U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

SESSION 1-5

RISK-INFORMED REGULATION CASE STUDY I ROP/SDP

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LEARNING OBJECTIVES

- To describe NRC's reactor oversight - significance determination process and decision criteria

- To illustrate key aspects of associated risk analysis methods using 2 examples
  - Consideration of multiple hazards
  - Consideration of common cause failure and human performance

Overview

- SDP Objectives
  - To characterize the safety or security significance of inspection findings, using best available risk insights as appropriate
  - To provide all stakeholders an objective and common framework for communicating the potential safety or security significance of inspection findings
  - To provide a basis for timely assessment and/or enforcement actions associated with inspection findings

Overview

- SDP Process
  - Develop inspection findings
  - Characterize significance (initial staff assessment)
  - Obtain licensee perspectives on initial characterization
  - Finalize staff's significance determination
  - Issue final determination letter
  - Provide licensee appeal opportunity

Overview

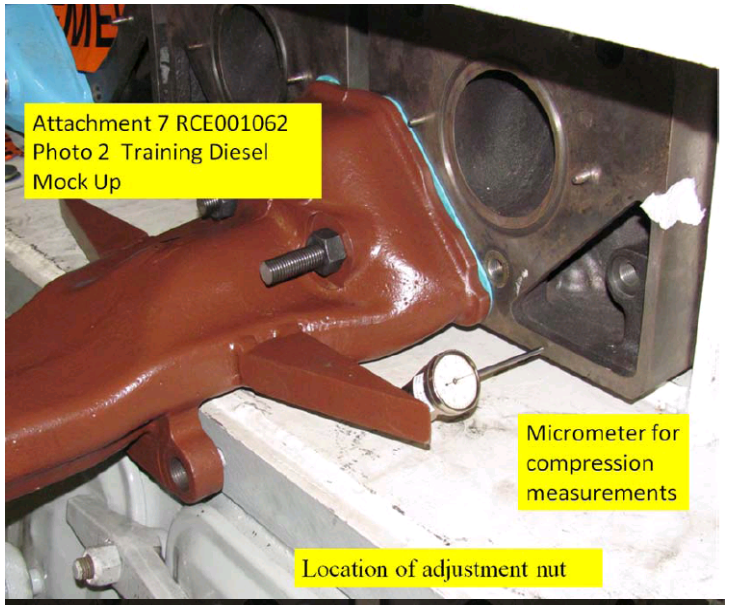
- Decision criteria
  - Change in:
    - Core damage frequency
    - Large early release frequency
  - Broad ranges

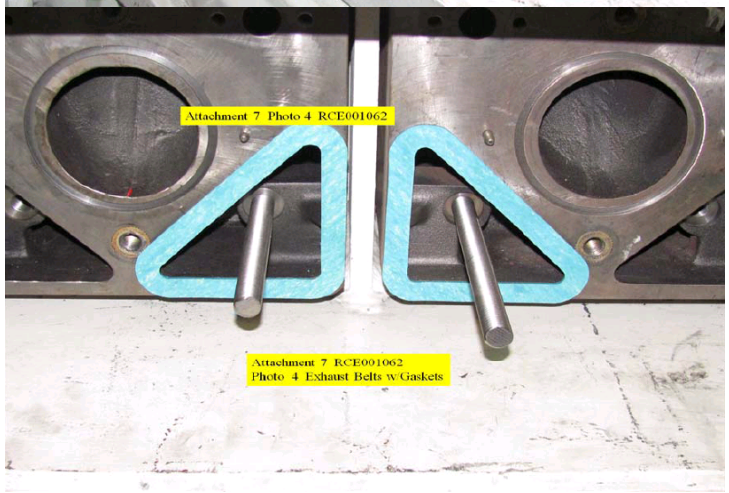
$\Delta CDF < 1x10^{-6}$
$1X10^{-6} \leq \Delta\ CDF < 1X10^{-5}$
$1X10^{-5} \leq \Delta\ CDF < 1X10^{-4}$
$\Delta CDF \geq\ 1x10^{-4}$

