any of the computer analyses used to reach the conclusions in his reports.

You are reminded that not later than 60 days after the reports of the independent consultant are filed with the Regional Engineer, you must submit to the Regional Engineer three copies of a plan and schedule for designing and carrying out any proposed corrective measures for each development.

Sincerely,

James H. Evans

James H. Evans, P.E.
Senior Civil Engineer
Division of Dam Safety and Inspections

Enclosure

cc: Public Files

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



# Appendix H
# Part 12D Safety Inspection Report Outline

**Table of Contents**

The Table of Contents must show the initial page numbers for each section. If any subsection is not applicable, include the subsection with a statement of "Not Applicable" and an explanation of the reason(s) why.

For licensed projects that include multiple independent dam and powerhouse developments, separate Part 12D reports should be published for each development.

1. **Findings and Recommendations**
2. **Project Description**
3. **Discussion of Potential Failure Mode Analysis Report**
4. **Surveillance and Monitoring with Respect to Potential Failure Modes**
5. **Field Inspection**
6. **Operation and Maintenance Programs Relative to Potential Failure Modes**
7. **Assessment of Supporting Technical Information Document**

**List of Tables** (with location)

**List of Figures** (with location)

**List of References**

**Appendices for Part 12D Inspection Report**

A. **FERC Letter Requiring Part 12D Inspection**

B. **FERC Letter Approving Part 12D Consultant** - Include date of current report outline provided by FERC. Use report outline provided with FERC letter, not latest revision.

C. **Project Figures**

Only provide general overview drawings necessary to understand the project and items discussed in the report. If figures are placed in Section 2, provide a statement that figures may be found in Section 2. Optionally, if the STI is bound with the Part 12D report provide a statement that figures may be found in the STI document; duplicate drawings from the STI do not need to be included in the Part 12D report proper.

Detailed drawings should be included in the Supporting Technical Information document.

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



**D. Instrumentation Monitoring Data Plots**

List each figure and drawing included in the report. Optionally, instrumentation plots may be placed in Section 4 of the report and a statement included in Appendix D that the plots may be found in Section 4.

**E. Inspection Photographs**

Optionally, some or all of the photographs may be included in the appropriate sections of the report. If photographs are included within the report, provide a list of the photographs and the corresponding page number in Appendix E.

**F. Inspection Checklists and/or Field Notes (Optional)**

**G. Operation and Maintenance Documentation (If required)**

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



## 1.0 Findings and Recommendations

This Section includes a summary of the Part 12D Independent Consultant's findings and assessments and the Part 12D Independent Consultant's conclusions and recommendations.

### 1.1 Findings

1.1.1 Summary assessment of the PFMA report

1.1.2 Summary assessment of the Surveillance and Monitoring Plan

1.1.3 Summary of Field Inspection Findings

1.1.4 Summary of O&M status

1.1.5 Summary Assessment of "Supporting Technical Information" document

Note: Specifically identify any new calculations prepared subsequent to the previous Part 12D Report.

### 1.2 Conclusions

The conclusions of the Independent Consultant regarding the condition and suitability for continued safe and reliable operation of the project and specific conclusions regarding the information in each Section of this Part 12D report.

1.2.1 Conclusions regarding the suitability of the Project for continued safe and reliable operation.

1.2.2 Conclusions regarding the Project Description

1.2.3 Conclusions regarding the Potential Failure Modes Analysis Report

1.2.4 Conclusions regarding the Surveillance and Monitoring Plan

1.2.5 Conclusions regarding the Field Inspection

1.2.6 Conclusions regarding the Operations and Maintenance Programs

1.2.7 Conclusions regarding the Supporting Technical Information

### 1.3 Recommendations

The recommendations of the Independent Consultant to improve or maintain the condition and suitability for continued safe and reliable operation of the project and specific recommendations regarding the information in each Section of this Part 12D report.

1.3.1 Recommendations regarding the suitability of the Project for continued safe and reliable operation.

1.2.2 Recommendations regarding the Project Description

1.3.3 Recommendations regarding the Potential Failure Modes Analysis Report

1.3.4 Recommendations regarding the Surveillance and Monitoring Plan

1.3.5 Recommendations regarding the Field Inspection

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



1.3.6 Recommendations regarding the Operations and Maintenance Programs

1.3.7 Recommendations regarding the Supporting

1.4 Certification

Note: By signing this document, the Part 12D Independent Consultant is stating that the entire report has been developed by and under the direction of the undersigned. The Part 12D Independent Consultant shall make a clear statement that he/she generally concurs with the assumptions, methods of analyses, and results of all studies documented in the report.

