


**USNRC**  
 United States Nuclear Regulatory Commission  
 Protecting People and the Environment


**RIC** 2018



## Accident Sequence Precursor (ASP) Program

Chris Hunter  
 U.S. Nuclear Regulatory Commission  
 Office of Nuclear Regulatory Research

---

---

---


---


---


---

---

---


**USNRC**  
 United States Nuclear Regulatory Commission  
 Protecting People and the Environment


**RIC** 2018



## What is a Precursor?

- An accident sequence precursor is an observed event and/or degraded condition that increases the likelihood for core damage.
  - Does not include events or conditions of minimal risk significance.
- Two types of analyses can be done:
  - Initiating Event
    - Precursor threshold is generally conditional core damage probability (CCDP)  $\geq 10^{-4}$ , with some exceptions for uncomplicated reactor trips.
    - Time window considered is generally the 24 hours after the initiating event.
  - Degraded Condition(s)
    - Precursor threshold is an increase in core damage probability ( $\Delta$ CDP)  $\geq 10^{-4}$ .
    - Time window considers full duration of degraded condition (up to 1 year maximum) and includes other concurrent equipment unavailabilities (including maintenance).

---

---

---

---

---

---

---

---


**USNRC**  
 United States Nuclear Regulatory Commission  
 Protecting People and the Environment


**RIC** 2018



## ASP Program Uses

- Provides input for the assessment of NRC Strategic Plan objectives to prevent and mitigate accidents and evaluation of operating events and trends.
  - **Significant** precursors (i.e., CCDP/ $\Delta$ CDP  $\geq 10^{-3}$ ) are an input into the annual Abnormal Occurrence, Congressional Budget Justification, and Performance and Accountability reports to Congress.
- Assesses the efficacy of existing agency programs (e.g., Reactor Oversight Process) and helps shape the agency's objectives and strategies for reactors.
- Provides feedback to improve the Standardized Plant Analysis Risk (SPAR) models.
- ASP analyses are sent to licensees for incorporation into their operating experience programs.

---

---

---

---

---

---

---

---

USNRC **RIC 2018**  
 United States Nuclear Regulatory Commission  
 Protecting People and the Environment

## ASP Process Overview

- All U.S. licensee event reports (LERs) are reviewed against screening criteria to determine if associated events are potential precursors and warrant a detailed risk analysis.
  - Approximately 80 percent of LERs are screened out in this initial review.
  - If events occur that are known to be precursors in most cases (e.g., losses of offsite power), the event analysis begins immediately.
  - The ASP Program also analyzes events that trigger increased inspection (e.g., special inspections and augmented inspections).
- Results from the Significance Determination Process (SDP) are leveraged when possible.
- Independent ASP analyses are performed for the following:
  - An initiating event (i.e., reactor trip) occurred.
  - Concurrent unavailabilities due to different causes (including maintenance).
  - Degraded conditions with no license performance deficiency was identified.
- Regulatory Issue Summary 2006-24 provides the review and transmittal process for ASP analyses.
  - Preliminary analyses with a CDDP/ $\Delta$ CDP  $\geq 10^{-4}$  are sent licensee for 60-day peer review.

---

---

---

---

---

---

---

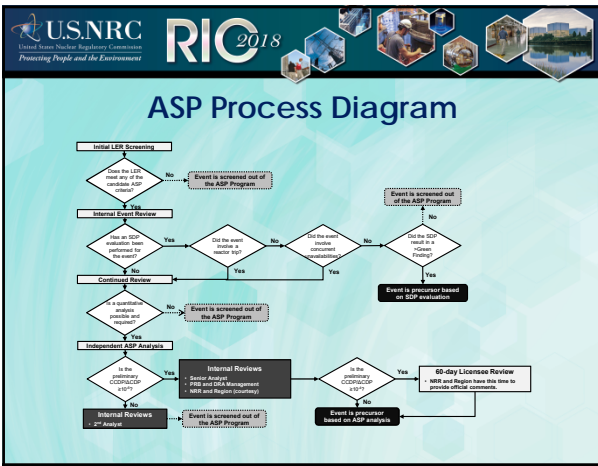
---

---

---

---

---




---

---

---

---

---

---

---

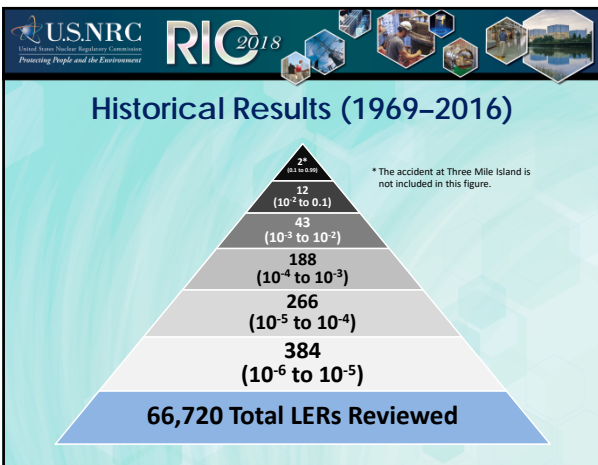
---

---

---

---

---




---

---

---

---

---

---

---

---

---

---

---

---





## Recent/Future Enhancements

- Increase capability of evaluating impacts of external hazards in ASP analyses.
  - In 2018, the ASP Program will evaluate seismic risk for all applicable analyses.
    - The incorporation of seismic hazards within all SPAR models was completed in December 2017.
  - In the past, the risk impact of external hazards is considered in ASP analyses if either an external hazard results in a reactor trip (e.g., seismically-induced loss of offsite power) or a degraded condition is specific to an external hazard (e.g., degraded fire barrier).
- Recent enhancements to the ASP Program have been identified to further increase efficiency.
  - Revise LER screening criteria to further optimize in-house resources.
  - Redistribute ASP workload to ensure analyses are completed more efficiently.
  - Participate in NRC Operating Experience Clearinghouse meetings to provide early risk insights.

---

---

---

---

---

---

---

---