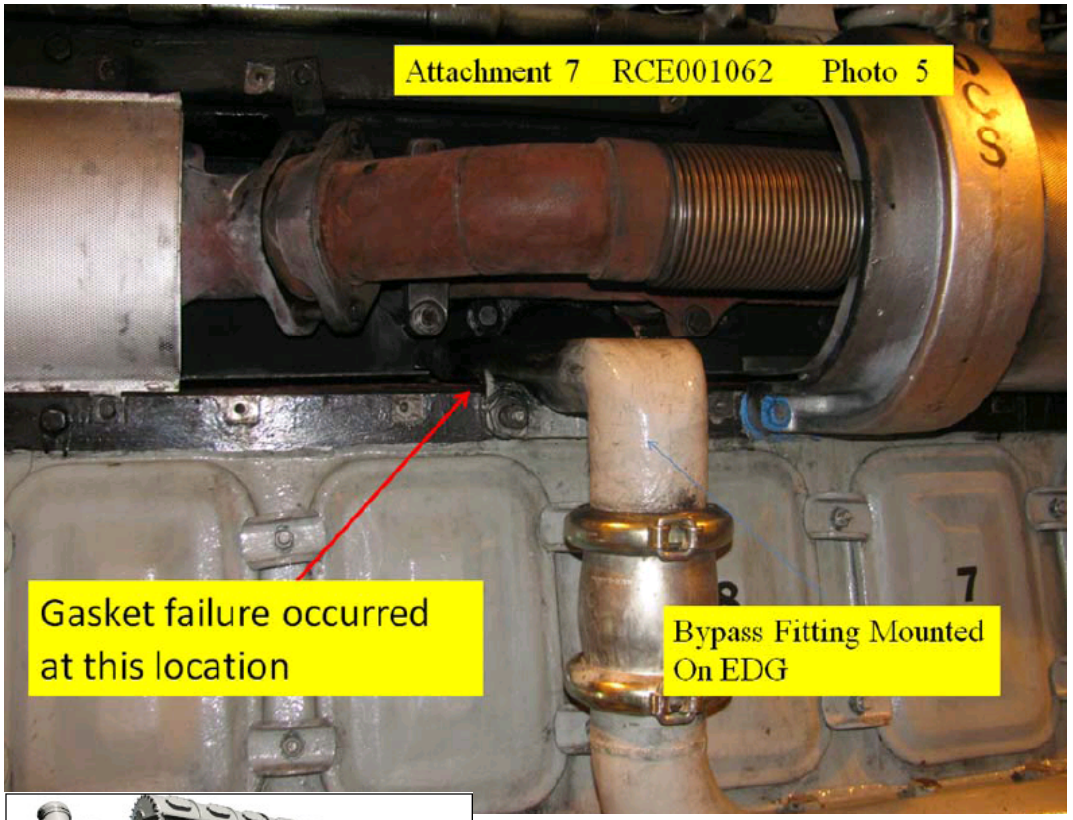
Application Example 1: The Event

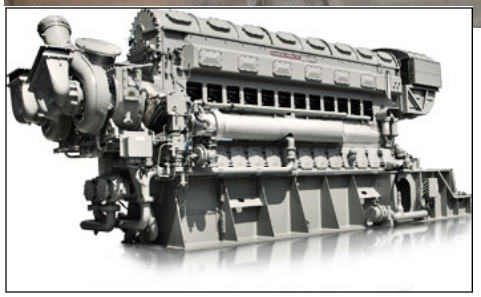
- August 23: 5.8 Magnitude (11 miles) at shallow depth.
- Reactor trip & LOOP. All four EDGs (1H, 1J & 2H, 2J) start/loaded.
- Coolant leak observed on Unit 2 EDG “2H”. SBO EDG start/loaded.
- After identifying leak, EDG 2H was repaired and made available (6 hrs)

