WOG/Westinghouse Presentation To The NRC

WOG Project A Process For Risk-Informing Fire Protection Impairments

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Agenda

- Introduction
- Meeting Objective
- Description of WOG RI Fire Protection Model
- Applicability and Limitations of the Model
- Regulatory Environment
- Model Compatibility with Fire SDP
- Pilot Plant Application
- Expected Benefits
- Action Plan & Schedule
- Comments & Feedback

Introduction

- WOG authorized a project to:
  - Risk inform Fire Protection Compliance Process
  - Apply process to a pilot plant
- Today's meeting is to introduce and discuss the project
- Meeting is expected to last about 2 hours including presentation and discussion

Meeting Objective

- Familiarize the NRC with the WOG project
  - Outline of technical work
- Alignment of project scope and goals
  - With NRC activities in fire protection
  - Feedback from NRC

Description of WOG RI Fire Protection Model

- Project Purpose: Develop a process for risk informing selective elements of a plant's fire protection program
- The approach uses concepts from:
  - The NRC's fire SDP concept
  - RI-ISI approach for identifying the most appropriate inservice inspection methodology (in our case, compensatory measure) for a given degradation type and level
- The project will not eliminate the need for repairing impairments
  - Similar to a JCO versus Operability Evaluation

Description of WOG RI Fire Protection Model

- Plant programs and procedures that may benefit include:
  - Procedures for dealing with fire protection impairments
    - Facilitate realistic evaluation of fire protection impairment and allow appropriate plant resources to be applied to correct the impairment
    - Ensure appropriate compensatory measures, improving safety and simplifying the process
    - Improve safety by requiring comprehensive compensatory measures for risk significant impairments
    - Reduce burden by using compensatory measures commensurate with risk significance

Description of WOG RI Fire Protection Model

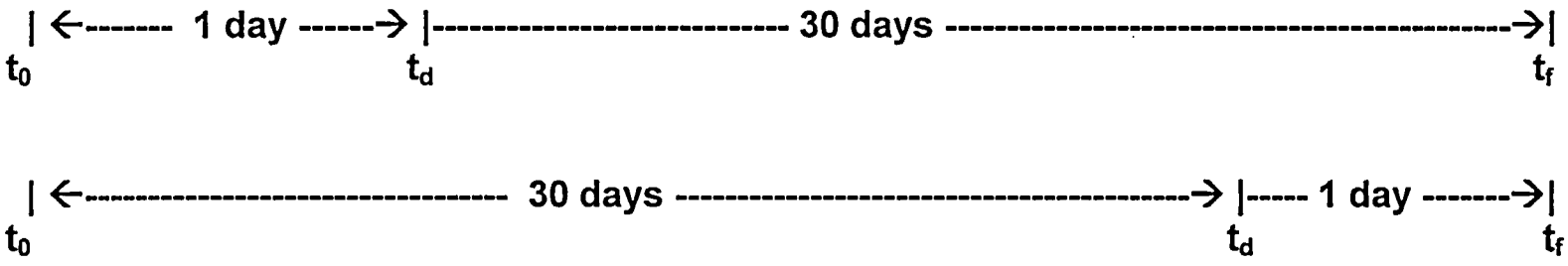
- Programs for reliability of fire protection features
  - A RI approach would improve safety and cost effectiveness by establishing fire protection system availability requirements commensurate with the risk level of the area/system being protected. Maintenance intervals would be based on component reliability data and risk significance of the protected area/system.
- Programs for assessing plant operational risk associated with degraded fire protection features

Description of WOG RI Fire Protection Model

Where Does the Program Fit?

- **Consider two fire SSC degradation cases with the same "total duration" time of**

Delta T = $t_f - t_0$



t_0 = Undetected degradation occurs

t_d = Degradation is detected

t_f = Estimated time when SSC is brought back into compliance

- **Once t_d is reached, the duration $t_f - t_d$ for future risk exposure is very different in two cases.**

FIRE SDP is used by the NRC inspector at $t = t_d$ for the "total duration" of delta T.

WOG PROCESS is used by the plant at $t = t_d$ to choose a compensatory measure (and also to determine an "AOT") applicable to the duration $t_f - t_d$.

