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Comment On: NRC-2021-0089-0001
Integrated Human Event Analysis System for Event and Condition Assessment Method and Software Tool

Document: NRC-2021-0089-DRAFT-0003
Comment on FR Doc # 2021-07214

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General Comment

See attached files. Submitted on behalf of PWR Owners Group Chairman and COO, Michael Powell.

Attachments

OG-21-148

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Project 694
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July 30th, 2021

OG-21-148

Yung Hsien James Chang
Office of Nuclear Regulatory Research, U.S.
Nuclear Regulatory Commission
Washington, DC 20555–0001

Subject: PWR Owners Group, Risk Management Committee
PWR Owners Group Comments on [NRC–2021–0089], "Integrated Human Event Analysis System for Event and Condition Assessment Method and Software Tool"

Reference: Federal Register Number 2021-07214, Document ID NRC-2021-0089-0001

The U.S. Nuclear Regulatory Commission (NRC) has requested comments on its Integrated Human Event Analysis System for Event and Condition Assessment (IDHEAS-ECA) method and software tool for human reliability analysis applications.

The purpose of this letter is to provide PWR Owners Group comments (Enclosure 1).

If you have any questions, please do not hesitate to contact me at (602) 999-2080 or Mr. W. Anthony Nowinowski, Executive Director of the PWR Owners Group, Program Management Office at (412) 374-6855.

Sincerely yours,

Michael Powell
Chairman and COO
PWR Owners Group

DSM:am

- Enclosure 1: Documentation of Comments Pertaining to IDHEAS-ECA," (Westinghouse Non-Proprietary)

cc: PWROG PMO
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To: File Date: July 30, 2021

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Our ref: POG-RAGN-TM-RX-000001

Subject: **Documentation of Comments Pertaining to IDHEAS-ECA**

The purpose of this letter is to transmit the PWROG comments pertaining to the review of Regulatory Information Letter RIL-2020-02, "Integrated Human Event Analysis System for Event and Condition Assessment (IDHEAS-ECA.)" as funded by PA-RMSC-1763.

The following comments apply to draft for public comment of RIL-2020-02*, Integrated Human Event Analysis System for Event and Condition Assessment (IDHEAS-ECA.)*

1. Section 1.1 states: "The method is intended to be used in event and condition assessment (ECA) of nuclear power plants (NPPs) and it is referred to as IDHEAS-ECA." However, section 1.2 states: "IDHEAS-ECA can be used in PRA applications, such as the review of risk-informed license amendment requests, and evaluations of Notices of Enforcement Discretion, operational events (e.g., Management Directive 8.3, "NRC Incident Investigation Program," and Accident Sequence Precursor Program), and inspection findings (i.e., the Significance Determination Process)." Finally, section 4.4 states: "IDHEAS-ECA is envisioned to be used by the staff involved in the NRC's PRA applications. The intent is for the method to be applicable to the same situations that existing HRA methods model…" The differences between these statements should be resolved. How will IDHEAS-ECA actually be used?

2. Regulatory decision making, for example review of a risk-informed license amendment, frequently considers PRA studies submitted by licensees. If a licensee submits a PRA study using current state-of-practice HRA methods rather than IDHEAS-ECA, how will the staff evaluate the HRA aspects of a licensee submittal?

3. Will IDHEAS-ECA completely replace the Standardized Plant Analysis Risk-HRA (SPAR-H) method? If not completely, please discuss when each method will be used.

4. Section 1.3 states: "The intended users of IDHEAS-ECA are U.S. Nuclear Regulatory Commission (NRC) staff involved in PRA applications." Licensees typically use other existing

state-of-practice tools and methods that are likely to yield different human error probabilities (HEPs). What is the process for evaluating these differences? Will it be assumed that IDHEAS-ECA always yields the "correct" result when compared to other state-of-practice methods? Will the process for evaluating differences be the same for all applications and/or situations?

5. Section 3.1.2 states: "Typically, pre-initiator and initiator HFEs are not explicitly modeled in PRA…" Pre-initiators typically are modeled as required to meet the PRA Standard, and human failures are screened from component reliability events. It appears that IDHEAS-ECA is not structured for assessment of pre-initiator HFEs. If so, what process will the NRC use in their assessment of pre-initiators?