Application Example 1: The Failure





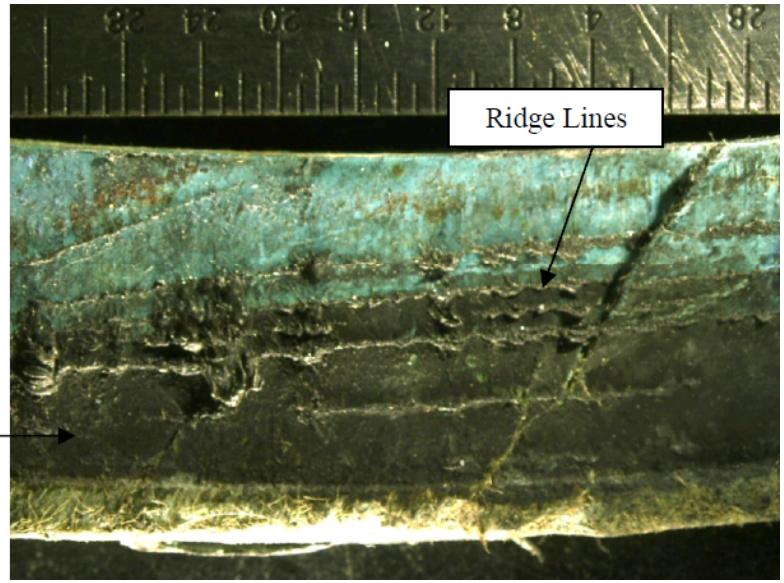




Fairbanks Morse
Diesel Generators
(Model 38TD8-1/8)

Example 1: The Root Cause

- Root cause evaluation on EDG gaskets found evidence of:
  - gasket to gasket inconsistencies in compression,
  - clear indications that failed gasket had been in the process of moving toward failure for some time,
  - failure most likely due to initial installation problems leading to movement over time.



