NHA-HPC-MHUG Meeting

Green Bay, WI
October 25, 2016

Olaf Weeks, D2SI - Chicago
Paul Shannon, D2SI - Washington, DC

- Engineering Guideline Updates
- RIDM
- Security
- Public Safety
- Drilling Guidelines
- Other Questions

Engineering Guidelines

Feb 2016	Chapter 14 – Appendix H
Mar 2016	Chapter 3 – Gravity Dams
Mar 2016	Chapters 1-4 – Draft RIDM Guidelines

Engineering Guidelines

Chapter 14 – Appendix H - Part 12D Safety Inspection Report Outline - Section 7.0, Assessment of Supporting Technical Information Document

- Specifies IC must determine the completeness and appropriateness of the STI to the current standard of the practice as well as conformance to the FERC requirements.
- Clarifies items to consider when summarizing each section of the STI.
- Contains example statements as guidance for use by the IC when making a definitive statement regarding each section of the STI.

Engineering Guidelines

Chapter 3 – Gravity Dams

- Clarifies drain efficiency/uplift reduction.
- Provides definition of sliding safety factor
- Corrects the Factor of Safety calculation in Appendix C

$$FSS = \frac{Tan(\phi_{actual})}{Tan(\phi_{reqd})}$$

Engineering Guidelines

RIDM Guidelines

- Draft final guidelines in March 2016
- Still taking comments
- Finalize after pilot program

RIDM Risk Guidelines

Interim Guidance

RISK-INFORMED DECISION MAKING (RIDM)

RISK GUIDELINES FOR DAM SAFETY

FEDERAL ENERGY REGULATORY COMMISSION
Office of Energy Projects - Division of Dam Safety and Inspections

Version 4.0
March 2016

Chapter 1 – Introduction
Chapter 2 – Risk Analysis
Chapter 3 – Risk Assessment
Chapter 4 – Risk Management

Outreach/Communication

Risk presentations at dam safety conferences

- USSD, Denver
- ASCE/EWRI, West Palm Beach
- International Symposium on Hydraulic Structures, Portland
- HydroVision (risk session panel), Minneapolis
- ASDSO, Philadelphia
- INCA/USSD, Mexico City

Outreach/Communication

- Currently producing a series of video clips on highlights of the RIDM guidelines
  - Scheduled to be available by Dec 31
- RIDM guideline workshops – TBD (depending on interest)
- Other risk training workshops – TBD
  - Best practices in dam safety risk analysis?

Risk Analysis Pilot Studies

Purposes of the risk pilot studies:

1. Provide a clearer understanding of the outstanding dam safety issues and a more confident path to resolve those issues

2. Evaluate the RIDM policy and processes and identify potential shortcomings in the draft guidelines.

Risk Analysis Pilot Studies

Purposes (cont.):

3. Evaluate the risk methodologies; identify potential challenges or short comings; and identify potential tools that would be beneficial for future risk analyses.

4. Identify future training needs for implementation.

5. Obtain input from licensees and consultants on the overall all processes and methodologies.

Risk Analysis Pilot Studies

- 8 to 12 projects
- A variety of projects are being sought:
  - Variety of technical/potential failure mode issues.
  - Range of loading conditions (variable annual reservoir water surface, seismic, flood)
  - Range of consequences, including loss of human life and economic consequences
  - Range in size of licensee
  - Geographic diversity

Risk Analysis Pilot Studies

- Pilot studies have started
- Still open to new proposals
  - Level 1/Screening level (for inventories)
  - Level 3/SQRA
  - Level 4/Issue Evaluation/Alternatives

Level 1 (Screening Level) Risk Analysis Update

- Currently updating 2012/2013 SLPRA
- Revised screening tool (version 2.4)
  - Improved process to estimate probability of failure
  - Address some previous inconsistencies
  - Incorporate better PFMA information
- Results used to aid FERC staffing, resources, and training
- Scheduled for completion in summer 2017

Level 2 Risk Analyses

- Extension of PFMA process
- Qualitative to semi quantitative approach
- Tentative schedule
  - Develop initial methodology — Sept 2016
  - Internal trials — Nov 2016
  - Refine methodology — Jan 2017
  - Limited external trials — Mar 2017

Security Question

Could you please discuss the progress of the newer cyber aspects of the “FERC Security Program for Hydropower Projects, Revision 3A”?

What are the compliance expectations for licensees by the end of 2016? By the end of 2017, and forward?

