

Best Practices in Dam and Levee Safety Risk Analysis

I-10. Facilitator Considerations

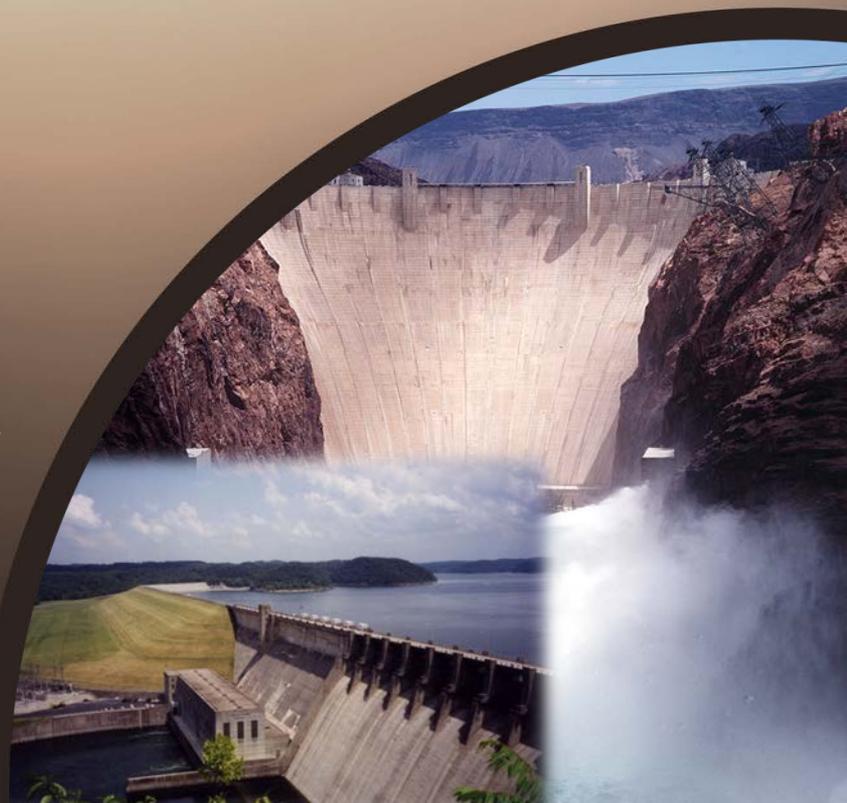
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RECLAMATION
Managing Water in the West



US Army Corps of Engineers
BUILDING STRONG®



Outline

- Role of Facilitators
- Training/Experience
- Skills
- Responsibilities



Role of Facilitators

- Meets with the team prior to a risk analysis
 - ensure engineering analyses are completed
 - ensure the team composition is appropriate to develop credible risk estimates
- Facilitates the team risk analysis, helping the team develop potential failure modes, event trees, strategies for estimating risks, and developing ranges of likelihood and consequence estimates
- Ensures alternative viewpoints are elicited, discussed, and recorded
- Reviews and certifies the final report



Best Practices

- Encourage having a kick-off meeting with the participants and stake-holders
- Two facilitators per Issue Evaluation Risk Analysis is helpful



Typical Skills

- Objectivity
- Open-mindedness
- Perseverance
- Diplomatic
- Insightful
 - Understands a wide range of engineering principles
 - Understands the big picture



Knowledge and Skills

- How to describe failure modes from initiator, through step by step development, to reservoir breach
- When it is not appropriate to add risks based on conditional probabilities
- How to develop an event tree
- When additional load ranges are needed
- How to weight analysis results for a given load range
- Generally how PrecisionTree and @Risk or DAMRAE work



Knowledge and Skills

- What kind of distributions are available and how to use them
- How to input uncertainty in the seismic and flood loading
- How to identify major risk contributors
- How to identify sensitive parameters and perform sensitivity analyses of the risks
- What residual risk is and how to identify if it is significant



Knowledge and Skills

- How to recognize whether events or variables are truly independent, and if not, how to handle correlations
- When the risk analysis team is not an appropriate qualified group to make the estimates
- When to make separate risk estimates to account for uncertainty
- Bernoulli's equation for annualizing failure probability
 - $p_n = 1 - (1 - p)^n$
 - where p_n is the probability of occurrence in n years and p is the annual probability of occurrence
- How to combine risks
- How to present the risk results



Knowledge and Skills

- About overconfidence and anchoring biases
- About model uncertainty
- How to build the case for the risk numbers generated



Training and Mentoring

- Facilitation is a Learn-by-doing process
- Minimum requirements (not typical)
 - Attend 2 team risk assessments;
 - Attend 2 additional team risk assessments and write the reports (can be concurrent with previous requirement); and
 - Facilitate 2 additional team risk assessments while being monitored and assisted by a facilitator
- Typical facilitator
 - 20 years of dam engineering experience
 - 10 years of experience with risk analysis



Self-Help

- Read Reclamation's public protection or USACE tolerable risk guidelines
- Attend Best Practices Training and become familiar with Best Practices Manual.
- Participate in team risk analyses as a relevant technical expert.
- Participate as a Team Leader
- Participate as risk analysis Co-Facilitator (matched with experienced risk cadre facilitator).
- Participate in post mortem discussions of the risk analyses they attended or co-facilitated as well as those facilitated by others.
- Participate in 1 to 3 more risk analyses as Co-Facilitator in addition to the time outlined above.
- Demonstrate proficiency in basic methodology and probability concepts, joint probabilities, event tree development, load ranges and weighting, operation of Precision Tree and @Risk or DAMRAE, development of distributions, uncertainty and sensitivity analysis, combining risks, and risk identification.
- Show ability to build the case for the numbers generated.



Typical Agenda

- Introduction of team members and their responsibilities
- Review relevant background information and material
- Discuss, identify, and fully document potential failure modes
- Screen potential failure modes
- Develop event trees for “risk-driver” potential failure modes
- Develop or review loss of life estimates
- Develop event trees and branch input distributions
- Review risk analysis calculations and results
- Discuss presentation of the results, the conclusions reached, and the recommended actions
- Build the case for the risk estimates and the path forward
- Brief decision maker(s) on the results of the analysis
- Set future schedules



Responsibilities

- Final Report
 - Ensures that there is enough description that someone picking up the report 5 or 10 years in the future can understand what the team was thinking and why
 - Ensures that all team estimates have been properly transcribed into the report
 - Ensures that all math is checked and has been performed in accordance with sound risk analysis principles
 - Ensures that the results are adequately portrayed, and the case has been made as to why they make sense. (The facilitator is not typically the author of the report, but can be)

