



ELECTRIC POWER
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Feasibility of a 'Unique Prompting Alarm' in Response to a Digital CCF

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Feasibility of a 'Unique Prompting Alarm' in Response to a Digital CCF

- Outline
 - Ground rules for crediting operator actions in application of PRA to digital I&C issues in support of PRA TWG activities
 - Characteristics of a 'unique prompting alarm'
 - Operator Action Event Trees
 - LOCA example
 - General Transient example
 - Preliminary results

Digital I&C PRA TWG Evaluations (Industry Initiated)

Ground Rules for Crediting Operator Actions

- Use EOPs for existing plants
 - BWR: Symptom oriented flow charts
 - PWR: Event oriented (optimal recovery) or symptom oriented (functional recovery)

Symptom oriented if the entry conditions for the functional recovery guidelines are met, e.g.,

- Reactor trip and diagnosis of a specific event is not immediately apparent
- Conditions/symptoms for which a licensed operator considers serious and other Emergency/Off Normal procedures can not be identified
- Actions for an in-use event oriented procedure do not result in meeting acceptance criteria for safety-function status check sheets
- Event oriented procedure directs use of functional recovery guideline.

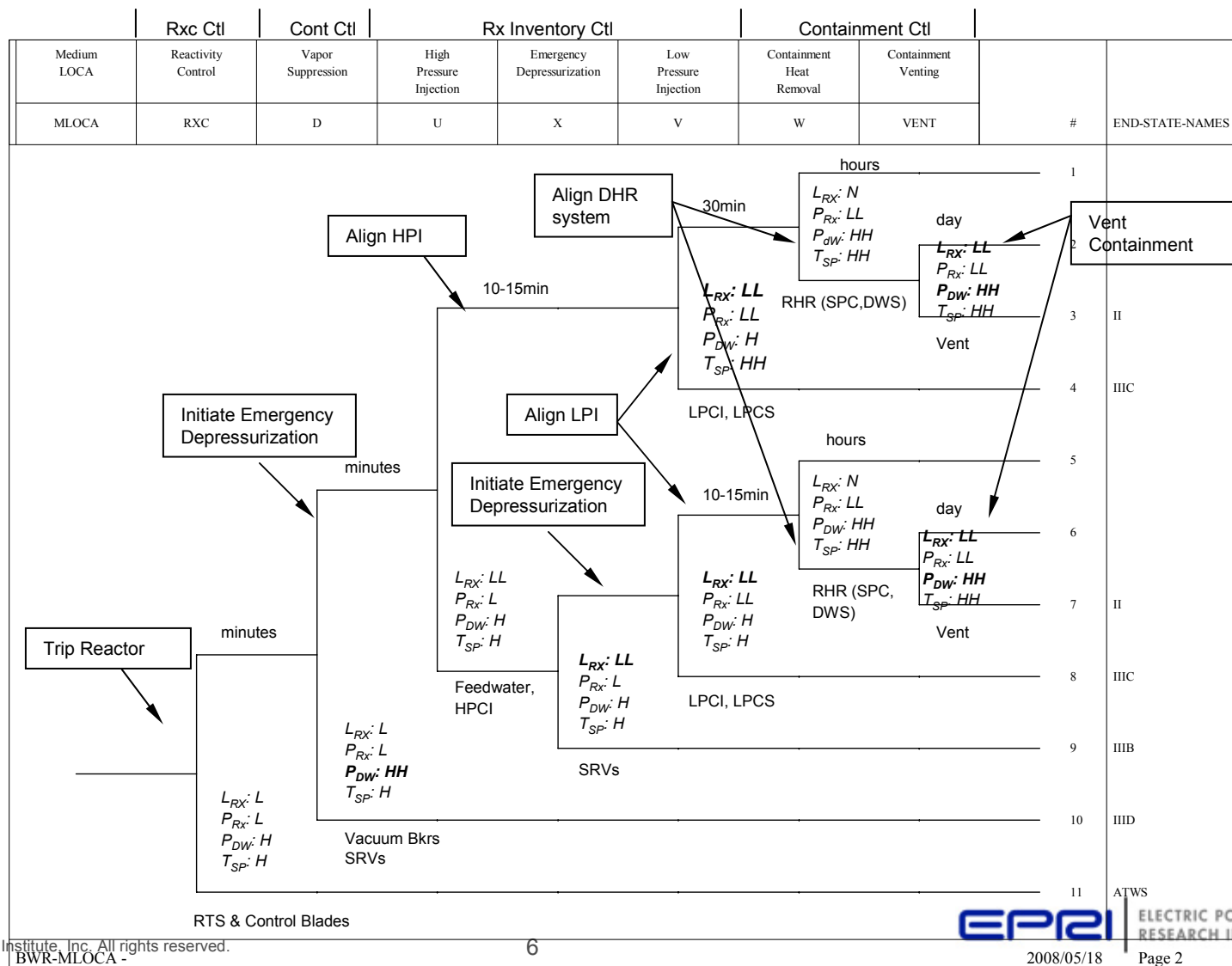
Characteristics of a 'Unique Prompting Alarm' when Credited in PRA Evaluations

- The alarm is based on plant conditions (it does not require monitoring the status of I&C systems to trigger the alarm).
- It is not necessary for the operators to diagnose the nature of the CCF, or that there is even a CCF, only that plant conditions are such that specific actions should be taken.
- The actions are appropriate regardless of whether the causes of the plant conditions are a result of an I&C CCF, hardware CCF or due to random causes not associated with a CCF.
- On spurious actuation of the alarm, if the specified operator actions would result in a significant safety concern, then additional symptoms are considered before prompting those actions.

