

August 8, 2002

LICENSEE: Nuclear Management Company, LLC (NMC)
FACILITY: Palisades Nuclear Plant (PNP)
SUBJECT: SUMMARY OF JULY 16-18, 2002, PUBLIC MEETING WITH NMC STAFF REGARDING INPUTS FOR USE IN THE PRESSURIZED THERMAL SHOCK (PTS) RISK ANALYSIS OF PNP (TAC NO. MB5392)

Background:

The Nuclear Regulatory Commission (NRC) staff and its contractors, with the active cooperation and participation of the nuclear industry, are currently conducting a reanalysis of the risk due to PTS at U.S. pressurized-water reactors (PWRs). The results will be used as part of the bases for a subsequent reevaluation (and possible change) of the PTS rule, 10 CFR 50.61. PNP is one of the four PWRs that has volunteered to participate in this effort.

At two of the four plants (Oconee and Beaver Valley), the NRC staff and its contractors are currently in the process of performing all portions of the reanalyses based, in part, on information obtained from those plants (i.e., they are performing the Probabilistic Risk Analysis (PRA), Human Reliability Analysis (HRA), Thermal Hydraulic (TH), and Probabilistic Fracture Mechanics (PFM) portions of those analyses).

At the other two plants (Palisades and Calvert Cliffs), the PRA/HRA portions of the analyses will be performed by the respective licensees and reviewed by the NRC staff and its contractors (the review will be based, in part, on information obtained from the licensees for those plants). After modification (if necessary) by the licensees and/or the NRC staff and its contractors, the PRA/HRA will be used, along with TH and PFM analyses performed by the NRC and its contractors, to determine the risk due to PTS at those plants.

Discussion:

On July 16-18, 2002, the NRC Office of Nuclear Regulatory Research (RES) staff and their contractors (Sandia National Laboratory (SNL), Science Applications International Corp. (SAIC), and Information Systems Laboratory (ISL)) met near the PNP site with NMC staff to discuss and quantify certain specific inputs to the PRA of hypothetical PTS events at PNP. Enclosure 1 is the meeting's agenda and Enclosure 2 is the list of attendees.

The meeting started with an NRC RES staff discussion of the overall organization of the joint NRC RES and nuclear industry PTS risk analysis effort, showing how the PRA, HRA, TH, and PFM portions of the analyses will be utilized, along with their associated uncertainty analyses, to produce the final PTS-related risk for each of the four plants included in the study. Enclosure 3 is the slides that were prepared for this discussion.

The remainder of the meeting consisted of detailed discussions regarding TH PTS sequence "binning." The "binning" process considers the tens of thousands of very low probability

sequences that might contribute to total PTS risk, and associates each sequence with one of the approximately 100 representative sequences for which a detailed TH analysis has been performed. This process is necessary because available resources cannot support a detailed TH analysis of every sequence. It is acceptable because the sequences are "binned" with (i.e., represented by) the TH analysis of a sequence judged to cause a slightly higher PTS risk. Therefore, this process produces a total PTS risk that is slightly higher than would be predicted if detailed TH analyses were performed for each of the tens of thousands of sequences.

Most of the discussions involved minute details of the binning process below the significance level reported in this summary, except for the following more general items.

It was realized that certain of the PNP TH analyses intended to represent the most severe example of certain types of sequences had inadvertently assumed high pressure injection (HPI) throttling (i.e., flow reduction) occurred when the criteria for such throttling were met. Since throttling is a manual action, it had been intended that these "most severe" cases be analyzed assuming the operator failed to perform the throttling (throttling reduces the overcooling, resulting in lower PTS risk). It was therefore agreed that certain additional TH runs would be made to correct those cases where a significant nonconservative affect might have resulted from the throttling assumption. It was also agreed that certain TH analyses where safety relief valve setpoints were assumed to be slightly below their actual setpoints (this would result in a slight under-prediction of PTS risk) would be reanalyzed using their correct (higher) setpoint.

