From: RILEY, Jim
To: Cook, Christopher; Miller, Ed
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Subject: FAQs for Review
Date: Wednesday, February 13, 2013 1:49:44 PM
Attachments: FAQ 008 - IA Lite Subbmittal Timing Rev 3.doc
FAQ 009 - IA Lite Peer Review Rev 2.doc
FAQ 015 Dam Breach Formulation, Rev 0.doc
Inquiry Status Table Rev 1 - current status.doc

Chris, Ed,

Several FAQs are attached for your review. Subjects are as follows:

- FAQ 008 – IA submittal timing – you guys have looked at this several times. I hope that the attached version resolves all your comments.
- FAQ-009 – IA peer review – same as FAQ-008, I hope this version resolves your comments
- FAQ-015 – Breach parameters – this is the first time you have seen this one.

I am also attaching a document that provides a status of all the FAQs we have identified to date. With regard to open FAQs you will note:

- We have sent you FAQs 008, 009, 011, 013, 015, and 017. I hope we can discuss these during our February 21st meeting.
- We have drafted FAQs 010, 012, 014, and 018 and these are being reviewed by the task force. I hope to send these to you prior to our February 21st meeting.
- FAQs 016 and 019 will be developed later

Jim Riley
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FOLLOW US ON

Inquiry Form – Industry Approval

A. TOPIC: Submittal Timing of Simple Integrated Assessments

Source document: NRC Integrated Assessment Trigger Letter Section: NA

B. DESCRIPTION:

The NRC Letter dated 12/3/12 on the subject of trigger conditions for performing an integrated assessment identified two scenarios for which a full integrated assessment (IA) is not required. In its description of scenarios 2 and 3 the letter indicates that the limited integrated assessments associated with these scenarios should be submitted with the hazard reevaluation. Due to time restraints, especially for Group 1 sites, additional time may be necessary to complete these limited assessments. Would it be acceptable to submit the limited integrated assessments at a later time (e.g., 6 months following submittal of final hazard evaluation) without constituting an extension of the hazard reevaluation?

C. Initiator:

Name: R Gil Phone:_______

Date: 12/14/12 E-Mail: rudy_gil@fpl.com

D. RESOLUTION: (Include additional pages if necessary. Total pages: 1)

Inquiry number: 008 Priority: M

In accordance with the 50.54(f) letter, integrated assessments must be submitted two years after submittal of the reevaluated hazard. Licensees may submit an integrated assessment, including those discussed in the description of scenarios 2 and 3 in the "trigger" letter, with the flooding hazard report at their discretion, but it is not necessary to do so. This is substantiated by the following sentence in the last paragraph on the first page of the "Trigger" letter: "It should be noted that, although only licensees in scenario 4 are required to perform an integrated assessment, licensees in scenarios 1, 2, and 3 may elect to perform an integrated assessment, to be submitted 2 years after submitting the reevaluated hazard report."

Revision: 3 Date: 2/13/13

E. NRC Review:

Not Necessary_______ Necessary X

Explanation:______________________________

F. Industry Approval:

Documentation Method:______________________________ Date:______________

Inquiry Form – Industry Approval

A. TOPIC: Peer Review of Simple Integrated Assessments

Source document: NRC Integrated Assessment Trigger Letter Section: NA

B. DESCRIPTION:

The NRC Letter dated December 3, 2012 on the subject of trigger conditions for performing an integrated assessment identified two scenarios for which a full integrated assessment (IA) is not required. Scenario 2 requires application of Appendix A of the IA ISG and NUREG-0800. Scenario 3 requires application of Section 6 and Appendix A of the IA ISG. Accordingly, other sections of the IA ISG, and specifically the requirements for peer reviews, are not required for evaluation of these scenarios. This approach appears reasonable, since the scenarios are not complex and normal reviews associated with submittals under 50.54(f) will ensure the accuracy of the evaluations. Please confirm this interpretation.

C. Initiator:

Name: R Gil Phone:

Date: 12/14/12 E-Mail: rudy_gil@fpl.com

D. RESOLUTION: (Include additional pages if necessary. Total pages: 1)

Inquiry number: 009 Priority: M

It is necessary to perform the peer reviews described in section 4 and Appendix B of JLD-ISG-2012-05 for all Integrated Assessments including those assessments described in scenarios 2 and 3 of the December 3, 2012 NRC letter to NEI.