The Part 12D Independent Consultant is thus taking responsibility for the Part 12D report contents as a Professional Engineer.

1.4.1 List of all field inspection participants

1.4.2 Reference to FERC Order 122 dated March 1, 1981 and paragraph 12.37 (c) (7).

1.4.3 Signature(s) of Part 12D Independent Consultant(s) and PE Stamp

See Appendix A: **FERC Letter Requiring Part 12D Inspection**

See Appendix B: **FERC Letter Approving Part 12D Consultant** - (Include date of current report outline provided by FERC)

## 2.0 Project Description

2.1 Brief Project Description

For each major element and ancillary structure, provide a brief description of the type of structure, general dimensions, etc. The detailed project description will be in the "Supporting Technical Information" document.

For multi-project or development licenses, include a brief outline of how this site fits with the other projects.

Include a short paragraph with very brief project history. When constructed, when modified, any incidents.

2.2 Hazard Potential Classification.

Based on views from the dam, other project works inspected and discussion with the licensee, document any changes in upstream or downstream conditions that might affect the Hazard Potential Classification. Review with the licensee the methods and assumptions used to develop the IDF. If the IDF is less than the PMF, the IC should confirm that the IDF is still valid based on an assessment of the downstream conditions as noted above.

2.3 Summary of Standard Operating Procedures

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



2.3.1 Purpose of Project (Run of river, storage, flow augmentation, flood surcharge storage, control reserve, pumped storage, etc.)

2.3.2 Reservoir rule curves by season (include seasonal reservoir level operating levels and restrictions of reservoir level due to safety concerns, if any)

2.3.4 Standard gate operation procedures (lead and following gates, emergency power systems, etc.)

2.4 Modifications Conducted for Project Safety

Document any modifications to project works since the last Part 12D inspection that have been done to improve project safety. (i.e.: spillway gates reinforced, seepage drain, berm added, crest raised, post-tensioned anchors installed, foundation drains or relief wells cleaned, etc.). In the next Part 12D Safety Inspection Report, these items will become part of Section 2.1. This information should be fully described in the updated "Supporting Technical Information" document submitted with the Part 12D report.

Do not include routine maintenance such as unit overhaul, gate painting, etc. Note, that generators, transformers, and transmission facilities are excluded from the Part 12D program under 18CFR subsection 12.35.

2.5 Flood History

2.5.1 Flood of Record, PMF, IDF

2.5.2 Zero freeboard spillway capacity

2.5.3 Peak spillway discharge during last five year period

2.5.4 Peak reservoir elevation during last five year period

See Appendix C: **Project Figures** (Note: If the STI is bound with this report, do not duplicate figures)

## 3.0 Discussion of Potential Failure Mode Analysis Report

Do not include security issues in the Part 12D report. For licensed projects that include multiple independent dam and powerhouse developments, separate PFMA studies and reports should be made for each development.

3.1 General

Identify the Core Team members, and their affiliations, who developed the comprehensive Potential Failure Modes Analysis (PFMA) or its update. Note that the process was in accordance with FERC "Engineering Guideline for the Evaluation of Hydropower Projects," Chapter 14.

3.2 Assessment of Potential Failure Mode Analysis Report

Assess the viable potential failure modes identified in the PFMA report. These would generally be Category 1 through Category 3 PFMs. Provide an assessment of the

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



reasonableness and completeness of the failure mode scenario and whether the PFMs identified have a real possibility of occurrence. Potential Failure modes should be listed in order of importance. Each PFM assessment should include:

- A description that includes the sequence of conditions and events that would lead to the potential failure mode;
- An assessment of the risk reduction opportunities for each PFM; and
- An assessment of the Surveillance and Monitoring Plan for each PFM.

For example, the report would be formatted as follows.

3.2.1 PFM 1. (i.e. Internal erosion, piping)

3.2.1.1 Description of PFM (may be taken from PFMA report)

3.2.1.2 Assessment of Risk Reduction Opportunities

3.2.1.3 Assessment of Surveillance and Monitoring Plan

3.2.2 PFM 2. (i.e. Seismic induced deformation)

3.2.2.1 Description of PFM (may be taken from PFMA report)

3.2.2.2 Assessment of Risk Reduction Opportunities

3.2.2.3 Assessment of Surveillance and Monitoring Plan

Etc.