In certain selected cases, it was agreed that new bins will be created that are identical to existing bins except that TH calculations for the new bins will be performed assuming the reactor at hot, full operating temperature and pressure, but producing zero power (called hot zero power, or HZP - these conditions exist during startup from an extended period of shutdown, e.g., for refueling). PTS analyses typically are made assuming full power operation for an extended period because those conditions exist a majority of the time. However, even taking into account that HZP conditions exist only about 2 percent of the time (which reduces the likelihood that a PTS event will occur starting with those conditions), a PTS event at HZP could be more severe (i.e., more likely to cause vessel failure) because the nuclear core would not contain as much stored heat and would not generate as much heat from fission product decay following shutdown, both of which would worsen the cooldown, making the PTS event more severe. These additional bins will enable the added risk due to HZP to be included for the selected cases.

Conclusion:

The NRC staff and its contractors expressed appreciation for the cooperation and support of the NMC staff during the meeting. The NRC staff believes that the meeting provided a significant contribution to the process of performing improved PTS risk analyses at PNP.

This meeting was not an inspection. Instead, it was an information gathering meeting with a licensee who has volunteered to cooperate with NRC's PTS reevaluation effort. As such, no "open items" were identified that require future actions or NRC approvals.

/RA/

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Probabilistic Risk Analysis Branch
Division of Risk Analysis and Applications
Office of Nuclear Regulatory Research

Docket No. 50-255

- Enclosures: 1. Meeting Agenda
2. List of Attendees
3. Slides prepared for the meeting

cc: w/encls: See next page

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OFFICE	DRAA/PRAB		DRAA/PRAB		DRAA/PRAB		NRR/DLPM/LPD3			
NAME	H. Woods*		M. Cunningham*		S. Newberry*		D. Hood*			
DATE	07/07/25/02		07/29/02		07/30/02		08/1/02			

*See previous concurrence

(RES File Code) RES -2C-1A

DISTRIBUTION:

PUBLIC PDIII-1 Reading

BSheron

JZwolinski/S. Black

SBajwa

WReckley

RBouling

JStrasma, RIII

MRing, RIII

DHood

AVegel, RIII

Attachment ML02

Package (both of above) ML02

FEltawila

HWoods, RES

DBessette, RES

MCunningham

MMayfield

SMalik

NChokshi

JRosenthal

Enclosure 1

AGENDA

July 16, 17, & 18, 2002 Meeting
Inputs for use in the Pressurized Thermal
Shock (PTS) Risk Analysis of Palisades

July 16:

8:00-8:15	Introduction and Purpose of Meeting	H. Woods, NRC/RES
8:15-9:45	Discussion of Thermal Hydraulic PTS Sequence Binning for Input to FAVOR Probabilistic Fracture Mechanics Code	A. Kolaczowski (SAIC), D. Whitehead (SNL), and B. Brogan, et. al. (NMC)
9:45-10:00	Break	
10:00-11:30	Continuation of Discussion	(Same)
11:30-12:30	Lunch	
12:30-2:45	Continuation of Discussion	(Same)
2:45-3:00	Break	
3:00-4:30	Continuation of Discussion	(Same)
4:30-5:00	Questions from the Public	

July 17:

8:00-4:30	Continuation of Discussion (with breaks and lunch, as above)	(Same)
4:30-5:00	Questions from the Public	

July 18:

8:00-11:30	Continuation of Discussion (with break as above)	(Same)
11:30-12:00	Questions from the Public	

Enclosure 2

LIST OF ATTENDEES

PUBLIC MEETING WITH NMC STAFF REGARDING INPUTS FOR USE IN THE
PRESSURIZED THERMAL SHOCK (PTS) RISK ANALYSIS OF PNP
JULY 16-18, 2002

NAME

ORGANIZATION

Roy Woods	NRC/RES
Donnie Whitehead	Sandia National Lab. (SNL)
Alan Kolaczowski	Science Applications International Corp. (SAIC)
Don Fletcher	Information Systems Laboratory (ISL)
Brian Brogan	Nuclear Management Company, LLC (NMC)
Gary Pratt	Nuclear Management Company, LLC (NMC)
Frank Yanik	Nuclear Management Company, LLC (NMC)
John Kneeland	Nuclear Management Company, LLC (NMC)
Dave Blanchard	Nuclear Management Company, LLC (NMC)

