Enclosure 2

Handouts discussed during the April 2, 2014 ROP WG Public Meeting

NEI 99-02 White Paper

"Initial Transient"

Two of the questions in NEI 99-02 used to determine if a BWR reactor trip was an Unplanned Scram with Complications include the undefined term "initial transient"; "Was pressure control unable to be established following initial transient?" and "Following initial transient did stabilization of reactor pressure/level and drywell pressure meet the entry conditions for EOPs?" The failure to define the term has resulted in confusion, with some licensees interpreting "initial transient" to be equivalent to "scram response".

The following definition is proposed to be added to NEI 99-02:

> *Initial Transient* is intended to envelope the immediate, expected changes to reactor parameters, such as pressure and level, which normally accompany BWR scrams due to the collapsing of voids in the core and the routine response of the main feedwater and turbine control systems. For example, at some BWRs the reflected pressure wave resulting from the rapid closure of turbine valves during a turbine trip may result in a pressure spike in the reactor vessel that causes one or more safety-relief valves (SRVs) to briefly lift. The intent is to allow a licensee to exclude the momentary operation of SRVs when answering "Was pressure control unable to be established?" The sustained or repeated operation of SRVs in response to turbine control bypass valve failures or Main Steam Isolation Valve (Group I) isolations are NOT a part of routine BWR scram responses and are therefore NOT considered to occur within the initial transient. Similarly, a reactor level decrease to Level 3 following a reactor trip due to the expected collapsing of voids in the core can be excluded when answering the question "Following initial transient, did stabilization of reactor pressure/level and drywell pressure meet the entry conditions for EOPs?" as long as the feedwater control system and at least one feedwater pump were operating as designed. "Initial transient" is different from "scram response", which bounds the time during which the performance indicator is active. The initial transient is a subset of the overall scram response time.

Exclusion of Low Risk Trains/Segments From Unavailability Monitoring

MSPI monitors URI and UAI for a rolling period of three years. NEI 99-02 section F 2.3.5 discusses Birnbaum importance as it relates the exclusion of some valves and circuit breakers from the requirement to monitor those components for failures. For

$$B = CDF*[FV/UR]max$$

If the Birnbaum importance (B) of a component (adjusted for Common Cause failure and Initiating Event frequency) is less than 1.0E-06, it may be excluded from the requirement to monitor for failures.

Currently, in NEI 99-02, there is no similar exclusion for monitoring the unavailability of trains or segments that have a low Birnbaum importance. In a three year period, there are 26,280 hours. Throughout the industry, it is not unusual to see trains or segments that can incur tens, if not hundreds of thousands of unavailability hours and remain Green. This means that they could be unavailable over the entire monitoring period and not make the indicator go white. Similar to monitored components, one can calculate the Birnbaum importance of individual trains or segments:

$$B = CDF*[FV_{UAP}/UAP]max$$

Where FV_{UAP} is a Basic Event in the PRA model and UAP is the Basic Event probability adjusted for Initiating Event frequency, if applicable.

The following was calculated from a plant's data. The plant name and names of the segments have been changed:

Plant X Cooling Water Unavailability							
Segment	$Segment_A$	$Segment_B$	$Segment_C$	Loop B	Loop A	Train B	Train A
CDF	1.07E-05	1.07E-05	1.07E-05	1.07E-05	1.07E-05	1.07E-05	1.07E-05
FV_{UAP}	2.13E-03	9.54E-04	1.42E-03	3.62E-03	2.61E-03	1.98E-02	1.69E-02
UAP	1.18E-02	1.07E-02	1.18E-02	7.32E-04	7.32E-04	2.59E-03	2.59E-03
Birnbaum	1.93E-06	9.54E-07	1.29E-06	5.29E-05	3.82E-05	8.18E-05	6.98E-05
Hours to White	14,240	29,120	21,360	519	720	355	407

The hours to White in this table came from the plant's MSPI Margin report. This indicates that the hours to remain Green reaches the three year total of 26,280 when the Birnbaum importance is approximately 1E-06. Since the impact of the train or segment unavailability is added to other trains and URI to calculate MSPI, the impact of a train with a Birnbaum of 1E-06 can't be ignored. Industry recommends that any train or segment that has a Birnbaum of < 1E-07 be excluded from the requirement to monitor for unavailability.