Description of WOG RI Fire Protection Model

- The process would estimate
  - The risk due to impairments in fire protection features or programs
  - The risk reduction worth of the set of potential compensatory measures and
  - Thereby risk inform and simplify the decision making process to address an impairment
- The following sets of information need to be compiled
  - Data from the plant fire PRA
  - A set of impaired state definitions and their technical bases
  - A quantification model that allows calculation of plant risk associated with impaired states
  - Quantification of the risk reduction associated with various compensatory measures

WOG RI Fire Protection Model – General Approach

- Define equation for estimating the fire induced risk

  CDF=f(fire freq, detection, suppress, propagation, equipment, manual action, etc)

- Develop method for quantifying fire induced risk (ie., detailed fire PRA)
- Develop high-level contributing factors for fire-induced risk
- Develop list of contributors to each high level factor
  - Ignition sources, types of detection/suppression, elements for manual action, etc
- Develop list of what constitutes a degraded state for each contributor to be a fire risk contributor
  - Open door, obstructed/inadequate suppression system, etc

WOG RI Fire Protection Model – General Approach

- Select a few commonly observed degradations in each fire risk contributor
  - Develop criteria and basis for assigning degradation level (H, M, L) for each defined degraded state
  - Develop estimate and basis for assigning probabilities to each degraded level
  - Develop list of appropriate compensatory measures for each degraded state and level
  - Develop estimate and basis for assigning impact reducing probabilities to each compensatory measure for a given degraded state and level
- Develop an efficient method for re-quantifying the fire induced risk given a certain degraded state, degraded level, and corresponding compensatory measures

WOG RI Fire Protection Model – An Example

An example:

A plant's compliance program specifies that response to inoperability of a fire barrier (e.g., door) between two fire areas containing equipment in two different trains of safe shutdown requires that a fixed fire watch be posted immediately or that the plant shut down until the condition is corrected. Currently, failure to comply (e.g., discovery that such a fire door had not been properly shut for an extended period of time) would be a procedural violation and potentially expose the licensee to NRC fines, regardless of how significant the degradation was to plant risk. However, a process that would identify, via a risk-informed evaluation, the relative risks associated with each barrier or type of barrier, would allow the compliance response to be made appropriate to the level of risk.

Degradation of one type of barrier might be cause for immediate fire watch posting or shut down, whereas degradation of other barriers that are shown not to be as risk-significant might only warrant a roving fire watch, and non-risk-significant barrier degradation might be dealt with via a condition report and scheduled repair.

WOG RI Fire Protection Model – An Example

The following event tree model can be used to quantify fire scenarios for the base case and sensitivity cases with degraded fire SSCs. Note that this model allows quantification of fire scenario CDF when fire propagates from one fire area (XX) to the adjacent fire area (YY), if a barrier is degraded or failed.

In this hypothetical illustrative example, if the barrier between the fire areas XX and YY is assumed to fail (highly degraded level: failure probability of ET node F becomes 1), then the CDF changes from 6.27E-07/year to 6.07E-06/year. Note the following implication:

> **If the barrier stays in a totally failed state for a duration of 72 hours, the ICCDP is calculated as 4.5E-8. An ICCDP of less than 5.0E-07 is considered small for a single tech-spec AOT change in RG 1.177. The ICCDP calculated in this hypothetical example meets the test for "small CDP increase" with a comfortable margin factor (the margin factor is 11 = 5E-07/4.5E-8). With a compensatory measure, this delta risk can be further reduced.**

Note that LERF is also a measure to be considered; but is left out of this example. Also see note below the event tree.