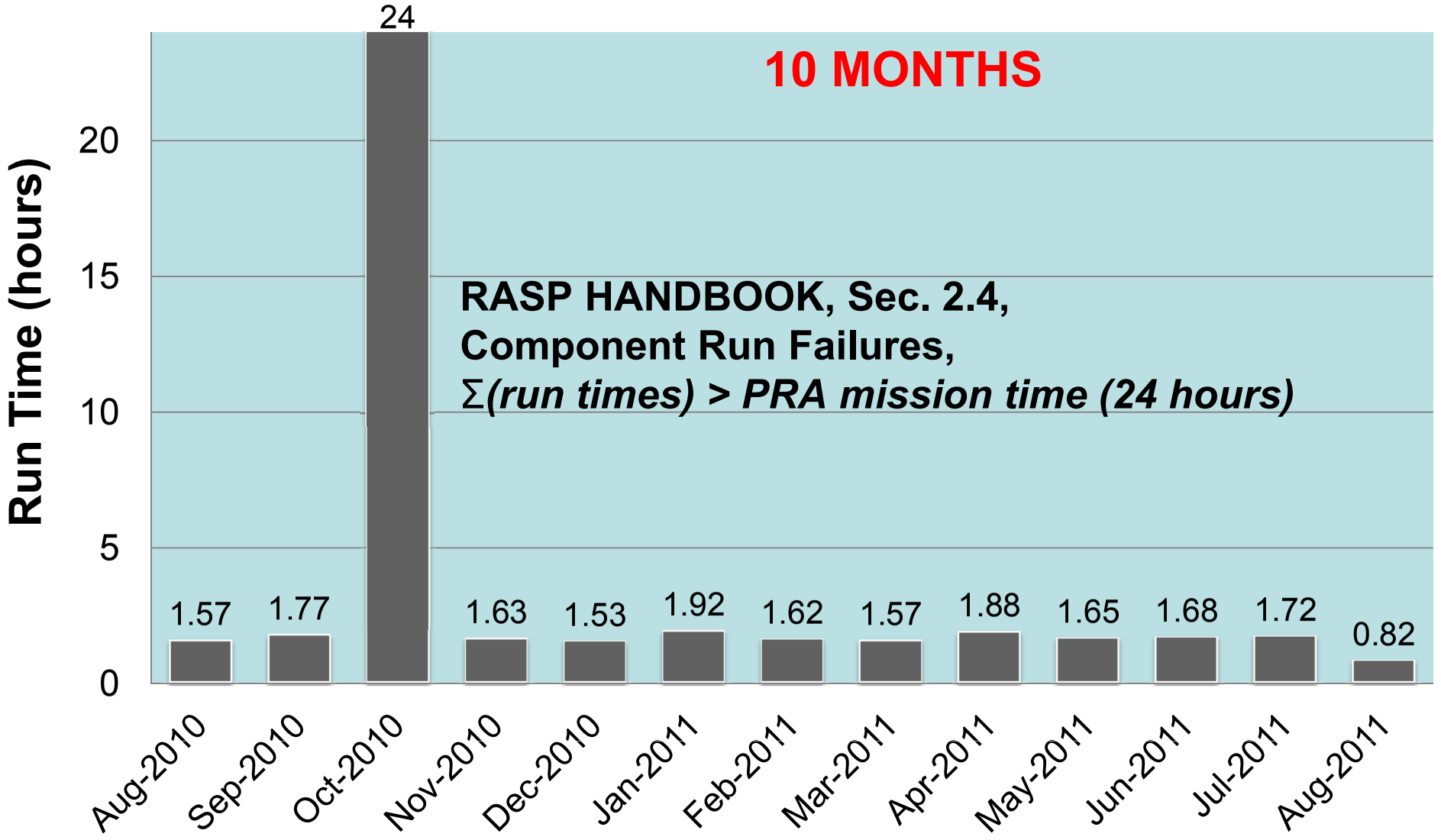
Example 1: The Performance Deficiency

- Self-revealing, Apparent Violation (AV): failure to establish and maintain EDG maintenance procedures as required by Regulatory Guide 1.33, Appendix A, Section 9, Procedures for Performing Maintenance.

- Contrary to the above, from June 2, 2010 until August 23, 2011, the licensee failed to establish and maintain adequate EDG maintenance procedures.

- Procedure did not provide adequate guidance for installation of the gasket which resulted in the failure of EDG 2H to perform its safety function on August 23, 2011.

Example 1: Exposure Time



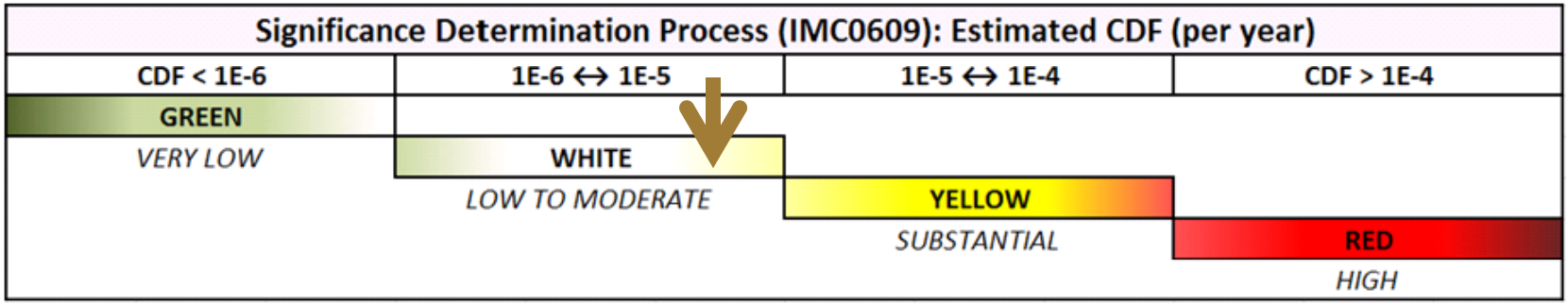
Example 1: The Evaluation

- Licensee
  - Exposure Time
    - 28 days based on root cause evaluation findings
  - Common Cause
    - Should be treated as independent failure with nominal common cause
  - Credit for various probabilities
    - Additional credit for operator actions
    - Lower values for component probabilities & common cause
    - Additional credit for recovery curves

- NRC
  - Exposure Time
    - 10 months based on root cause evaluation findings
  - Common Cause
    - Should be treated as a failure with potential for common cause to other EDGs
  - Credit for various probabilities
    - Limited additional credit for operator actions
    - Lower values for component probabilities & common cause not justified
    - Additional credit for recovery curves does not affect results