Enclosure 3

Slides Prepared for the Meeting

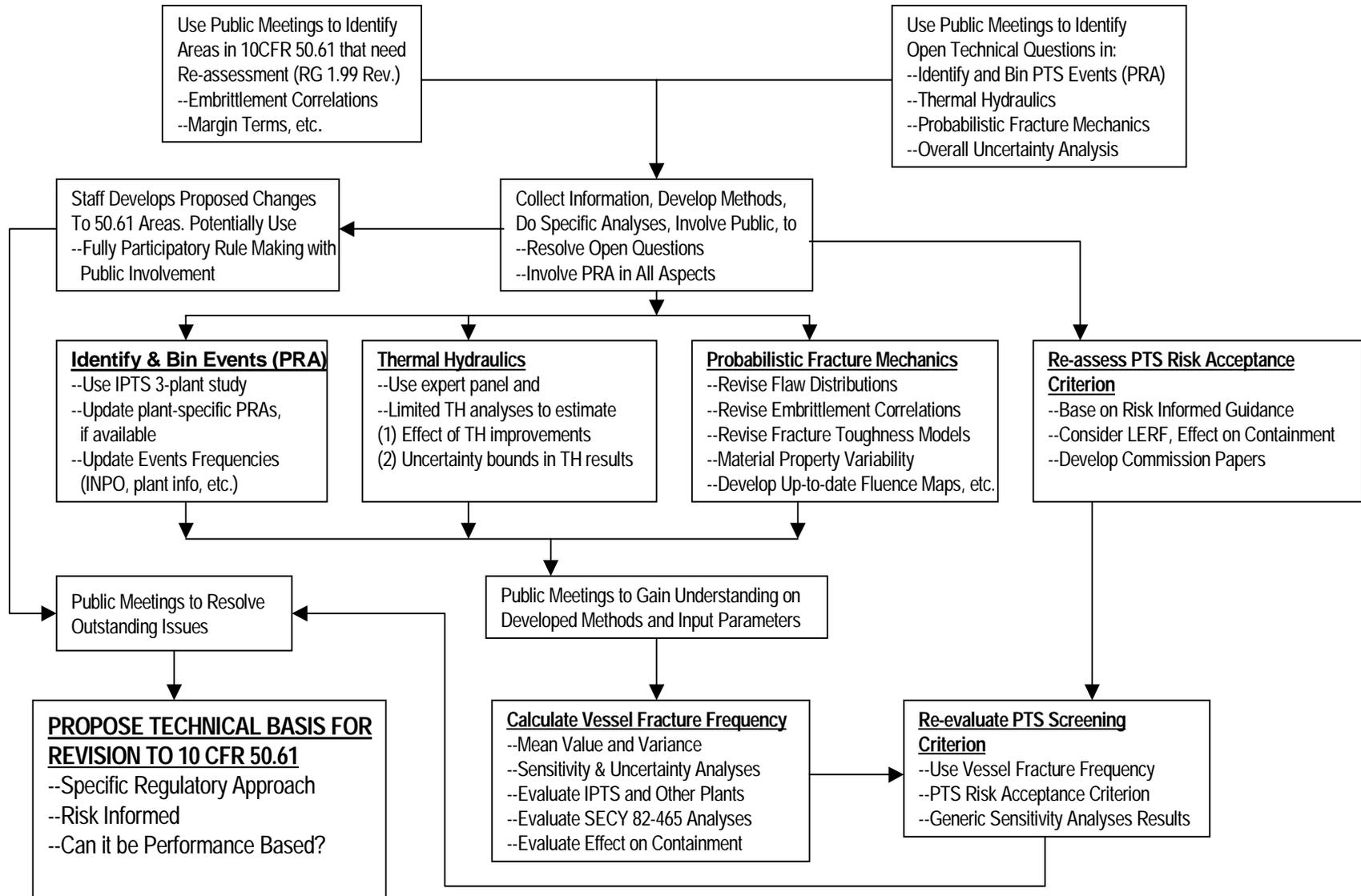
PRA/HRA & TH for PTS Rule Revision

Roy Woods

**Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission**

**Presented at Palisades Nuclear Plant
Covert, MI
July 16, 2002**

Development of Technical Basis to Revise PTS Rule 10 CFR 50.61



