FRM-PCX Webinar #6 – Incorporating Life Safety in FRM Planning Studies
August 8, 2019
Q&A Session

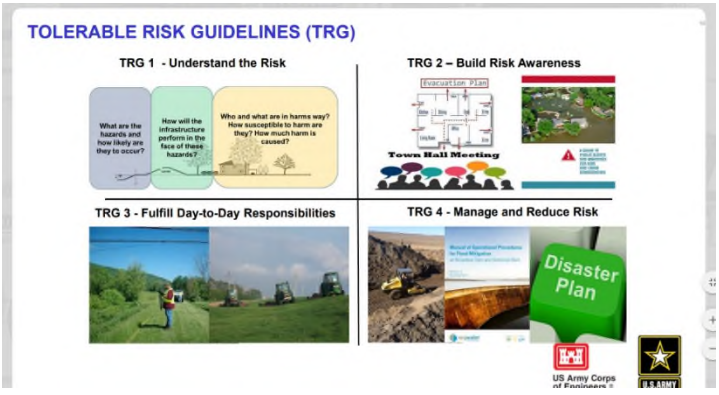
This webinar focused on best practices for incorporating life safety into Flood Risk Management (FRM) Planning studies, including discussion about the recently released Planning Bulleting 2019-04: Incorporating Life Safety into Flood and Coastal Storm Risk Management Studies. The webinar was presented by Kendall Zaborowski (Dam Safety Modification Mandatory Center of Expertise) and Nicholas Applegate (National Technical Specialist, Flood Risk Management Planning Center of Expertise), and addressed the following questions: Why is life safety becoming more important in FRM Planning? What do you need to know about Life Safety Risk? What are Tolerable Risk Guidelines and why are they important? What's the difference between Incremental Risk and Total Risk? What are some of the best practices I can use to incorporate Life Safety into my Planning study? What's the right level of detail and analysis for my study? This is the sixth in a series of webinars from the FRM Planning Center of Expertise (FRM-PCX) focused on helping PDTs with current and relevant challenges on their FRM Planning studies through tips, tools, and lessons learned.

This summary of the Question / Answer session of the webinar is not a transcription; questions and responses have been edited and reordered for clarity.

Risk Definitions and Communication

Is residual risk synonymous with non-breach risk?
No. Flood risk is the same as residual risk, which is the same as total risk – and these three terms also represent the combination of incremental and non-breach risk.

Please discuss further the meaning of the term "incremental risk" and the appropriate context for using it to evaluate alternatives relative to Tolerable Risk Guidelines (TRGs).
The term "incremental" in this context represents the risk we can attribute to the existence of the project in question (e.g., a levee or dam). In other words, the incremental risk represents the consequences of the project not performing as it was designed to. This is not to be confused with the concept of Cost Effective – Incremental Cost Analysis (CE/ICA), which is not used to determine incremental risk. CE/ICA is a necessary part of the NED evaluation focusing on total risk and not just incremental risk.



The Corps of Engineers has adopted TRGs to judge the appropriateness of actions to manage federal interest. TRGs apply ONLY to incremental risk.

It is important to remember that when teams are evaluating alternatives with respect to life safety, in most cases they should be comparing the without project flood risk to the with project flood risk. The incremental risk is one component of the overall flood risk. Teams should keep in mind the decision they are trying to make and the appropriateness of the level of detail needed to support the decision. The evaluation of incremental risk is scalable – incremental risk can be evaluated qualitatively, semi-quantitatively, and quantitatively.

The Risk Management Center offers a training course for anyone interested in learning more about the methodology for calculating incremental risk.

Can or should life loss estimates be made available in publicly accessible documents?
Regarding modeled data, teams should be cognizant of how life loss estimate information is communicated (i.e., be sure to clarify that an average statistical life loss is not the same as an actual individual life loss). As a best practice, reports should include ranges rather then single numbers. In addition, always be sure to review language regarding life loss with your vertical team. Your District Security Officer or Dam or Levee Safety Program Manager may be a good resource for discussing how this type of information should be presented to the public.