3.3 Are there new potential failure modes that have been identified and addressed in this report or that should be assessed? If so, include the appropriate Description of the PFM, Assessment of mitigation actions and Assessment of the SMP as discussed above.

See "Supporting Technical Information" document: **Potential Failure Mode Analysis Study Report** (Update as appropriate)

## 4.0 Surveillance and Monitoring with Respect to Potential Failure Modes

Note: Review and assessment of Surveillance and Monitoring Plans must always be done from the point of view of potential failure modes. Although the primary assessment is with respect to the potential failure modes identified in the PFMA study, the Independent Consultant must determine if there are potential failure modes not previously addressed or not adequately considered.

For the purposes of this section, a Threshold Level is the value used in the analysis or design, or is established from the historic record. An Action Level is the instrument reading that triggers increased surveillance or an emergency action.

4.1 Operator's Surveillance Program

Daily/weekly operator's inspections and reports.

4.2 Active Instrumentation: Include a schematic figure showing location of instrumentation (not detailed or cross section).

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



This will vary by project. Discuss only the instruments actually at the project. Is instrumentation in accordance with Chapter IX of the FERC "Engineering Guideline for the Evaluation of Hydropower Projects"? Is the instrumentation functioning properly? Etc.

- Piezometers
- Weirs
- Settlement/alignment monuments
- Crack gages
- Upstream river and/or rain gage stations
- Headwater/tailwater (alarm systems)
- etc.

4.3 Threshold and Action levels

For each instrument, or group of instruments as appropriate, provide a table of Threshold and Action levels as defined above.

4.4 Reading procedures/frequency

For each instrument, or group of instruments as appropriate, discuss:

- Data acquisition procedures (manual/automated)
- Data evaluation procedures (process; is data evaluated in a timely manner by a qualified engineer; are readings compared to Threshold and Action levels defined for each instrument)
- Spurious readings (are spurious readings confirmed or explanations provided)

4.5 Assessment of Instrumentation Data and Surveillance and Monitoring Plans Relative to Potential Failure Modes

Include newly identified potential failure modes.

## 5.0 Field Inspection

5.1 Field Inspection Observations

For each element of the project (i.e.: spillway, earthfill embankment, gravity section, intake, powerhouse, conveyance system, etc.), observe and report visual observations of the following issues as appropriate. Include photographs to document significant project features and observations. If an inspection checklist is used, include a copy of the checklist Appendix F. A site specific inspection checklist should be formatted to include specific visual surveillance items identified in the PFMA.

The intent of this section is to highlight changed conditions for the report reviewer, not to document unimportant or minor details.

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



The report should be in text format by structure or element addressed individually. For each structure or element of the project, the Part 12D Independent Consultant should consider the following items as appropriate:

- Settlement
- Movement – including abutments (cracks or other signs of distress or change)
- Erosion
- Seepage/Leakage
- Cracking
- Deterioration
- Spillway gate Operation/Standby Power (At a minimum, the Part 12D Independent Consultant needs to review the licensee's annual certificates of spillway gate operation and interview project operating staff to assure that emergency backup systems work and that operating personnel know how to use them. At least one spillway gate should be operated at least one foot during the Part 12D inspection using the standby generator.)
- Outlet/Sluice Gate Operation
- Water conveyance systems (canals / flumes / penstocks / tunnels / surge chambers, emergency bypass or closure systems, etc.)
- Foundation Drain/Relief Well Operation
- Evidence of high artesian or uplift pressures (structures / foundations / abutments)
- Observations of sediment transport (piping evidence)
- Observations of seeps, wet areas, springs, green grass
- Other Pertinent Observations

5.2 Status of Response(s) to Recommendation(s) in Last Part 12D Report.

5.3 Field Observations with Respect to Potential Failure Modes

Document field observations pertinent to each potential failure mode noted in Section 3

5.4 Adequacy/Operation of Public Alert Systems

Note: Are upstream spillway warning buoys, and downstream sirens and lights operable?

See Appendix E: **Inspection Photographs** (Optionally, some or all of the photographs may be included in the appropriate sections of the report. If photographs are included within the report, provide in Appendix E a list of the photographs and the corresponding page number)

See Appendix F: **Inspection Check List** (optional)

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



## 6.0 Operation and Maintenance Programs Relative to Potential Failure Modes

Do not include security issues in the Part 12D inspection report. If observations of significant O&M issues are made, include in report for possible new potential failure mode analysis.