6. It would be helpful to define the term "team" in the context of interteam coordination. For example, several discussions imply that an operating crew is a team. Would operators in the control room and operators in the field be considered a single team?

7. Section 3.6 discusses the types of distributions that can be selected for $Treqd$ and $Tavail$. However, the discussion may not be sufficiently practical to guide the analyst for a specific condition. For example: "Gamma distribution is a two-parameter family of continuous probability distributions. The two parameters specify the shape and scale of a distribution. It is widely used to model continuous variables that are always positive and have skewed distributions." This describes the gamma distribution but provides little guidance on when to select it. The choice of distribution can affect the HEP. Please provide additional guidance here.

8. Table 3-5 is entitled "Uncertainty Factors that Modify the Distribution of $Treqd$." It includes a list of uncertainty factors and considerations associated with those factors. However, the discussion is qualitative and there is no guidance on the quantitative impact of the uncertainty factors.

9. Section 3.8 addresses uncertainties and sensitivity analysis.
    - Item 2 directs the analyst to "develop uncertainty distributions for the significant HEPs." There is no guidance for selecting the type of distribution or the quantitative parameters (standard deviation, etc.) In many cases insufficient data are available to derive the parameters. Please provide additional guidance here.
    - Item 3 directs the analyst to "perform sensitivity analyses that demonstrate the effects … for extreme estimates in the HEPs." The example cited compares a situation with a less experienced crew versus a more experienced crew. This example can be evaluated subjectively, but how can the differences between the two crews be expressed quantitatively so a quantitative distribution of HEPs is calculated?

10. Section 4.3 acknowledges that the IDHEAS-ECA method does not include HFE dependency analysis and "this is an area to be resolved in near future." Given that the dependency analysis can have a major impact on calculated core damage frequency and large early release frequency, how will IDHEAS-ECA be used for regulatory decision making before a

dependency analysis process is created?

11. The worksheets in Appendix A break a human failure event (HFE) into multiple critical tasks. The cognitive failure modes (CFMs) are then identified for each critical task. The cognitive failure modes are:

    CFM1 – Failure of Detection

    CFM2 – Failure of Understanding

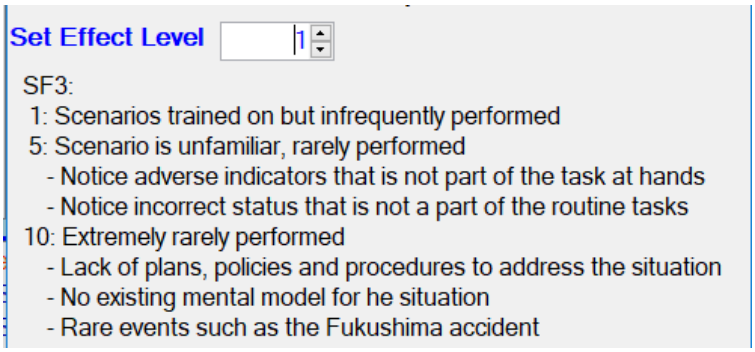
    CFM3 – Failure of Decision-making

    CFM4 – Failure of Action execution

    CFM5 – Failure of Interteam coordination

    It seems there is potential for double-counting if all applicable CFMs are attributed to each critical task. For example, low steam generator level is a cue to depressurize with a PORV (critical action 1) and feed a steam generator with the FLEX pump (critical action 2.) Failure of Detection – in this case, failure to detect low steam generator level – is the same for both critical actions. Should this failure of detection only be attributed to the first critical action to avoid double-counting?

12. Some of the PIF attributes have Effect Levels. The value selected can have a major impact upon the HEP, but the guidance for selecting a value is ambiguous. For example, in SF3 shown below is there a basis for selecting values between 1 and 5, or between 5 and 10? What is the meaning of “adverse indicators that is not part of the task at hands?” Would FLEX HFEs always be a 10 since FLEX was created for events like Fukushima, regardless of whether training and procedures exist?



13. The worksheets in Appendix A are not a one-for-one match with the worksheets in the Appendix C examples. For example, see Section C.2 of Worksheet C.