Revision: 2 Date: 2/13/13

E. NRC Review:

Not Necessary____ Necessary X

Explanation:

F. Industry Approval:

Documentation Method: Meeting summary Date:

Inquiry Form – Industry Approval

A. TOPIC:

Source document: NUREG CR/7046 Section: NA

B. DESCRIPTION: An essential part of the dam failure modeling process is formulating and characterizing the dam breach. NUREG CR/7046 does not provide specific guidance on dam failure analysis including breach parameter determination. What are key attributes that should be considered in the development of breach parameters?

C. Initiator:

Name: Dean Hubbard Phone:
Date: February 2, 2013 E-Mail: dean.hubbard@duke-energy.com

D. RESOLUTION: (Include additional pages if necessary. Total pages: __________)

Inquiry number: XX Priority:____________

Dam breach determination should be based on realistic but conservative assumptions. Key parameters, such as location, formation time, and size, can have a significant effect on the estimated outflow from a breach. Breach characteristics can be estimated using several approaches such as: comparative analysis, empirical methods using regression equations, and physically based models. Empirical methods and physically-based models are the two approaches most often used for estimating breach parameters and are discussed further below.

1. Embankment Dams

Breach Analysis Methods

Empirically-Based (Regression) Estimation - Empirically-based methods for breach parameter and peak outflow estimation are based on regression equations, generated using observed flows from actual breach events. Simple regression equations that rely on an assumed hydrograph shape with a known volume of water can be useful as a screening tool, or for sensitivity analysis to check the reasonability of other methods. The most realistic breach equations include multiple parameters, such as the primary geometric parameters with additional control variables (e.g. dam type, failure mode, and dam erodibility). Original technical papers or documentation should be reviewed prior to using these equations to understand their limitations and applicability. The most credible and appropriate technical papers include validation of the breach parameter assumptions and equations with documented dam failure data for dams of similar size, design, materials, and construction to the dam being evaluated. For example if the given regression equation was developed primarily with data from small dam failures (less than 15 meters), the method may not provide a realistic representation for large dams. Since estimates of breach parameters can vary significantly, it is recommended that that more than one method be used to establish a range of breach parameters, giving due consideration to the dam's design characteristics.

Wahl (1998) and Pierce (2010) identified and evaluated regression equations for peak outflow as a function of dam and/or reservoir properties. Other notable and more recent reviews of breach parameter prediction methods (and peak-flow prediction equations and related dam-failure modeling guidance) include Washington State (2007), Gee (2008), Wahl (2010), and Colorado Department of

Natural Resources (2010).

Physically-Based Breach Methods -The use of a physically-based breach model requires more dam specific information than empirical methods. Dam and reservoir details must be specified, alternatives for erosion calculations selected, and soil erodibility properties estimated or measured. Sensitivity analyses should be conducted to investigate the effects of variation of input parameters. The use of physically-based models is appropriate when more accurate results are needed and soil erodibility can be reasonably estimated and requires detailed documentation of the assumptions and inputs.

Breach Parameters

Failure Mode - The two primary failure modes for embankment dams are overtopping and piping failures. Breach formation and development time differ for overtopping versus piping failures. This is discussed under the section addressing breach formation time.

Failure Location – Breach location should be based on factors such as dam type, failure mode and the structural elements of the dam. Consideration for the history of the specific dam performance should included in the basis for breach location including seepage points, prior repair locations and known areas with lower margin. If the probable location cannot be determined based on design and history, the centerline of the breach should align with the centerline of the downstream main channel.

Breach Formation Time - The breach formation time is a variable that affects peak discharge and warning time for failure responses. The definition of breach formation time varies based on the methodology being used. However the breach formation time definition must be consistent with the breach formation methodology and analytical software being used to calculate the breach outflow and routing. Breach time is commonly characterized in two phases starting with breach initiation with a transition to breach formation if no action is taken to correct the developing abnormal condition.

- **Breach initiation:** During the breach initiation phase, flow through the dam is minor and the dam is not considered to have failed. It may be possible to prevent a dam breach during this phase if flow is controlled.
- **Breach formation time:** The breach formation time is commonly defined as starting when flow through the dam has increased and is progressing to the point that erosion is significant, uncontrolled, and will result in the failure of the dam. The specific hydrologic or geologic failure mode must be considered when determining the starting point for the breach formation time.

  Overtopping failure breach formation time: The time from when the breach has eroded back to the upstream side of the top of the dam to when the breach is fully formed (i.e., significant erosion has stopped, not the time when the reservoir pool is emptied).