Example 1: The Outcome

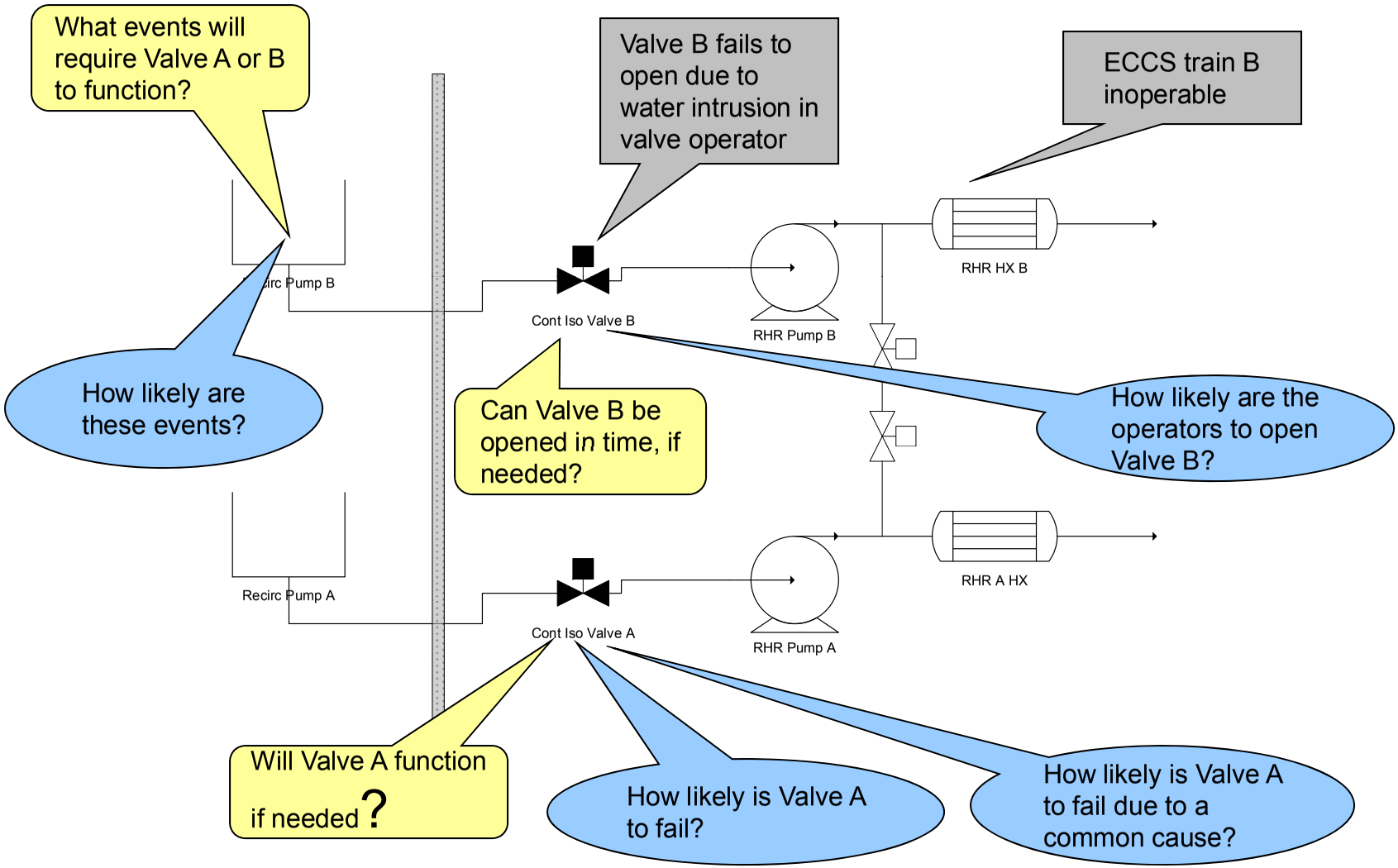
- Example 1
  - Final SDP:
    - White (Unit 1) & White (Unit 2), i.e., low to moderate safety significance (internal and external events)
  - Factors
    - Exposure Time & Common Cause
    - Multiple redundant sources of emergency AC power