14. In Appendix B, it is often difficult to discriminate between identifiers. This can be important because the base HEPs and weighting factors are different. For example:

- Table B-1 has different base HEPs for SF0 “Unpredictable dynamics in known scenarios” and SF1 “Unfamiliar elements in the scenario.” How does one distinguish between those two identifiers?
- Table B-1 has different base HEPs for SF3 “Scenario is unfamiliar, rarely informed” and “Extremely rarely performed.” How does one distinguish between those two identifiers?
- Table B-2, Inf1 has a base U HEP of 5E-3 for “Information is temporarily incomplete or not readily available.” Inf2 has a base U HEP of E-2 for “Personnel is aware that source of information could be temporarally [sic] unreliable.” Why is the HEP larger if personnel are aware of an information problem?
- Table B-2, Inf2 includes PIF Attributes “Highly unreliable” and “Extremely unreliable.” How does one distinguish between the two Attributes?
- In Table B-13, what is the difference between MT1 “Distraction by other on-going activities that demand attention,” MT2 “Interruption taking away from the main task,” and MT3 “Concurrent visual detection and other tasks?”

15. Appendix B uses terminology that may not be well understood. For example, the PIF Attribute for Table B-3, C12 states: “Relational complexity (Number of unchunkable topics or relations in one understanding task.)” What is an “unchunkable topic”?

16. Table B-3, C30 has a base HEP of 0 for PIF Attribute “No impact - Simple execution with a few steps.” However, C36 has a base HEP of 5E-3 for “No immediacy to initiate execution - time span between annunciation (decision for execution made) and operation.” Why is the HEP larger if there is no immediacy to initiate execution?

17. Table B-3, C42 has a base HEP of E-2 for both “Complex or ambiguous command-and-control” and for “Coordinate activities of multiple diverse teams or organizations.” The latter case could be well organized and managed, which seems a better situation than complex or ambiguous. Should these have different HEPs?

18. Table B-4 defines moderate coldness as <5°C. However, the term extreme coldness is not defined. Please define the term “extreme coldness.”

19. Table B-7 has PIF weights for equipment and tools. Why would equipment and tools be involved with detection?

20. Table B-10, TE1 has a gap between Infrequent training of 6-12m, and Highly infrequent training of >4 years. This gap is particularly meaningful since a common training interval is two years. Please provide guidance for the 1-4 year training frequency.

21. The PIF Attribute for Table B-10, TE13 is ambiguous: “Poor training on the importance of data in frequently checking data for execution.” Please provide additional clarification of this PIF Attribute.

22. The PIF Attribute for Table B-12, WP6 is ambiguous: “Lack of or ineffective instrumentation for safety reporting.” What is meant by safety reporting in this context?

23. Table B-14 is entitled “PIF Weights for Mental Fatigue and Time Pressure and Stress.” Why does this table include MF4, “Reluctance to execute an action plan due to potential negative impacts (e.g., adverse economic impact, or personal injury)?”

24. Worksheet C for Critical task HFE1-T1, Section C.1, Action execution states: “The communication between the MCR crew and onsite operator (interteam coordination) has little impact on the HFE success.” This illustrates the need to define team and interteam coordination. Why would the MCR crew and onsite operator not be a single team?

25. The executive summary (and concluding remarks) states that “*IDHEAS-ECA improves existing HRA methods by (1) providing a systematic process and guidelines to analyze and model human actions and the associated scenario context…*”. It is unclear exactly what the improvement is here for item (1). Does this statement imply that NRC believes existing state-of-practice HRA methods do not use a systematic process with appropriate guidelines?

26. Why are “Training” and “Scenario Familiarity” treated as 2 distinct PIFs? There would seem to be a lot of overlap here so there may be some double counting.

27. The Performance Influencing Factors are described as having no impact on the HFE when they are ideal, and having a negative impact on the HFE when they are not ideal. If these factors are “influencing” the scenario, why is there no consideration of ideal PIFs having a positive impact on the HFE rather than just no impact? For example, if procedures are written in a confusing way this is considered to result in an increased chance of human error. By this logic, it would then seem that if the procedures are written in a very concise and straightforward way that this would result in a decreased change of human error. This treatment of only negative to neutral would seem to increase conservatism and result in less realistic analysis. It is recognized the Item 3 on page 3-19 states that in some cases the “positive PIF” that are treated as neutral for calculation purposes “may alleviate some PIF attributes,” but this does not appear to be an effective means of evaluation as the most impact it can possibly have would be to make other PIF attributes neutral as well.