6.1 Summary of PFMA identified O&M issues (from PFMA report)

6.2 Operation and Maintenance Procedures

6.2.1 Communication/Response

Address adequacy and reliability of remote monitoring, communication and control systems (Operations / Instrumentation / Telemetry – Do the systems provide adequate reliability and redundancy? Can a specific spillway gate, valve or other project component be operated remotely on demand?)

6.2.2 Electrical/Mechanical Systems

- Spillway Gate Motors (line/line voltage, amperage draw, motor name plate rating information)
- Standby and Redundant Power Sources
- Manual/Remote/Automatic Operation of Gates and Valves
- Gate Operation Sequence
- Icing protection (heaters/bubblers/reservoir level restriction)

6.2.3 Human Factors

- Adequate Staff for Emergency Response (Multiple Sites)
- Reliable Access Routes (winter/storm conditions)
- Training
- Electricians/Mechanics/Laborers
- Adequate Time to Respond
- Call Out Systems (time for crew to reach site after call out)

6.3 Assessment of O&M Procedures Relative to Potential Failure Modes

See Appendix G: **Operation and Maintenance Documentation**

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



## 7.0 Assessment of Supporting Technical Information Document

The purpose of this section is for the Part 12D Independent Consultant to assess the contents of the "Supporting Technical Information" document compiled by the licensee. The STI document should include information needed to understand and confirm the underlying assumptions and the conclusions of the analyses of record supporting the assessment of the safety of the Project.

In each section, where appropriate, the Independent Consultant shall make a clear statement that they have reviewed the pertinent analyses and evaluations along with the underlying assumptions and that they have concluded that the assumptions and methods of analysis or evaluation were appropriate for the structure, were applied correctly and are appropriate given current guidelines and the state of dam safety practice.

7.1 Potential Failure Mode Analysis Study Report (Include a statement referring to Section 3 for a discussion of the Potential Failure Mode Analysis)

7.2 Description of Project

7.3 Construction History

7.4 Standard Operating Procedures

7.5 Geology and Seismicity

7.6 Hydrology and Hydraulics

7.7 Surveillance and Monitoring Program

7.8 Stability and Stress Analyses of Project Structures

7.9 Spillway Gates

7.10 Pertinent Correspondence Related to Safety of Project Works

7.11 Status of Studies in Process and Outstanding Issues

7.12 References

7.13 Conclusions

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



## APPENDICES

**List of Tables** (with location)

**List of Figures** (with location)

**List of References**

### A. FERC Letter Requiring Part 12D Inspection

**Note:** May include specific FERC concerns to be addressed by Part 12D Independent Consultant.

### B. FERC Letter Approving Consultant

**Note:** Include date of report outline provided by FERC.

### C. Project Figures

This Appendix should include the following figures as appropriate. All Figures should be consecutively numbered. Figures should be general without excessive detail so as to be clearly legible. Figures should include documentation of significant changes since last Part 12D report. If STI document to be directly bound in this report, do not duplicate the figures. FERC Exhibit and relicensing drawings can be used.

- Location map with project facilities located including conveyance systems and access routes from main roads and nearest town
- Plans of project facilities
- Typical sections and profiles of key project features (dams, spillways, powerhouses, intakes, emergency/fuse plug spillways, chute profiles, etc.)
- Profiles and typical sections of water conveyance systems (canals, tunnels, penstocks, flumes, surge chambers, etc)
- *Satellite or aerial photo of project and downstream area*
- Spillway and tailwater rating curves

### D. Instrumentation Monitoring Data Plots

Note: Plans and cross-sections with locations of each instrument, including design phreatic surface or uplift pressure profile, and tabulated data for each instrument are included in the "Supporting Technical Information" document only. See Chapter IX, Instrumentation and Monitoring, of the FERC Engineering Guidelines for the Evaluation of Hydropower Projects for additional information. Only time versus reading graphs are included here as NEW information. Tables of data should be provided on a CD bound into the Part 12D report

If data plots are included in Section 4 of the Part 12D report, a statement should be provided here directing the reader to Section 4 for the information.