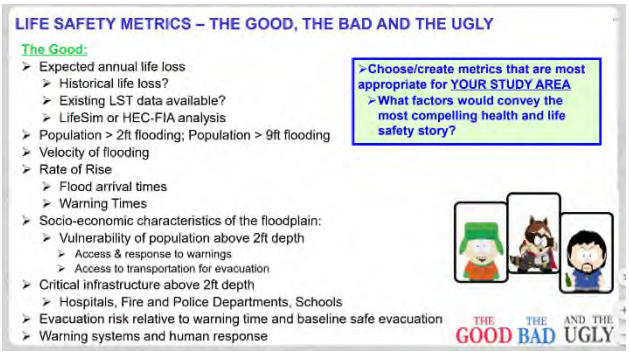
Application of Life Safety and Incremental Risk Considerations

Does incremental risk need to be considered for a Section 216 rehab study that does not propose any changes to a flood project, just restoration to authorized status?
Section 216 studies are feasibility studies and are subject to PB 2019-04. For more information, see Engineer Regulation (ER) 1105-2-100, Planning Guidance Notebook Paragraph 3-10.b and ER 1165-2-119, Modifications to Completed Projects. Any decision regarding incremental risk should be coordinated through your vertical team, but generally speaking in the case of a Section 216 study where there is a potential modification of existing conditions, it's a good idea to have a solid understanding of what the existing incremental risk of the project is and how that risk might change based on the proposed modification.

In your opinion, how do you think life safety analysis could or should be used for a back bay study?
PB 2019-04 applies to CSRM studies as well as FRM studies. If life safety is a concern for the study area and/or if the study has existing dams/levees or is proposing new dams/levees then a life safety assessment would be required. Many of the concepts discussed during this presentation will apply regardless of the type of flood risk management study, but specific applications should be discussed with the Coastal Storm Risk Management PCX.

Would "Traffic Count > 2 feet of flooding?" work as a life safety metric *(see slide 19 of presentation)?*
This would be a great metric, especially your study team has reason to believe based on past flood events (or existing/future condition expectations) that it's likely a significant number of people could be caught evacuating at this stage.

Does 2' depth refer to depth within the structure (above the first floor elevation) or depth above ground elevation *(see slide 19 of presentation)*?
The 2-foot flood depth in this case is the flood depth on your evacuation routes and paths of egress out of the floodplain. Once the depth reaches 2 feet, no one is likely to be able to drive on the roads and people will have to shelter in place instead. For those caught evacuating, the mortality rate rises substantially after 2 feet.



Are there any life safety risk considerations related to reduced water quality in flooded areas?
As of right now, the LifeSim modeling we do for statistical loss of life only addresses primary effects, and not secondary or tertiary effects that could lead to additional loss of life, including water quality. However, this type of effect could be discussed qualitatively in a report.

When formulating for nonstructural measures, are areas with vulnerable populations a logical grouping?
Grouping vulnerable populations is not necessarily a bad idea, but there are additional economic and environmental justice concerns that also need to be taken into consideration, particularly with measures such as buyouts.

Is there guidance on assessing incremental risk for existing non-federal (not federally authorized) levees? What about facilities that are not in the National Levee Database, and that lack good data on geotechnical conditions or documentation of construction/existing conditions?
USACE has outlined several different ways to assess incremental risk through potential failure mode analysis or rapid consequence analysis using Levee Screening Tool Information, any of which will be improved by good data. If good data isn't available, the study team has to make assumptions, which leads to additional uncertainty. Big picture, if a team thinks a non-federal levee without sufficient data will drive one of its alternative measures, then the team may need to shift resources toward data collection efforts. However, if this information isn't critical to decision making, then the team can probably move ahead with the existing data and document assumptions and uncertainties as needed. The key is to focus on what decisions are being made, and what data is needed to make those decisions.

Does Planning Bulletin 2019-04 apply to rehabilitation assistance for non-federal projects (PL 84-99) or Flood Plain Management Services projects?
No; the bulletin states that it applies to all FRM and Coastal Storm Risk Management (CSRM) feasibility studies, including those conducted under the Continuing Authorities Program and those conducted by non-federal sponsors under Section 203 (WRDA 1986).

Processes for Incorporating Life Safety into Feasibility Studies

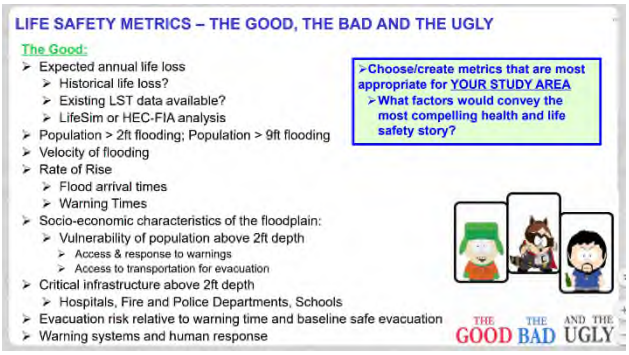
How are teams fitting in the cost and time necessary for life safety assessment prior to the Tentatively Selective Plan (TSP) within the 3 years/$3M study requirements?