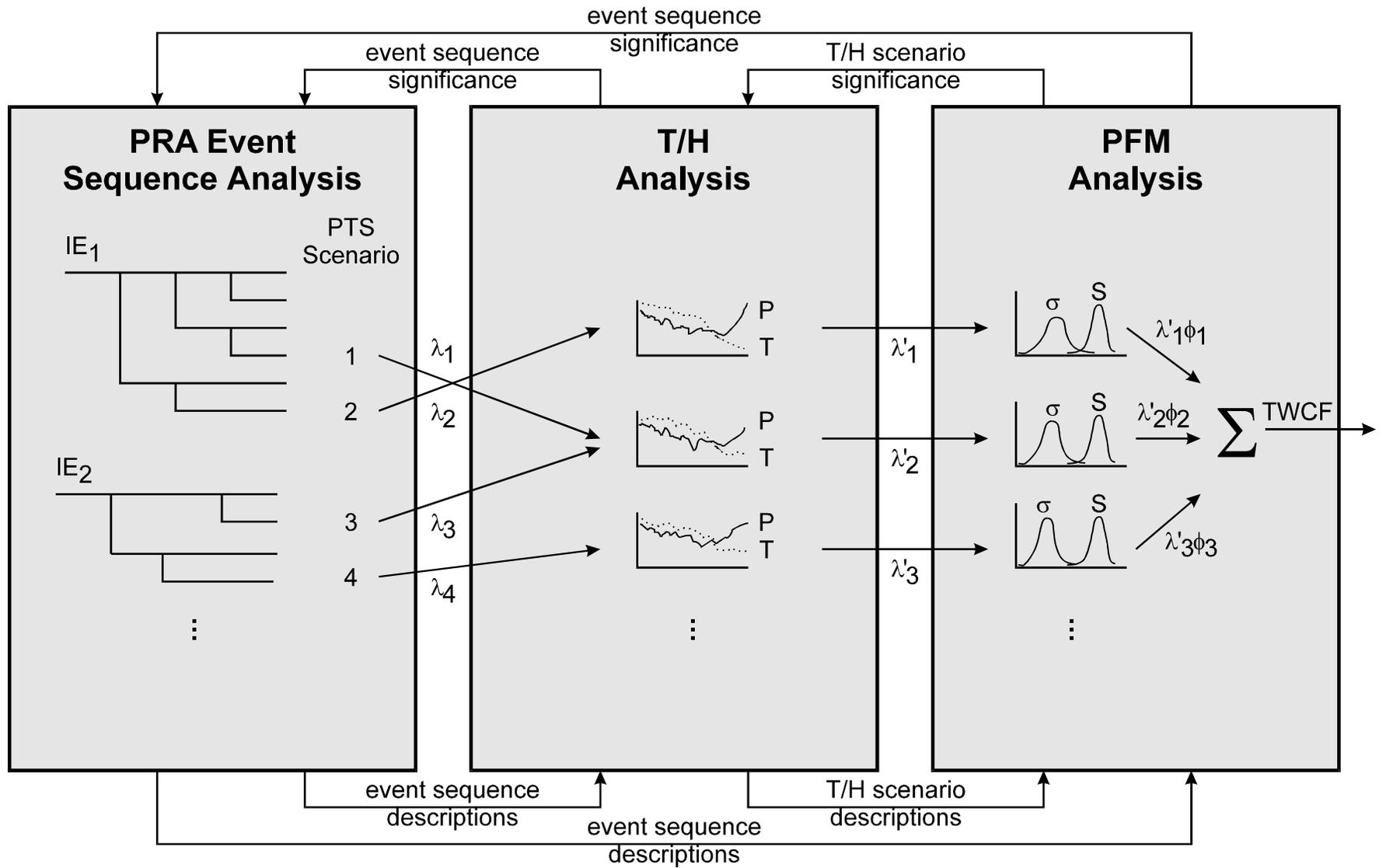
PRA/HRA Objective

Support development of technical basis for revised rule

- **Ensure overall process is coherent, risk-informed**
 - **Appropriate integration of T/H, PFM, and PRA/HRA**
 - **Consistent treatment of uncertainties**