- Time versus Reading data plots

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



- Plot all data to date, not just last five years (alternative is to plot last 15 years and note historic range for each unit)
- Do not put too many instruments on one plot
- Try to put all instruments from one section or profile on the same plot
- Mark tip elevation, unscreened length, ground elevation and top of piezometer elevation for each piezometer on the data plot. This information can be provided in a Table to enhance legibility of the graph.
- Use symbols and/or different line types for each unit, not just colors (colors do not reproduce in black and white and some people are color blind - Note that yellow and blue do not reproduce on Xerox machines)
- Include headwater and tailwater levels on each plot
- Force all time scales to show full year cycles from January through December
- For multiple plots for the same project, force vertical and horizontal scales on all plots of the same type to have the same scale or total range so plots can be directly overlaid
- Mark threshold values
- Show monthly precipitation on one sheet
- Mark action levels requiring emergency response

**E. Inspection Photographs**

**F. Inspection Checklist (optional)**

**G. Operation and Maintenance Documentation (if required)**

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



# Appendix I
# Guidelines for Supporting Technical Information

The "Supporting Technical Information" document must include a revision sheet and contain the following sections:

| Section | Title |
|---|---|
| | **Table of Contents** |
| 1. | **Potential Failure Mode Analysis Study Report** |
| 2. | **Description of Project Structures** |
| 3. | **Construction History** |
| 4. | **Standard Operation Procedures** |
| 5. | **Geology and Seismicity** |
| 6. | **Hydrology / Hydraulics** |
| 7. | **Surveillance and Monitoring Plan** |
| 8. | **Stability / Stress Analysis of Project Structures** |
| 9. | **Spillway Gates** |
| 10. | **Pertinent Correspondence Related to Safety of Project Works** |
| 11. | **References** |

The information to be included in each section is described below. If an item is not pertinent to the Project, include the item in the report and state that the item is Not Applicable (i.e. Section 9 "Spillway Gates" if the dam has an uncontrolled spillway).

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



## SUPPORTING TECHNICAL INFORMATION

**Revision Log**
**Table of Contents**

### 1.0 Potential Failure Mode Analysis Study Report

Include a complete copy of the latest "Potential Failure Modes Analysis Report" with all attachments. All updates shall be included in this Section of the STI.

### 2.0 Description of Project Works and Project Drawings

This is a detailed description of the project and project works that is part of the Part 12D Independent Consultant review. In general, this information will come directly from existing sources such as prior Part 12D Inspection Reports, licensing or relicensing documents or company brochures. The detailed descriptions would include the following elements as appropriate:

- General project description including project name and owner
- Project location including nearest town(s), river system, etc.
- Purpose of Project
- Main dam and any auxiliary dams
- Spillway(s) including stilling basins
- Non-overflow water retaining structures such as powerhouses
- Intakes
- Conveyance systems (penstocks, tunnels, surge chambers, flumes, canals, inverted siphons, including control, regulating, and pressure relief devices, etc.)
- Powerhouse(s)
- Low level outlets including minimum flow devices

The following drawings shall be included

- USGS Quad map or other location map with project facilities located including conveyance system alignment
- Plan of licensed project facilities and project boundaries
- Typical sections and profiles of key project works (dams, spillways, powerhouses, intakes, canals, tunnels, penstocks, flumes, surge chambers, inverted siphons, etc.)
- Satellite or aerial photo of project and downstream area if available

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



## 3.0 Construction History

In general, this information will be copied directly from existing sources such as prior Part 12D reports, construction reports or company brochures. Include a summary of the project construction history based on the following sources of information:

- Design reports and pertinent memoranda from licensing and permitting documents
- Laboratory investigations and construction testing reports
- Field and lab geotechnical investigations
- Construction reports and photographs
- Specification documents
- Reports of major modifications conducted for dam safety since last Part 12D inspection
- Construction chronology that includes all a summary of original construction and all significant work completed related to project safety. Do not include routine maintenance items such as gate painting, unit overhauls, etc.

## 4.0 Standard Operation Procedures

Include summaries of the standard operating procedures for the project. This section should include: seasonal minimum flow requirements, lead and follow gate sequence, reservoir level restrictions by season, etc.