Security Answer

2016

- Complete the Cyber Security checklist to determine applicability
  (Appendix A – Form 3 – Questions 1-4)

- If applicable identify any gaps in Cyber Security
  (Appendix A – Form 3 – Questions 5-33)

- Annual security-certification letter must at a minimum, specify compliance with Revision 2 and include progress towards meeting Revision 3

Security Answer

2017

- Addressed all deficiencies identified through the Cyber Security checklist or for any outstanding items have concurrence with FERC on the date for completion

- Annual security self-certification letter must specify compliance with Revision 3 or concurrence with FERC on the date for completion

Security Answer

- We have had many meetings with security personnel from licensees over the last year.
- Based on our discussions, there have been 5-6 common questions/themes that come up.
- We will have a webinar during the early part of next year to go over these questions/themes.

Public Safety Question

We understand that revised guidelines for Public Safety are in development. When do you foresee these being released, and is there anything that the HPC can do to help in the development process?

Public Safety

2015 - FERC Public Safety Task Group

- Internal Task Group of D2SI and DHAC staff was formed to evaluate the overall Public Safety Program
- DHAC recreation staff worked with D2SI for review and site inspection of randomly selected submitted PSPs

Public Safety Task Group Findings

- Quality of submitted PSPs varied greatly
- Measures on PSP inconsistent with field conditions
- Lack of maintenance of signs, fencing, & buoys
- Areas away from project works not routinely inspected
- Difficult to read or confusing signs
- Public had easy access to project works and dangerous areas

Enhancements to the PS Program

- Updating FERC Public Safety Guidelines (2017)
  - public safety plan preparation
  - public safety incident reporting
  - new technologies
  - remote operation impacts
- Public Safety Hazard Reference Table
- Licensee/Exemptee Self-Assessment Form
- Opportunity to Provide Comments
- Public Safety Workshops(?)

Drilling Guidelines

- Main Purpose - Prevent damage to embankments and their foundations from drilling operations

- Not an all-inclusive guidance or best practices document on considerations for the development of a subsurface exploration or investigation program for a dam.

Background

Need arose because of:

- Variability in the quality of the plans. Deficient or lack of information on type of drilling and testing required.
- Plans lacked basic information on the dam structures and foundation conditions
- Plans lacked a discussion on the purpose/reason for drilling and the associated risk with drilling.
- Plans failed to review existing documentation regarding previous drilling information.
- Field personnel (drillers & inspectors) had little to no experience drilling on or near embankment dams and with no understanding of the hazards.
- Field Personnel inability to recognize problems developing in the field and correct them before damage occurred.
- Referenced USBR or USACE guidance to assist developing the Drilling Plan.

Drilling Hazards

- The use of water, drilling mud, compressed air, and various drilling fluids have resulted in hydraulic fracturing of embankments or foundations. These are evidenced by loss of circulation, connections to other borings, and blowouts on embankment slopes.
- Heave, borehole collapse and other significant disturbances have occurred during drilling in soils below the groundwater table.
- This typically has been the result of improper use of materials and methods to stabilize the bore hole during drilling.
- There is a balance between excess fluid pressure that causes hydraulic fracturing and insufficient fluid pressure that will result in borehole instability, heave, etc.

Drilling Guideline - Highlights

Drilling Hazards
- Restrictions on the use of Drilling Fluids

Preferred Drilling Methods/Procedures

In Situ Testing/Sampling

Hole Completion

Personnel Qualifications

Other Considerations

Drilling Program Plan Requirements

Guidelines

- Success of the drilling program depends on experience and knowledge of field personnel performing the work.
- We strongly recommend the Drilling Program Plan (DPP) follow Appendix B (Outline for organizing the information in a DPP).

Personnel Qualifications
Drill Rig Operators

- Minimum 5 years experience with the equipment and procedures described in the drilling plan.
- Drilling experience on embankment dams should be clearly indicated in their resume.
- Familiar with the FERC guidelines.
- All drilling activities must be conducted in the presence of a qualified Inspector.

Personnel Qualifications Inspector

Factor	Low Hazard Dams	Significant and High Hazard Dams
Education	Minimum B.S. in Civil Engineering or Geology (or licensed as a professional engineer, professional geologist, or certified engineering geologist)	
Training	Independent study or formal training in the identification and mitigation of drilling hazards in embankment dams	
Experience	Minimum of two years of general drilling experience	Minimum of four years of embankment dam drilling experience

Education, training, and experience must be clearly shown in the resumes

Flexibility

The guidelines are required to be followed for all drilling work at project sites

HOWEVER:

- Judgement is needed because not all drilling projects are the same.
- D2SI is willing to allow reasonable and justifiable changes to the recommended guidelines based on project conditions and risk.