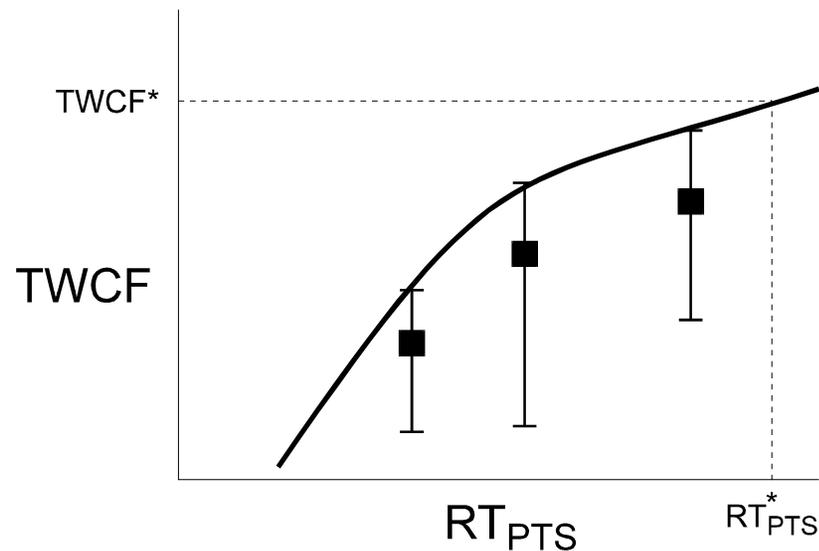
- **Update old PTS/PRA studies**
 - **Reflect changes to study plants**
 - **Reflect changes to PRA state of the art, knowledge base**
 - **Update HRA**
 - **Address other plants**

Overall Analysis Framework



Overall PTS/PRA/HRA Analysis Approach

- Estimate PTS-induced through-wall crack frequencies (TWCFs) for 4 plants, including uncertainties
 - Develop PTS/PRA/HRA models for Oconee and Beaver Valley
 - Review PTS/PRA/HRAs for Calvert Cliffs and Palisades
 - Resolve inconsistencies, generalize results to population
- Develop TWCF vs. RT_{PTS} relationship, e.g.,



PTS/PRA/HRA Analysis Status

- **Oconee**
 - Kickoff meeting: March, 2000
 - Initial PRA/HRA & TH results: December, 2000
 - Review meeting at Duke Energy: January, 2001
 - Model revised, preliminary TWCF: Dec., 2001
 - “Final” TWCF: July, 2002

- **Beaver Valley**
 - Kickoff meeting: July, 2000
 - Initial PRA/HRA & TH results: April, 2002
 - Review meeting at FENOC: May 14, 2002
 - TWCF results: August, 2002

- **Palisades**
 - Kickoff meeting: March, 2001
 - HRA Quant. meeting Nov., 2001
 - Initial PRA/HRA & TH results: April, 2002
 - TWCF results: September, 2002

- **Calvert Cliffs**
 - Early meeting August, 2001
 - Kickoff meeting June 5-7, 2002
 - TWCF: February, 2003

Meeting Objectives

- **Discuss draft results of PTS PRA/HRA and TH analyses for Palisades**
- **Finalize TH “binning” of results for input to PFM calculations (“FAVOR” code)**

(Backup Slide)

Characteristics of Events that Cause a PTS Challenge

- **Embrittlement**
 - irradiation sensitive steel
 - years of exposure to high energy neutrons
- **Presence of a crack or flaw**
 - critical size and orientation
 - located in embrittled region
- **Vessel rapidly cooled**
- **Vessel remains at a sustained low temperature**
- **Primary system remains at high pressure, or is repressurized**