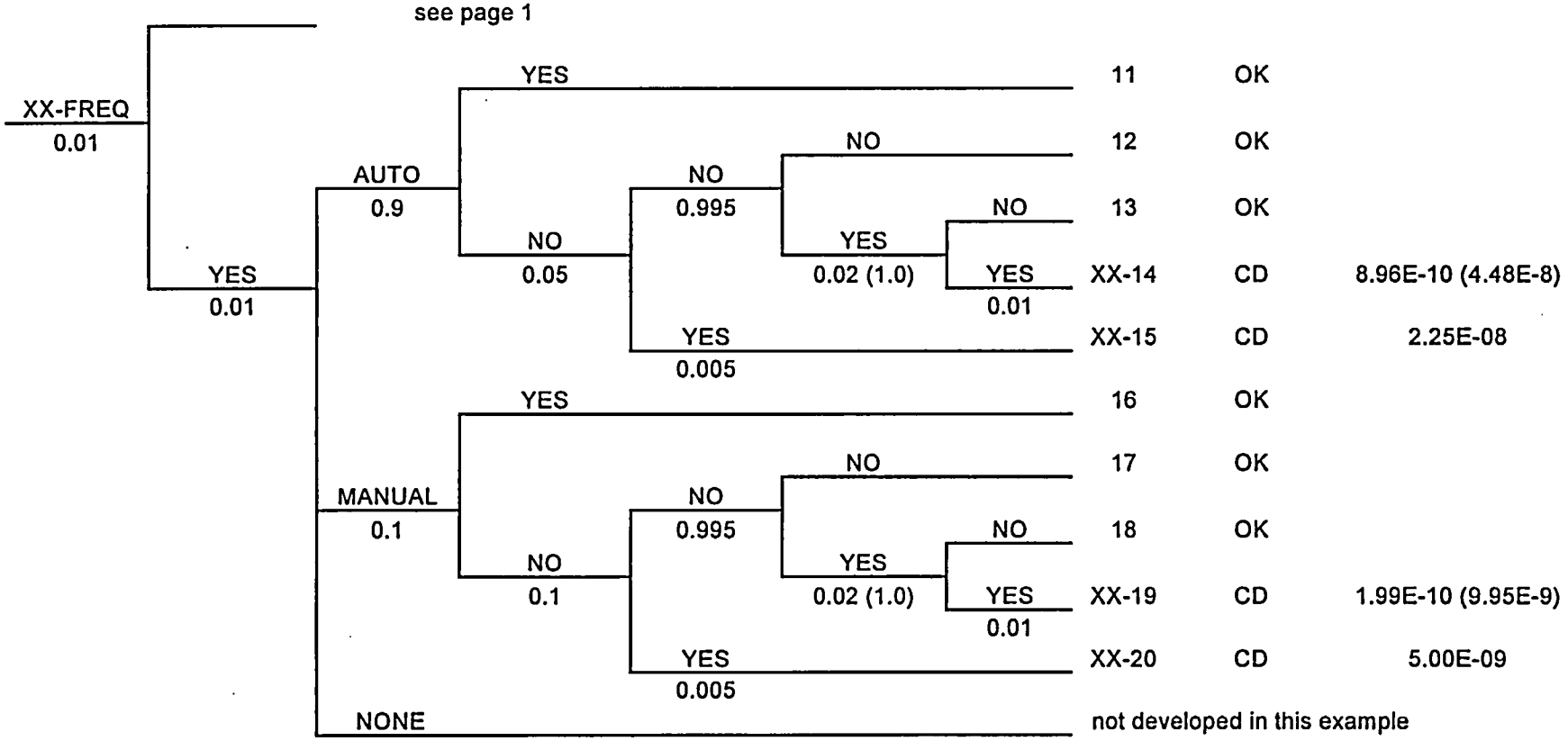
WOG RI Fire Protection Model – An Example

Table 1 A Detailed Representation of the Fire Model Components

Fire Initiation in Fire Area XX A	Fire Propagation in XX B	Fire Detection C	Fire Suppression D	Core Damage E	Fire Propagation into YY F	Core Damage from YY G		End State	Frequency
XX-FREQ 0.01	NO 0.99						1	OK	
		AUTO 0.9	YES				2	OK	
			NO 0.05	NO 0.999	NO		3	OK	
					YES 0.01 (1.0)	NO	XX-4	CD	4.45E-08 (4.45E-6)
						YES 0.01	XX-5	CD	4.46E-07
				YES 1.00E-03			6	OK	
		MANUAL 0.1	YES				7	OK	
			NO 0.1	NO 0.999	NO		8	OK	
					YES 0.01 (1.0)	NO	XX-9	CD	9.89E-09 (9.89E-7)
						YES 0.01	XX-10	CD	9.90E-08
				YES 0.001					
		NONE					not developed in this example		
	continued on page 2								