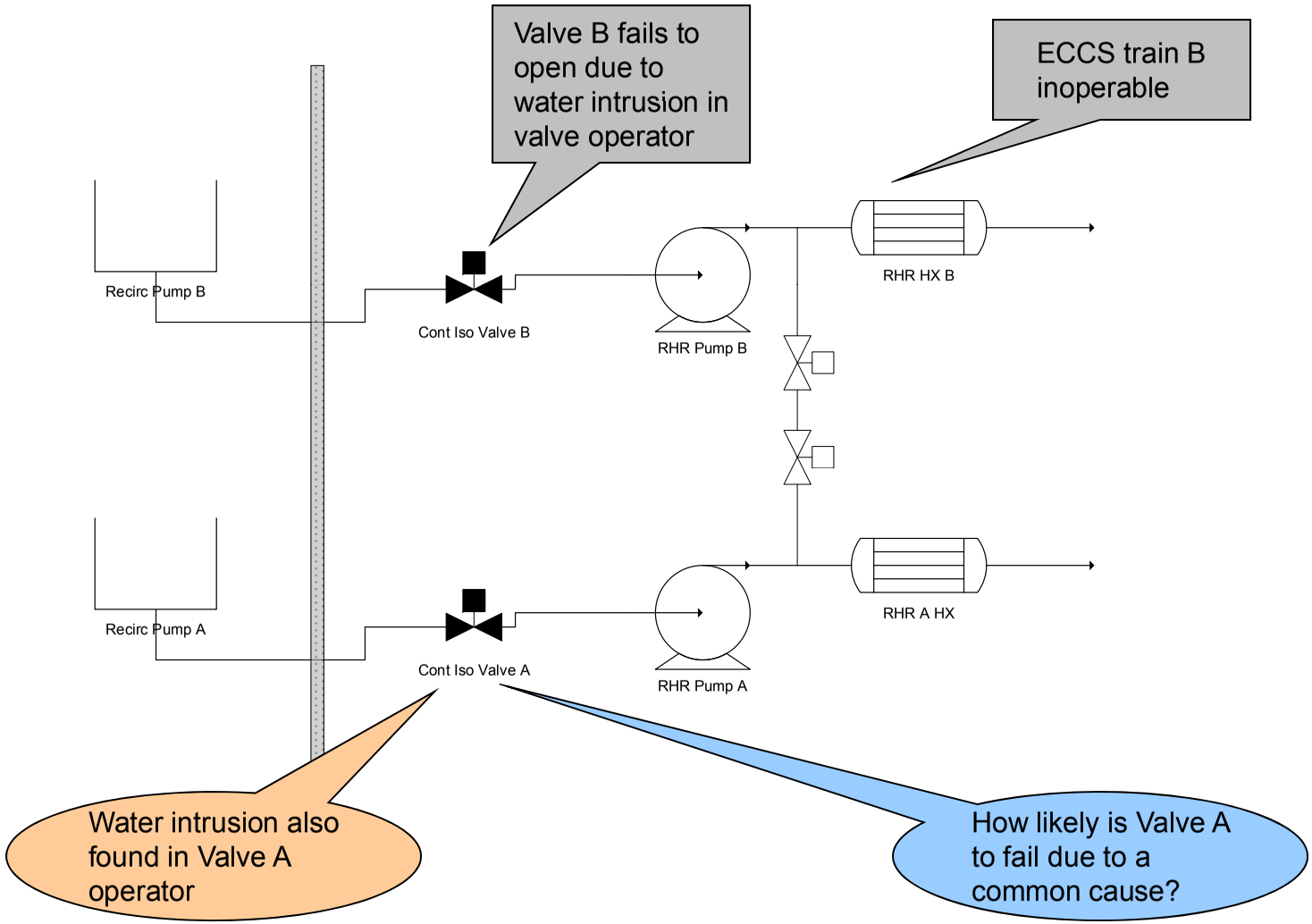
Application Example 2: The Inspection Finding

- Improper maintenance of ECCS recirculation line valve(s)
  - Key PRA/SDP aspects
    - Importance of valve in different LOCA scenarios
    - Potential for common cause failure of redundant valve
    - Potential for human action to open valve