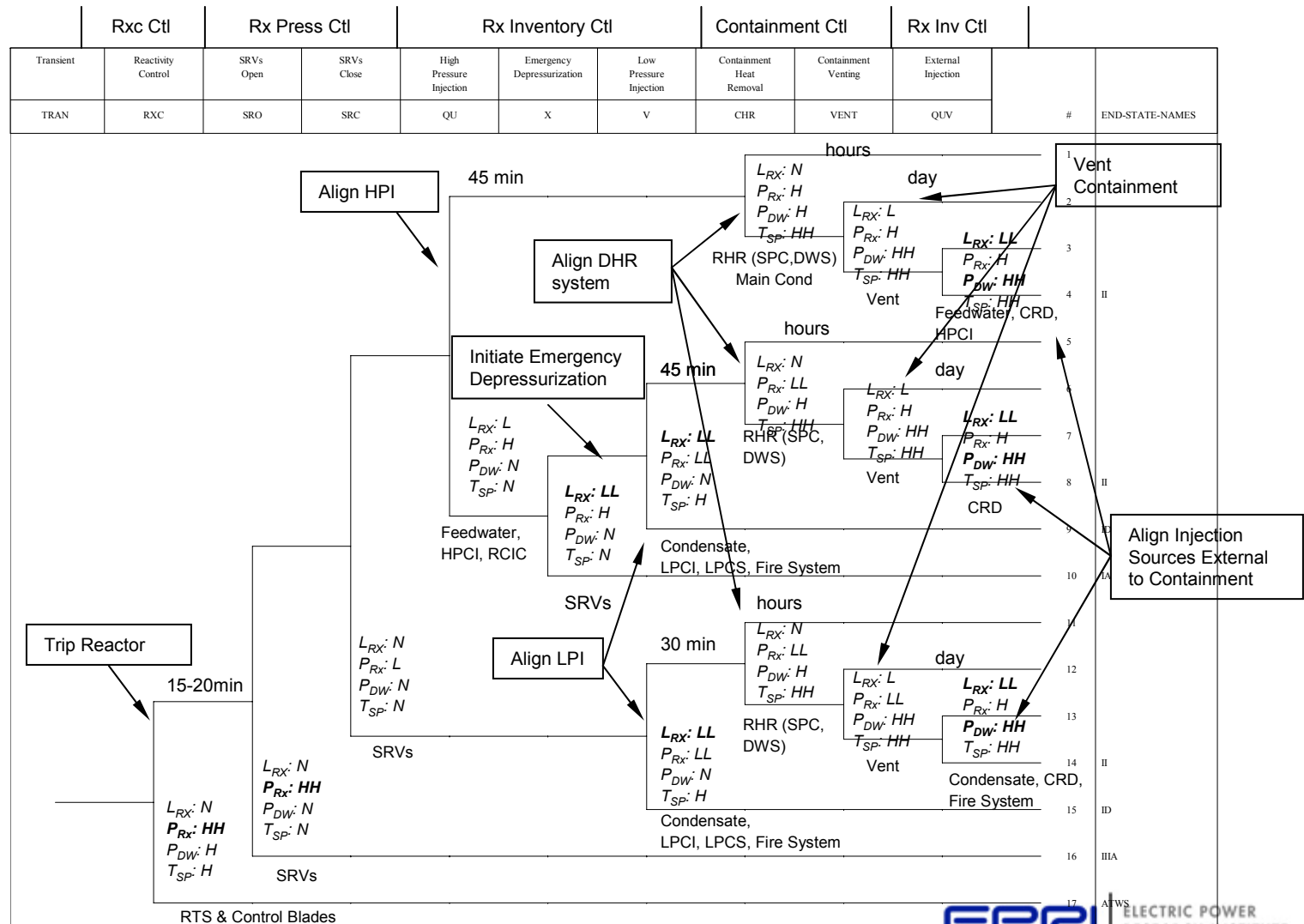
Operator Action Event Trees (OAET)

- The purpose of Operator Action Event Trees is to systematically determine at any point in any accident sequence (Logic model development)
 - The plant conditions at that point in the accident sequence (Deterministic analysis)
 - The actions that the operators can (or must) take in response to those conditions
 - The operator informational needs necessary and sufficient to determine, unambiguously, that those plant conditions exist
 - The operator informational needs necessary and sufficient to take the required actions at that point in the accident sequence
- Reference: NUREG/CR-1440, “Light Water Reactor Status Monitoring During Accident Conditions”.

BWR Operator Action Event Tree (Medium LOCA) Symptoms Leading to Core Damage



BWR Operator Action Event Tree (Transient) Symptoms Leading to Core Damage



Preliminary Results

Unique Prompting Alarm

- Based on the BWR Transient and LOCA operator action event trees reviewed thus far, a unique prompting alarm might have the following symptoms
 - Low Low reactor level (near MSIV closure setpoint), or
 - High High reactor pressure (above SRV setpoint)
combined with
 - Reactor not at power (low flux or control rods inserted)
- The appropriate operator response appears to be
 - Confirm normal HSI is consistent with alarm and backup instrumentation
or
 - Emergency depressurization
 - Initiate one or more injection systems
- Note that
 - The symptoms for the unique prompting alarm are similar to the plant conditions which initiate RPT and ARI
 - The proposed operator response is similar to the existing BWR EOP for RPV Flooding