    On a related note, bullet 2 on Page 3-20 says that “PIFs model the context that can increase or decrease the likelihood of human errors”. While one may agree with the sentiment of this statement, it may not be accurate with respect to this methodology. As noted above, positive PIFs are only given a neutral impact and never a positive impact in the analysis so the statement appears to be misleading with respect to treatment in this methodology.

28. Page 3-19 (Item 2) says that if specific PIFs do not contribute “significantly” to the CFM they may be eliminated. This guidance would seem to allow for considerable variability so it may be helpful to define what is considered “significant”.

29. Page 3-23 states that IDHEAS-ECA does not provide reference values for the recovery factors because they are “situation specific”. Is there guidance elsewhere to help the analyst assign a recovery factor if the values themselves are not provided? This would seem to lead to considerable variability based on specific analyst bias.

30. Section 4.1 states that one of the objectives of the IDHEAS-ECA method is that it "should be easy to use and should not over-burden HRA analysts". A review of the methodology indicates that this method is likely considerably more complex than existing methods and there are still many unrefined aspects (e.g., uncertainty, recovery and HRA dependency analysis). Perhaps there should be reconsideration of some aspects of the methodology to reduce complexity/burden. This may be especially important following the development of an HRA dependency analysis. Current state-of-practice industry HRA dependency analysis methods heavily influence the HEPs, often to the point where the independent HFE is completely overridden by the dependency analysis and the independent HEP value is of little consequence. Should this prove to be the case with IDHEAS-ECA, there should be consideration of greatly simplifying the method to derive the independent HEPs to meet the stated objective.

31. Has there been any consideration of common cognitive failures or will this be addressed with the HRA dependency analysis in a future update?

32. Table 2-4 discusses "work-related experience" and "the amount of time passed since training" as considerations for personnel-related factors. How exactly are these accounted for? This would seem to require constant update as these aspects would constantly be changing.

33. The following comments are for Appendix C, Example 3: Human actions of implementing FLEX strategies in a beyond-design-basis event.

    - The applicability of the worksheets is confusing. The event title in Worksheet A is "Deploy FLEX generator in an extended loss of AC power (ELAP) event." However, worksheet B has two HFEs: "Fail to declare ELAP within one hour," and "Fail to implement the FLEX generator."
    - Section A.4 lists some PIFs that are not applicable, and some that should be evaluated further. However, the combined lists do not address all the PIFs in Table 2-1.
    - Section C.3 states: "Assessment of PIFs is performed only for the PIFs relevant to the event as determined in Worksheet A Section A.4." The assessed PIFs are Task complexity, Training, Teamwork and organizational factors, Procedures, guidance, and instructions. However, Section A.4 states: "The following PIFs may impact personnel performance of specific tasks thus they should be further analyzed: Environmental factors, Scenario familiarity, Information availability and reliability, Task complexity, Procedures, Multitasking/interruption/distraction, Stress and time pressure." Please address this discrepancy.

34. The following comments are for the IDHEAS-ECA software.

    - For FLEX activities, Time Required and Time Available typically come from the validated FLEX timeline. Sufficient data are generally unavailable to determine the distribution type or the 95% value. The selections can have a significant impact upon the human error probability. Guidance should be provided for how to populate these Pt(HFE) fields when used for FLEX.

- As mentioned in the documentation, additional guidance is needed on when and how to select a recovery value. It would currently be difficult to translate a qualitative recovery basis into a revised human error probability.
- For the Pt(HFE) panel, is would be helpful to have a narrative field so the bases for the times could be documented. For example, do the times include the times until the cue or just the times after the cue?
- If there are only two critical actions, is there a way to delete the tab for a third action? Similarly, is there a way to add critical actions if there are more than three?
- The Critical Task 1 tab has a typo: “Criticak.” There are other typos in the document as well.
- With certain screen resolutions it was not possible to access the bottom of the critical task panel because it dropped off the bottom of the screen and there was no scroll bar.