  Piping/Internal erosion failure breach formation time (hydrologic or geologic induced): The time from when a significant amount of flow and material are moving through the piping failure to when the breach is fully formed (i.e., significant erosion has

stopped, not the time until the reservoir pool is emptied).

Breach Geometry - The final breach dimensions will vary based on the dam type, materials, and construction. The maximum size is reached when water velocities are low enough such that material transport drops to nominal levels. By using the breach parameter approach to dam break modeling, the analysis can exert control over the breach parameters in the dam break model taking into account specific site parameters.

The ultimate bottom elevation is the point at which erosion stops; usually either bedrock, or the bottom of the reservoir pool taking into consideration debris deposition and tailwater effects downstream of the breach. Due to the uncertainties associated with the breach predictions, sensitivity studies should be performed to support the final breach selection.

2. Concrete Dams

In general, the current approach to concrete dams is instantaneous failure. The analysis does not necessarily need to include failure of the entire dam based on the dam design and failure initiation event. For example, for a dam with large gates on the top, it may be reasonable to analyze a failure mode where only the gates fail, but that the concrete portion of the dam beneath and adjacent to the gates remains intact. For dams with distinct structural segments (e.g., buttress dams), limiting failure to one or more segments that are most prone to a deficiency may be justifiable. A technical justification will be required to provide the basis for a determination of partial failure based on an analysis of the dam design and construction.

3. Uncertainty

In general, uncertainty in formulating a dam failure should be evaluated by applying multiple methods and evaluating sensitivity to reasonable variations in input parameters. Methods and assumptions should be realistic but conservative. Justification for use of a particular method should be established based on an understanding of how the method was developed and its applicability to the dam in question. Examples of uncertainty information can be found in Froehlich (2008), Wahl (2004), and Xu and Zhang (2009).

Revision: 0 Date: 2-2-13

E. NRC Review:

Not Necessary________ Necessary____________

Explanation:____

F. Industry Approval:

Documentation Method:_____________________________________ Date:________________

Inquiry Status Table

No.	Topic	Pri.	Ref. Doc.	NRC Rev?	Next Action	Respons.	Status
001	Gap Analysis	H	50.54(f) ltr.	Y			Appvd
002	Dam Failures	H	NUREG/CR 7046	Y	Complete white paper	J Bellini	Closed to FAQs 10 thru 15
003	Hazard Screening	H	NUREG/CR 7046	Y	Address NRC comments	D Hubbard	Closed to FAQ 014
004	APM – Interim Actions	H	NEI 12-07, 5.8	Y			Appvd
005	Seal Inspections	H	NEI 12-07, 3.13	Y		J Riley	Appvd
006	APM Determinations	H	NEI 12-07, 3.13	Y		J Bellini	Appvd
007	Exterior wall inspection	H	NEI 12-07, 5.5.2	N		J Bellini	Appvd
008	Simple IA Submittal Timing	H	NRC IA Trigger Letter	Y	NRC review	J Riley	Open
009	Simple IA Peer Review	H	JLD ISG-2012-05, App B	Y	NRC review	J Riley	Open
010	Flood Duration for IA	H	JLD ISG-2012-05	Y	FFTF review	D Hubbard	Open
011	Seismic Evaluation of Dams	H	JLD ISG on Dam Failure	Y	NRC review	P Selman /M Ryan	Open
012	Hydrologic Evaluation of Dams	H	JLD ISG on Dam Failure	Y	FFTF review	J Bellini	Open
013	Sunny Day Evaluation of Dams	H	JLD ISG on Dam Failure	Y	NRC review	J Riley	Open
014	Screening Criteria for Dam Failure Evaluations	H	JLD ISG on Dam Failure	Y	FFTF review	J Bellini	Open
015	Dam Failure Breach Parameters	H	JLD ISG on Dam Failure	Y	NRC Review	D Hubbard	Open
016	Dam Failure Evaluations with Limited Design Information	H	JLD ISG on Dam Failure	Y	Draft FAQ	J Gasper	Open
017	IA Scope: Hazards that must be Evaluated	H	JLD ISG on Dam Failure	Y	NRC review	J Riley	Open

Inquiry Status Table

018	Reevaluation – Debris Loading	H		Y	FFTF Review	J Mallon	Open
019	Seismic evaluation for multiple dams	H		Y	Draft FAQ	P Selman	