WOG RI Fire Protection Model – An Example

Fire Initiation in Fire Area XX A	Fire Propagation in XX B	Fire Detection C	Fire Suppression D	Core Damage E	Fire Propagation into YY F	Core Damage from YY G		End State	Frequency



WOG RI Fire Protection Model – An Example

- Five of the seven event tree nodes address different fire related functions, equipment, and manual actions that can be further examined and categorized
  - Fire ignition sources – node A
  - Fire propagation inhibitors/enablers in a given fire area – node B
  - Fire detection equipment (automatic and manual) – node C
  - Fire suppression equipment (automatic and manual) – node D
  - Fire barriers around a given area – node F
- Inventory of such functions and equipment for a typical plant can be generated and impaired states for these functions/equipment defined

Note: When a fire barrier is degraded, the fire scenarios associated with BOTH adjacent fire areas must be quantified and their CDF contributions summed to assess the delta risk

WOG RI Fire Protection Model – Applicability

- Applicability and Limitations
  - Applicable to all WOG plants
  - Plant must have a fire PRA or must be able to quantify the fire scenario risk for the impairment of interest
  - Due to schedule and resource limitations, only a small number of impaired states (with their technical bases) can be defined and applied to the pilot plant

Industry/Regulatory Environment

- NRC has recently endorsed the use of risk insights to allow assignment of resources commensurate with the safety significance of the subject matter
- NRC use of a fire SDP for measuring the importance of findings during inspection of fire program is an indication of growing acceptance of a risk informed approach for addressing fire protection impairments
- NFPA-805 has been developed which adopts a performance based, risk informed approach to fire protection programs
- NRC published the proposed rule for Adoption of NFPA-805 as a Risk Informed, Performance Based Voluntary Alternative
- NEI also has proposed guidance for Implementing a Risk Informed, Performance Based Fire Protection Program Under 10CFR 50.48c

Industry/Regulatory Environment

- The proposed process does not involve changes to 10CFR50 Appendix R
  - criteria, barrier design bases or related requirements
- The process is intended to risk inform owner controlled fire protection programs,
  - Risk inform the set of pre-defined actions to be taken to maintain and respond to degradations of fire barriers
- The methodology developed can be implemented by a plant to efficiently evaluate impairments and optimize application of resources in addressing such impairments

WOG Fire Model Compatibility with Fire SDP

- Compatibility with fire SDP
  - The latest revision of the fire SDP is now available
  - The intention is to make the WOG project process complementary to the SDP
    - Especially phase 3 of the SDP by allowing choices among compensatory measures
  - Since both methods utilize risk informed methods, compatibility should be achievable

Pilot Plant Application

- The process to be applied to a volunteer plant to interactively develop, test and refine the process
  - Diablo Canyon is the pilot plant
- The pilot plant fire PRA data is expected to be available in February 2004 time frame to allow application and refinement of the process

Expected Benefits

- The benefits are many
  - Improve safety
    - Implement comprehensive compensatory measures for risk significant degradations
    - Focusing attention and resources on the risk significant items
  - Reduce costly fire protection compensatory measures for low risk areas
  - Simplify and speed up the finding and assessment process

Reduction in Operational Costs

- Reduction in compensatory costs – the process facilitates implementing compensatory measures commensurate with the safety significance of the impairment. Such an approach is expected to reduce the cost associated with implementing compensatory actions. This is because all impairments are currently compensated in the same manner, independent of the impairment or the areas impacted by the impairment. Fire PRA results typically indicate that 50% of all fire areas in a plant are risk significant. Therefore, the less risk significant areas are expected to require less costly compensatory measures and non-risk significant areas may requires no compensatory measures

Reduction in Operational Costs

- Reduction in cost of assessing findings – The NRC is using the fire SDP for measuring the importance of findings during the inspection of the fire protection programs. The results of the program would provide an assessment approach that can be used to readily identify the risk significance of all findings

WOG Project Schedule

- Action Plan and Schedule
  - Project Start — August 2003
  - Process development — Fall 2003- Spring 2004
  - Process application — Winter-Summer 2004
  - Report preparation — Summer-Fall 2004
  - Project End — November 2004

Comments and Feedback

- We encourage NRC comments and feedback at this meeting
  - Assure the project is compatible with and positively contribute to the ongoing efforts to risk inform fire protection