



Improving Realism Through the Use of Conditional Probabilities for Plant Trip due to Operator Discretion

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Potential Realism Improvement

- A plant trip is associated with less than 14% of the approximately 400 fires in the FEDB on which the ignition frequencies are based, but some kind of plant trip is the initiating event for every fire scenario.
- Assuming a fire-induced plant trip (i.e., automatic, manual or LCO forced trip), when one is neither required nor likely, tends both to inflate the total risk and to skew the relative risk contributions.
- Soliciting operator input on Conditional Trip Probabilities (CTPs) due to operator discretion can reduce uncertainty and improve realism.



Megawatts



Core Damage

Relevant Guidance

Section 2.5.3 of NUREG/CR-6850 states that a Fire Compartment need not have an initiating event assigned to it when a review of associated equipment (that could be affected by a fire) concludes that a plant trip (i.e., an automatic, administratively required manual, or LCO forced trip) could not occur.

Both pilot plants incorporated some treatment of CTPs with the process becoming more structured and better documented as it was extended to other plants in the fleet.

(NFPA 805 Safety Evaluation, ML101750604; PRA RAI 1C, ML13205A016; PRA RAI 21, ML15079A025)

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Proposed Approach to Enhance Realism

Input From Component Selection (Task 2)

Step 2.5.3 identifies Fire Compartments containing equipment whose failure would:

- 1) Cause an automatic trip;
- 2) Cause a procedure-driven manual trip; or
- 3) Invoke an LCO requiring a shutdown.

Input From Cable Selection (Task 3)

Step 3.5.6 compiles the FPRA Cable List

Input From Qualitative Screening (Task 4)

Step 4.5 screens Fire Compartments having no:

- 1) FPRA equipment (and associated circuits)
- 2) Equipment causing a plant trip

Step 1: For Fire Compartments retained from Task 2, Set Conditional Trip Probability to 1.0

Step 2: For remaining Fire Compartments, interview Operators on probable response to fire

- Consider fire effect on equipment and cables
- Bin Trip Likelihood: Likely, Not Likely, Very Not Likely
- Document a Basis for the Binning

Step 3: Assign Conditional Trip Probability

- Likely=1.0, Not Likely=0.1, and Very Not Likely=0.01

Uncertainty:

- Binning of Fire Compartment
- Magnitude of Conditional Trip Probabilities

Output To Fire Risk Quantification (Task 14)

Use the Conditional Trip Probabilities to adjust the fire scenario frequencies to obtain:

- 1) Final Fire CDF in Step 14.5.1.2
- 2) Final Fire LERF in Step 14.5.2.2

Anticipated Realism Improvements

- Expect typical risk improvements of about 10%.
- Usually only a few Fire Compartments are affected.
 - Fires related to Diesel Generators represent a typical improvement
- For those few Fire Compartments, the risk impact can be more significant.
- Better alignment between the model and Operator expectations increases overall confidence in the risk results of the Fire PRA.

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Questions???