Drilling Guideline - Questions

1. Are new requirements being applied to all projects? Should they?

Yes, guidelines are being applied to all projects where drilling is taking place.

2. Is it necessary to have a qualified geotechnical engineer or engineering geologist on-site at all times?

A qualified engineer/geologist should be on site during all drilling, testing and backfilling work because they are the QCIP representative and responsible for documentation (logs, testing data, etc).

Drilling Guideline - Questions

3. Is it necessary to communicate with FERC at the end of every day of drilling or just if there are problems?

Any aberrant conditions encountered should be reported to FERC as soon as practical after the situation is discovered (without interfering with any emergency response). Field logs of the borings should be submitted daily to FERC, if feasible.

Drilling Guideline - Questions

4. Although costs are secondary – at recent projects the cost of the engineering associated with the development of the drilling plan and the on-site engineer far exceed the cost of the actual drilling – can something be done about this?

Plan - Reviewing existing documentation for available information that could result in reduced drilling cost. Good specifications tend to ensure desired results.

Drilling – An experienced inspector ensures the drilling is providing the information needed and minimizes risk of drilling.

Construction Cost Question

5. The FERC has been requesting project engineering, construction, etc. costs every six months. Why is this information requested and how is it being used?

Construction Cost Answer

- Information is used internally at FERC for planning purposes.
- Combined with project construction costs in other energy areas, the data highlights industry trends.
- Detailed costs are not required but estimates should be realistic.

PFM Questions

6. Please give an update for separating PFMs into individual failure modes. Is there more flexibility now to avoid repetitive failure modes?

7. Is there a difference between Category 1 & 2 verses Category IV PFMs when describing PFMs?

8. Are there firm standards, or do individual inspector have discretion?

PFM Answer

D2SI is aware

- that the focus on fully developing PFMs is resulting in large increase in numbers of PFMs.
- that a large number of PFMs can be cumbersome and challenging to manage.
- D2SI is still evaluating alternatives for combining PFMs.

PFM Answer

Key Principles:

- Include all PFMs that could result in failure of the dam and appurtenant structures
- No minimum or maximum number of PFMs for a given structure can be specified in advance
- PFMs should be separate when any one of the following conditions are met:
  - Failure mode location/pathway is different
  - Loading condition/initiating event is different
  - Likelihood of failure is different
  - Monitoring for PFM is different
  - Breach location and geometry is different
  - Consequences are different
  - Risk reduction actions are different

PFM Answer

Observations

- PFM table summaries are often randomly organized
  - Makes it difficult to see similarities/differences
- Sorting PFMs by
  - structure (main dam, dike, spillway, etc.)
  - loading condition (usual, unusual, extreme)
  - failure mode type (internal erosion, slope stability, scour, operational, mechanical, etc.)
- Organizing PFMs into similar groups aids with identifying and implementing monitoring/inspection programs, and risk reduction measures.

PFM Answer

Category IV PFMs are determined by one of two means:

- Determined to be not credible after initial brief consideration. (Brief description of PFM)
- Ruled out after full development of the failure mode description and discussion of the more likely/less likely factors as a result of finding specific information that shows that the subject PFM is **<u>not physically possible</u>**. (Same level of detail as those developed for Category I and II PFMs)

PFM Answer

Finally "Category IV should only include PFMs that have been dismissed as **physically impossible**. Low consequences and/or low probability of occurrence alone are not sufficient reason to classify a Potential Failure Mode Category IV." (Chapter 14 of FERC Engineering Guidelines).

Dam Safety 101 Question

9. This past September, you held a session of the Dam Safety 101 Training in Boise, Idaho. Do you foresee holding additional sessions of this seminar in other regions?

10. If you are planning on holding additional sessions, could you describe the agenda in the Dam Safety 101 course? Who is your target audience for this course?

Dam Safety 101 Answer

- Three so far (Alaska, Spokane, Boise)
- Target Audience: Operators
- 1 day class – Case Histories, PFMs, Surveillance & Maintenance
- Hosted by Owners who have several operators that would benefit by training, but open to others.
- 50-60 people
- Future?

Cleaning Drains in Embankment Dams

Direction of water jet

Federal Energy Regulatory Commission
Division of Dam Safety and Inspections

Black River Falls Question

11. Please give an update of the Tainter gate failure at Black River Falls. Is there an indication of cause? What is the timeline for an investigation?

Are there any new initiatives being considered?