4.1 Dam Operations

- Schedule of Inspections (include routine operations by operating staff, inspections by engineering staff, and special inspections as appropriate)
- Inspection checklist(s)
- Procedures for assuring satisfactory operating condition of critical systems including; SCADA systems, spillway gate operators, spillway gates, and low level outlet works

4.2 Reservoir Operations

4.2.1 Normal Operations

- Typical filling schedule
- Inflow forecasting procedure
- Ramping rate requirements (reservoir and releases)
- Downstream minimum flow requirement schedule

4.2.2 Flood Operations

- Criteria for starting gate operations
- Method of gate operation (local or remote)
- Gate operating sequence (both spillway and low level outlets as applicable). Are gates operated such that all gates are opened a similar amount? Are some gates opened fully before others are operated? etc.

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



## 5.0 Geology and Seismicity

In general, this section should be copied from existing reports and company brochures. Include summaries of applicable information in the following sections:

5.1 Geology

5.1.1 Regional geology

5.1.2 Site geology and local foundation conditions including geologic maps, cross-sections and profiles under the dam(s) and pertinent project works.

5.1.3 Potential landslides, loose rock formations or adverse bedding orientations that could affect project works

5.1.4 Potential sinkhole, karst, solutioning, basalt flow issues, etc. that could impact project works

5.1.5 Potential weak seams such as bentonite or soluble gypsum layers

5.1.6 Geologic artesian sources (geothermal, high abutments, etc.). Do not include artesian pressures due to normal dam seepage.

5.2 Seismicity

5.2.1 Map of fault traces that effect project. Differentiate between those traces that have been confirmed by trenching or other means and those that are inferred from other means.

5.2.2 Table of fault, distances, depths, magnitude at fault, PGA at site, etc. including local (floating or random crustal) earthquake.

5.2.3 Site MCE and DBE development

5.2.4 Time history of adopted earthquakes

5.2.5 Response spectrum used in analyses

5.2.6 Historic earthquake centers map

The USGS website (http://neic.usgs.gov) includes information on seismicity and may be a useful reference.

## 6.0 Hydrology and Hydraulics

Provide supporting information to document the development of the Probable Maximum Flood (PMF) and the routing of the PMF through the reservoir and project spillways. In general, this information will come directly from existing sources such as prior Part 12D Inspection Reports or company reports. The following information that should be included as applicable:

6.1 Hydrology

6.1.1 Hydrometeorology report used

6.1.2 Probable Maximum Precipitation for general and local storms

6.1.3 Drainage basin description including drainage area

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



6.1.4 Antecedent conditions

6.1.5 Loss rates

6.1.6 Basin and sub-basin precipitation/runoff models

6.1.7 Unit Hydrograph

6.1.8 Reservoir inflow and outflow hydrographs for the PMF event

6.1.9 Floods of record including highest flood flows and reservoir elevations

6.2 Hydraulics – Dams

6.2.1 Project discharge-rating curves (For multiple gate spillways, outlet structures, powerhouse units, and emergency/fuse plug spillways, include the contribution of each component as well as the total capacity. Include the equations used to develop the curves including overtopping and orifice flow where appropriate).

6.2.2 Tailwater rating curve (Compare to dam break studies)

6.2.3 Normal and IDF freeboard without wave action

6.2.4 Zero freeboard flood capacity (without wave allowance)

6.2.5 Inflow Design Flood (based on dam break) The pertinent information from dam break analyses necessary to support the determination of the IDF should be included

6.2.6 Reservoir Probable Maximum and Inflow Design Flood outflow hydrographs and corresponding reservoir levels

6.2.7 Freeboard for general and thunderstorm events

6.2.8 *Stilling basin or plunge pool design flood flow*

6.2.9 Operating rule curve (if storage reservoir) including license restrictions on storage levels by season

6.3 Hydraulics – Water Conveyance Systems

6.3.1 Hydraulic capacity of water conveyance system(s)

6.3.2 Normal operating freeboard

6.3.3 Spillway discharge rating curve(s)

6.3.4 Summary of transient analysis

## 7.0 Surveillance and Monitoring Plan

This section is to include drawings and/or sketches showing the location of each active instrument. Include cross-sections of project structures showing instrument tip elevation, ground elevation and readout point location. See Chapter IX, Instrumentation and Monitoring, of the FERC *Engineering Guidelines for the Evaluation of Hydropower* Projects for additional discussion.

Note: time versus reading graphs for each instrument will be included only in the Part 12D Inspection Report, not in the STI.