Proposal for use of Licensee PRA Models in the Significance Determination Process

Objective:

Initiate dialogue between NRC and industry on growing delta between site detailed PRAs and NRC SPAR Models and how they are used in the regulatory process.

Background:

Since the development of initial risk reviews by licensees in support of IPE and IPEEE, the sophistication of site-specific Probabilistic Risk Analyses has grown. There have been significant advancements in calculational methods and much greater detail in the modeling of the as-built, as-operated plant. NRC's standards for acceptability in using the plant-specific PRA's have also evolved, with most plants having assessed their models in accordance with RG 1.200, rev 2.

By contrast, the NRC SPAR model was developed as a basic tool to generate order of magnitude estimates of Core Damage Frequency (CDF), based on generic plant design. It was introduced into the ROP as a tool for assessing performance deficiencies to determine the contribution to risk (change in CDF). Though the SPAR models have also been improved, in general, they do not contain plant specific details and are still standardized (e.g., use of generic success criteria, data and exclude significant crosstie capability), yet they continue to be used as an authoritative tool for assessing risk significance.

Consequently, the difference between risk reviews performed using the SPAR model regularly diverge from those performed using the site-specific PRA, resulting in significant efforts expended by licensees to understand the differences and driving additional ad hoc changes to SPAR models to account for those existing inaccuracies. These efforts present a distraction from the intent of ROP and result in expenditure of unnecessary hours of NRC and licensee staff hours.

Site specific PRAs undergo significant internal reviews and a rigorous peer review process. Additionally, these analyses are used in the regulatory process and reviewed by NRC for risk-informed licensing actions, further adding to their credibility.

Discussion Points

- SPAR models were created several decades ago to provide a big picture perspective. Since then plant specific models have been created that are up to date and used for all plant risk informed applications
    - Modeling of human actions is conservative.
        - NRC SPAR-H is not as robust a HRA tool and results in some cliff effects.
        - Human action dependency floor value is used as an absolute value, rather than a screening value for additional review/analysis. This can lead to overly conservative results.
    - Generic nature has resulted in numerous differences that must be discovered and identified individually, typically only during SDP evaluations.
    - SPAR models are only updated every few years.
    - SPAR models are based on generic data.
    - SPAR Fire and internal flooding PRAs are bounding and very conservative.
- Plant specific PRA models have been assessed against RG 1.200.
    - Plant models are continually evaluated following plant changes to determine if the models need to be revised.
    - Plant models have plant-specific data.
    - Licensees' either have or are developing detailed Fire PRA models.
    - Licensees' typically have detailed internal flooding PRAs.
    - Site specific PRAs are the basis for MSPI and other risk-informed regulatory applications.
- Benefits of using the plant specific PRA models include:
    - Makes use of the best information available
    - Get closer to the "true" risk significance of the finding
    - Potential to reduce the amount of time to resolve the SDP and reduce the number of regulatory conferences

Recommendation:

Given that the NRC SPAR models are not as realistic as licensee models, industry recommends that the SPAR results be used as a confirmatory tool for licensee results from plant-specific PRAs in regulatory actions. A draft process for using Licensees' PRA models in the SDP process is provided below:

1. The licensee and NRC staff should benchmark the licensee and SPAR models whenever there is a revision to either model. This activity should be completed outside of an actual SPD evaluation. Benchmarking should consider:
    a. Baseline Average CDF and LERF values,
    b. Top 100 CDF and LERF cutsets,
    c. Importance Measures (RAW and F-V).
2. Significant differences should be investigated to determine the reason for the differences. Examples could be:
    a. Success Criteria,
    b. Data,
    c. Human Reliability Modeling,
    d. Modeling of Recovery Actions.
3. Significant differences in assumptions/modeling should be documented and treated as sources of uncertainty in future SDPs.
4. Prior to starting an SDP, the NRC and Licensee should agree to the boundary conditions and assumptions needed to model the impact of the finding
5. The same process (see Recommendation above) should be used to validate the SDP results as is used for the base model.
6. Need to have open communication between the SRA and utility PRA personnel