

External Flood Seal Risk-Ranking Process

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Risk Ranking of External Flood Penetration Seals

- Plants include several hundred penetration seals which provide in-leakage protection from external flood. Experience shows that the quality, condition and capability of these seals is variable.
- Project prioritizes which of the many flood seals are potentially important to plant flooding risk
 - Process should focus on important characteristics of flood seals and what they protect in order to focus resources on risk significant items
 - Process should make use of information expected to be readily available to utility to the maximum extent practical



Failure of Cable opening

Scope

- Develop practical process to “Risk” Rank External Penetration Seals in Response to External Flood risks. The overall process is intended to:
 - Be practical (does not require External Flood PRA)
 - Capture plant knowledge of challenges, plant layout passive flood barriers and active mitigation strategies
 - Explicitly consider seal design features, and location
- Process builds upon deterministic information available from plant post-Fukushima Hazard Re-evaluation Reports (HRRs) and External Flood Integrated Assessments (IAs) along with Deterministic and Probabilistic Internal Flood Studies
- Process to integrate insights from available information on available industry seal tests and EPRI Flood Protection Systems Guide



Key Elements Considered in External Flood Penetration Binning Process

Two Phase Process

- Phase 1: Ranking of Flood Penetration Seals based on Seal Failure Probabilities and Seal Leak Rates
- Focuses on Flood Hazard, Seal Characteristics, Leakage Removal Strategies.
 - Characterization of the Flood Challenge
 - Extent of hazard (flood depth, duration)
 - Seal Capability
 - Type
 - Condition/Failure Mode
 - Seal Leak Rates
 - Means of Barrier protection
 - Floor drains
 - Sump pumps



Phase 1 Results: High level screening of the external flood seals

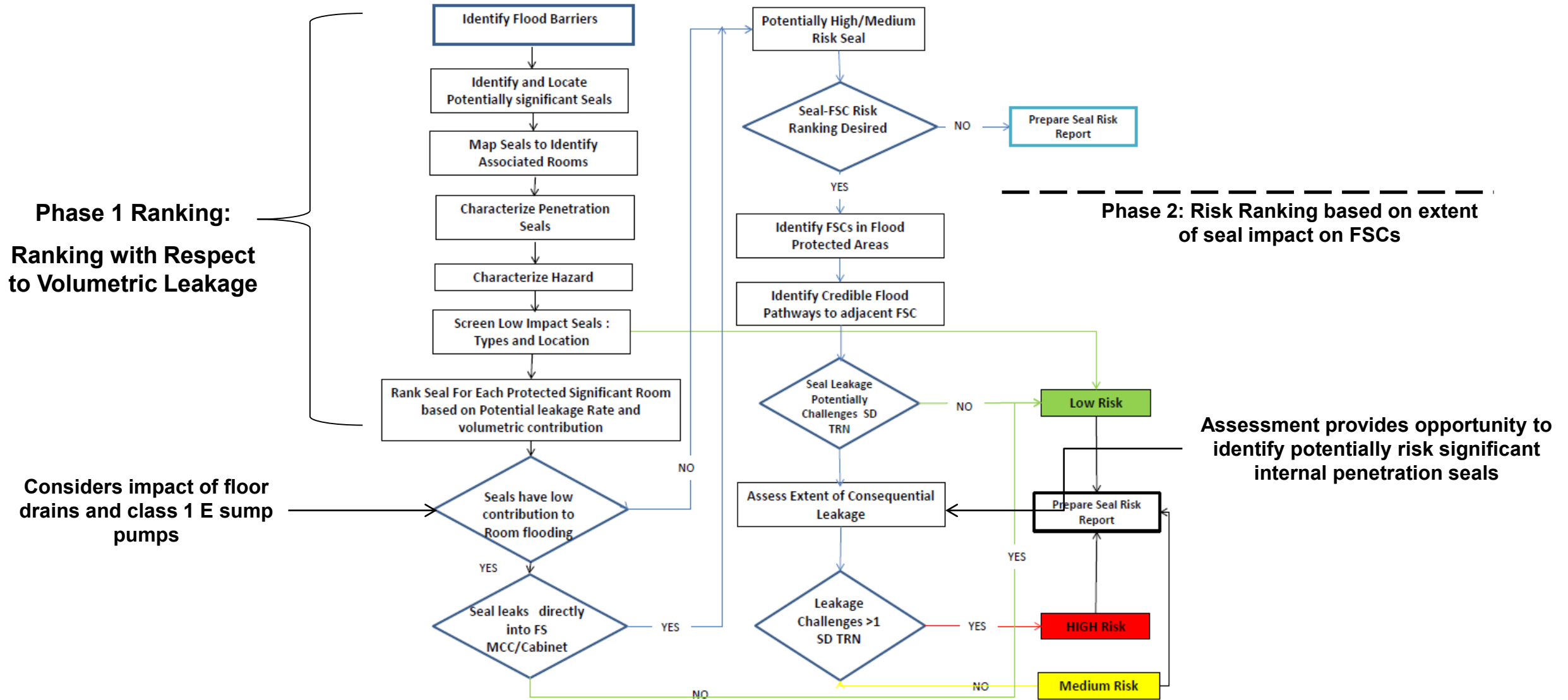
Key Elements Considered in External Flood Penetration Binning Process

Two Phase Process: Phase 2

- Phase 2: Ranking of Flood Penetration Seals based on Potential Risk Impact of Flood Significant Components
 - Uses leakage information generated in Phase 1
 - Extends impact assessment to directly Map potentially risk significant seals with Flood Significant Components (FSCs)
 - Characterizes FSC Water-Induced Failure Conditions
 - Establishes room specific volumetric inflows considering
 - Hazard related inflows (not related to penetration seals)
 - Room related water removal features
 - FSC water-protection/ placement
 - Room flood calculations used to identify potential for flood significant internal penetration seals
 - Seals ultimately ranked/binning by their potential impact on operation of flood significant components

Phase 2 Results: Ranking/ Binning using three bins (H,M, L for risk significance)

Preliminary Overview of Seal Risk Ranking Process



Flood Seal Risk Ranking Approach

Expected Benefits

- Task provides a proactive means to provide a plant-specific assessment of the importance of flood seals
- Structured “Risk-Informed” classification provides a reasonable basis for graded treatment of seals.
- Prioritizes actions important to surveilling and maintaining seals
- Focuses on those seal penetrations as well as internal flood barriers that may be significant to plant risk
- Provides basis for identifying Risk Important seals for treatment in an external flood PRA



Known Limitations

- Binning process limits resolution in seal characterization within “buckets”. More refined categorization may be needed
- Process does not establish fragilities for seals, instead focuses on their importance to risk should they fail. However, it does identify those seals where a fragility assessment would be beneficial, and does credit experimentally observed seal type performance in seal flood/leak assessments, where available.

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