7.1 Plans, sections, and details of active or useful reference instrumentation

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



If a unit has been abandoned or replaced, but the historic data is still being used for safety evaluations, include the appropriate information for the record

7.2 Reading frequency for each instrument (reading procedures should not be included in this document)

7.3 Procedures for resolving spurious readings

7.4 Tabulated Data for each instrument (may be included on CD in Excel format)

7.5 Type of instrument (pneumatic/vibrating wire piezometer, Parshall flume, gape gage, inclinometer, etc)

7.6 Predicted value for each instrument (threshold values are values used in design or analysis of project structures)

7.7 Historic range of readings for each instrument

7.8 Threshold and Action level for each instrument

## 8.0 Stability and Stress Analyses of Project Structures

Because every dam and hydroelectric project is unique, it is not possible to list here all the various items that are required to adequately detail stability or stress assessments of the project water retaining structures. It will be the responsibility of the Licensee to include all information necessary for the reader to understand the assumptions, methods of analysis, and load cases assessed for each project structure. Stability and stress analyses for each structure shall be summarized graphically for ease of understanding.

The following types of information should be provided:

8.1 General

8.1.1 Listing of credible load cases analyzed (including water levels for dam, canal and flume analyses or pressure for penstock and flowline analyses)

8.1.2 Statement of the method of analysis used and the computer program adopted.

8.1.3 Properties of materials based on site specific tests or assumptions (state which). Include representative test data and summary sheets.

8.2 For each gravity structure and load case:

8.2.1 Graphic free body diagram (cross-section) of each structure showing:

- the assumed self weight of the cross section
- all applicable loads including, as appropriate:
- assumed uplift pressure distribution
- silt loads
- headwater and tailwater loads
- point loads
- ice load

8.2.2 Key elevations

8.2.3 Key lateral dimensions

8.2.4 Piezometer and drain locations

8.2.5 Foundation shear strength parameters

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



8.2.6 Minimum cohesion to meet stability criteria

8.2.7 Negative crest pressures

8.2.8 Concrete unconfined and splitting tensile strength test results

8.2.9 AAR potential or evidence

8.2.10 Failure planes investigated, etc.

8.3 For each embankment structure and load case:

8.3.1 Graphic cross-section showing

- embankment zoning
- phreatic surface by load case
- critical failure surfaces
- key elevations
- key lateral dimensions
- slopes
- headwater and tailwater elevations
- relief wells, drainage layers, cutoff trenches, slurry walls, etc

8.3.2 Potential for uncontrolled seepage at toe

8.3.3 Summary of liquefaction analyses

8.3.4 Summary of deformation analyses

8.3.5 Procedures used to determine soil types and properties, etc.

- Soil Classification
- Atterberg limits
- etc.

8.3.6 Procedures used to determine soil strengths

- Triaxial Tests (type and loadings)
- Standard Penetration Tests
- Cone Penetration Tests
- Becker Hammer Tests
- etc.

8.4 For each arch dam load case:

8.4.1 Finite element mesh

8.4.2 Stress contours

8.4.3 Vector diagrams

8.4.4 Thrust block stability and joint sterionets

8.4.5 Pulsating load potential, etc.

8.5 For each water conveyance system that has a highlighted PFM

8.5.1 Stress and stability analyses

8.6 Summary table of factors of safety for each structure and load case, with required value.

Unofficial FERC-Generated PDF of 20051216-0012 Issued by FERC OSEC 12/14/2005 in Docket#: P-2079-000



For embankment structures and overburden foundations, the material strengths used in the stability analyses should be properly identified i.e. effective stress or total stress. The methods used to determine/estimate pore pressures, such as flow nets or field measurements, should also be described.

For gravity structures, it is useful to provide a spreadsheet of the key numbers from the analysis.

## 9.0 Spillway Gates

*For each spillway gate type, include the following information:*

9.1 Table of material properties (steel type, trunnion bearing type and friction properties, etc).

9.2 A summary of the stress analysis computations

9.2.1 Graphic of gate model used for stress analysis

9.2.2 Table of critical stresses in each member for each load condition.

9.3 Trunnion, wheel, or other lubrication procedures, schedule, etc.

9.4 Summary of gate hoist motor load tests to date (motor name plate rating, line-line voltage, amperage draw, reservoir level, and initial draw if available)

9.5 Spillway gate detailed inspection report

## 10.0 Pertinent Correspondence Related to Safety of Project Works

Include the most recent FERC Annual Operation Inspection Report. Include any major correspondence from FERC or State Dam Safety Agencies related to outstanding dam safety issues for the project.

## 11.0 References

List of references available for review of dam safety issues and that were used to assemble this document.