There is no single answer to this question; it varies from study to study. It's especially important to utilize available data, especially leading up to the TSP, after which it might make sense to spend resources on additional detail going into the Agency Decision Milestone and final report. There are also rapid assessment tools available that cost relatively little (around $10K) and don't take up much time, which may provide an initial assessment to help you determine if you need to spend the time and money on additional data collection. The rapid assessment tools include worksheets to help guide teams through a Probable Failure Mode Analysis (PFMA), the use of RMC approved PFMA Facilitators, and the Mapping, Modeling, and Consequence Center of Expertise's (MMC) rapid consequence assessment tool. The MMC also has a myriad of experts with experience in doing life safety consequence assessments and we should lean on these folks to help us in feasibility studies where appropriate. Finally, if your study has a high life safety risk and the team anticipates recommending a plan based on life safety, a vertical team may decide that it's appropriate to spend more resources on quantitative life safety assessment as opposed to National Economic Development (NED) plan analysis during the feasibility phase.

Can you clarify the best project delivery team (PDT) member to dive into the life safety analysis early on in the planning process, as well as what methodology or tool should be used?

The PDT member who generally conducts the consequence assessment and runs life safety modeling is the economist, but this person will need inputs from the H&H and Geotech team members as well. The model used will depend on what level of detail is needed to make the next decision (i.e., rapid assessment for less detail, full blown LifeSim modeling for more detail).

Can we recommend projects based on life safety? If so, do we need a quantitative analysis? Are there any metrics (such as cost to save a statistical life) that such projects will be judged by (similar to benefit-cost ratios)? Or, can PDTs simply make a compelling qualitative case with information from the metrics list *(see slide 19 of presentation)*?



Moving forward, USACE looks to be incorporating life safety more and more into its decision making processes, and there may well be projects that end up being recommended based on life safety where there is not a NED plan. There are several flood risk management feasibility studies funded under the 2018 Emergency Supplemental that are heading in this direction, but they haven't gotten far enough to know if they'll seek the policy exemption to recommend a "non-NED" plan. The specific metric that will be used to recommend these projects – whether it's cost of a statistic life or some other metric – still remains to be seen, but regardless it will be important to teams to "tell the story" about life safety in both a quantitative and qualitative manner. It

could also be the case that more generic metrics are used during screening and then if it looks like justification will rely on life safety, then a more quantitative assessment could be made using LifeSim to help verify the previous evaluations and show changes to annual life loss (which is the best life safety metric for us to use if we can/need to develop it).

Typically, a life safety analysis for an existing levee or dam looks at the incremental risk between the breach and non-breach scenarios. How does the incremental analysis change when taking into account a new project? Are we looking at "non-breach without project" vs. "non-breach with project" risk, or are we building risk matrices for "without project" and a risk matrix "with project" risk and comparing them?

When looking at a new project in a planning study, the focus for evaluation of life loss should focus on the comparison of without project flood risk to the with project flood risk. The calculation of incremental risk would be included in the with project flood risk calculation for a new project. For new projects though these analyses are essentially the same. It's difficult to pinpoint the likelihood of failure because much of the project detail will come in the design phase, but the consequences will stay the same and can be used to measure the difference between incremental risk and non-breach risk. The type of risk being focused on at any given time (i.e., flood risk/total risk, incremental risk, non-breach risk) depends on the decision that need to be made.

In order to discuss incremental risk in our feasibility reports, wouldn't that presumably require E&C to assign a probability to the failure of the proposed project below the design event, which isn't typically done? Is this something we should expect we will need to provide in future feasibility studies for each proposed project?

Teams should be intentional and realistic about describing the possible ways in which the design of the project can fail. It's probably not realistic to assume zero likelihood of failure below the top of levee even for a new project as there are some things out of our control (i.e. rodent holes, etc.). It's also important to look at overtopping breach risk. Many times, teams will assume that levees breach once overtopped in the economic and residual risk assessment, but teams need to look at designed overtopping features that decrease overtopping breach risk as a way to decrease incremental risk.

It all comes back to the decision needing to be made – if your study requires a semi-quantitative or quantitative risk assessment, then your team should involve E&C or Dam and Levee Safety personnel in your District to help estimate the probabilities of the potential failure modes associated with the proposed project and how you can mitigate those risks to make them tolerable.