Example 2:
ECCS recirculation line valve fails to open



Example 2a:
ECCS recirculation line valve fails to open



Example 2a: The Evaluation

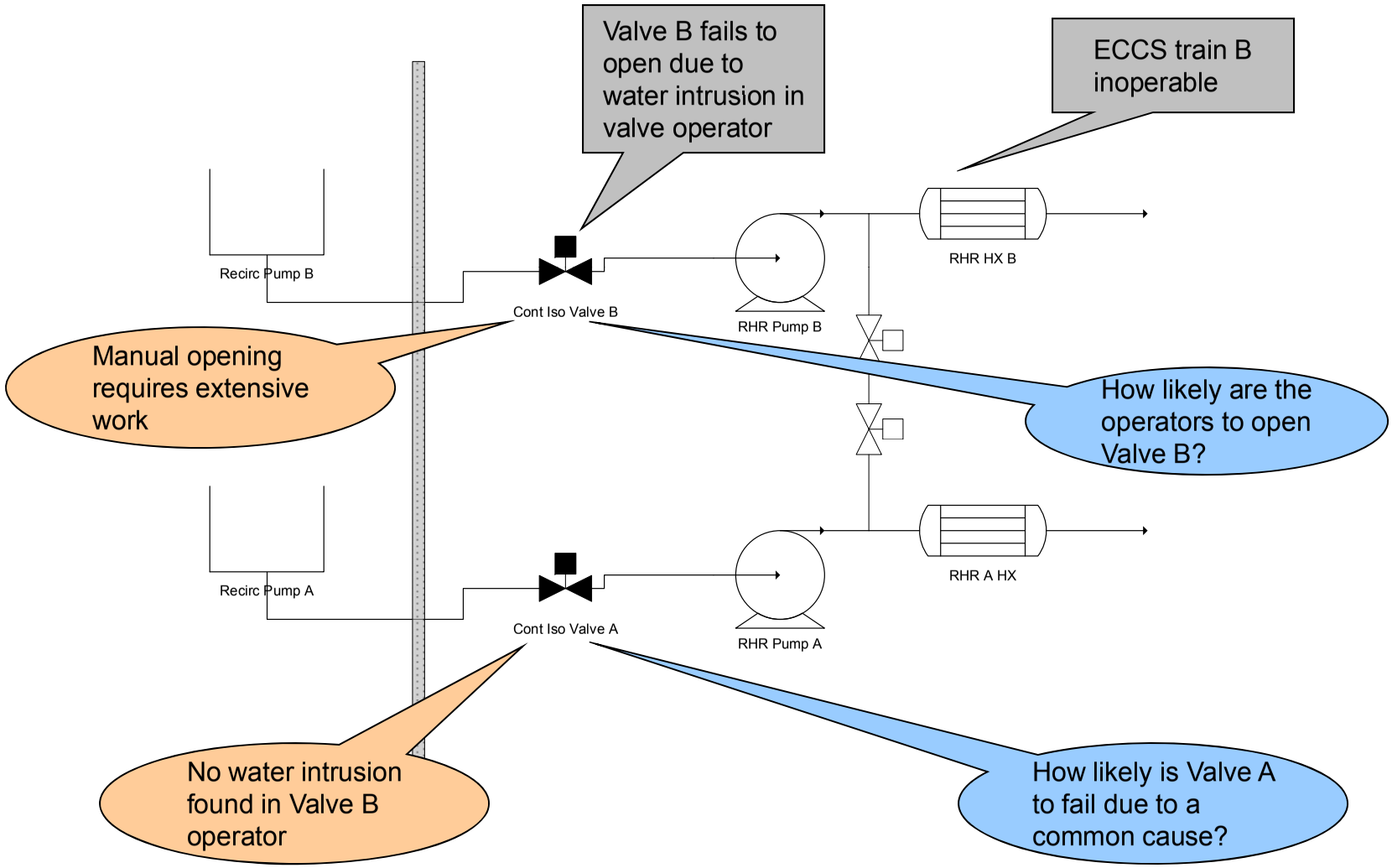
- Licensee
  - Low head safety injection pump would
    - be started with Valve B indicating dual position
  - Valve B has a moderate probability of being restored
    - success probability of local manual actions
  - Valve A has
    - low random failure probability
    - no increased probability of common cause failure

- NRC
  - Low head safety inject pump would
    - Not be started with Valve B indicating dual position
  - Valve B has a low probability of being restored
    - success probability of local manual actions
  - Valve A has
    - low random failure probability
    - increased probability of common cause failure

Example 2a: The Outcome

- Example 2a
  - Final SDP:
    - Substantive safety significance
    - Yellow
  - Factors
    - Time frame for required operation
    - Low recovery probability of first valve
    - Common cause failure probability of second valve

Example 2b:
ECCS recirculation line valve fails to open



Example 2b: The Evaluation

- Licensee
  - Recovery for operation of Valve A and B for Medium LOCAs should be credited
    - Adequate time is available to perform recovery actions
  - Valve B has a moderate probability of being restored
    - success probability of local manual actions
  - Valve A has
    - low random failure probability
    - no increased probability of common cause failure

- NRC
  - No recovery for operation of Valve A or B Medium LOCAs should be credited
    - Adequate time is not available to perform recovery actions
  - Valve B has a low probability of being restored
    - success probability of local manual actions
  - Valve A has
    - random failure probability
    - Increased probability of common cause failure

Example 2b: The Outcome

- Example 2b
  - Final SDP
    - Low to moderate safety significance
    - White
  - Factors
    - Time frame for required operation (timing of RWST drain down and depletion)
    - Low recovery probability of first valve
    - Moderate common cause failure probability of second valve

SUMMARY

- The objective of the significance determination process is to characterize the safety or security significance of inspection findings, using best available risk insights, as appropriate.

- NRC staff perform these evaluations, providing licensee opportunities to provide perspectives.

- SDP evaluations illustrate the importance of having realistic, current PRAs.

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The End

Questions & Answers…..