

Description of the Industry Initiating Events Performance Indicator

As discussed in SECY-02-0058, "Results of the Industry Trends Program for Operating Power Reactors and Status of Ongoing Development," RES developed about 10 additional risk-informed indicators for significant initiating events for both PWRs and BWRs. The staff developed these indicators by updating data that were most recently published in NUREG-5750, "Initiating Events at U.S. Nuclear Power Plants: 1987–1995." These indicators were selected because NUREG-1753, "Risk-Based Performance Indicators: Results of Phase 1 Development," identified them as events that contributed >1% to industry core damage frequency. The list of risk-significant initiating events is provided below.

1. Loss of Offsite Power
2. Loss of Safety-related Vital AC Bus
3. Loss of Safety-related Vital DC Bus
4. Small/Very Small Loss of Coolant Accident
5. Loss of Feedwater
6. Loss of Instrument Air/Control Valve
7. General Transients
8. Stuck Open Safety/Relief Valve
9. Loss of Heat Sink
10. Steam Generator Tube Rupture (PWRs only)

During FY 2002, RES and NRR built on this work by developing an overall industry-level indicator for the initiating events cornerstone. An overall indicator can provide a better representation of the overall risk from initiating events than multiple individual indicators of initiating events with varying degrees of risk significance. For example, it is possible that there could be an increase in loss of general transient events in any given year, but the overall risk from all initiating events may actually have declined if the contribution to risk from that single indicator is low and the contribution to risk from all other initiating events has declined.

This overall initiating events indicator, tentatively called the Industry Initiating Events Performance Indicator (IIEPI), consists of an index of these risk-significant industry initiating events. An index was developed for BWRs that has 9 risk-significant initiating events, and a similar index was developed for PWRs that has 10 events. Each initiating event is weighted in the index based on its contribution to industry core damage frequency (CDF).

The contribution of each initiating event to CDF is determined by multiplying the frequency of occurrence by a risk weighting factor. The contribution of the 9 or 10 terms is then summed to get the overall index for initiating events. Mathematically, this can be shown for an individual plant by the following equation:

$$CDF = \sum_{i=1}^m B_i I_i$$

where the risk weighting factor is represented by B_i , and the initiating event frequency is represented by I_i . The risk weighting factor is a common measure used in probabilistic risk assessments (PRAs) called the Birnbaum importance measure.

An industry average CDF can be calculated by using average industry values for the Birnbaum importance measures and the initiating event frequencies. This is illustrated in Figure 1.

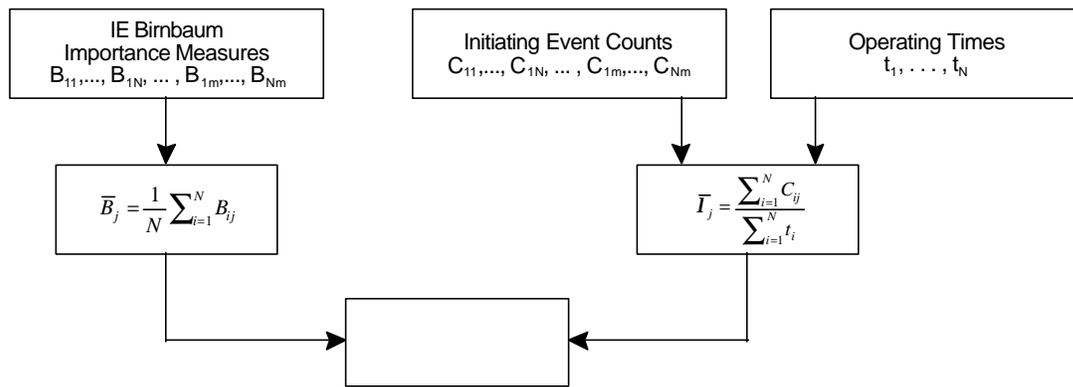


Figure A3-1 Integrated initiating event performance indicator calculations

In addition, should the concept be demonstrated successfully at the industry level, the indicator could potentially be adapted to monitor plant-level performance as well by using plant-specific values for either or both terms in the equation as appropriate. This approach would be similar to the Mitigating Systems Performance Index (MSPI) that is currently being assessed in a pilot program as part of the ROP PIs.

An interesting characteristic of the IIEPI is that it need not require any additional submission of data from licensees, even at the plant level. The staff currently receives all required information from existing data, including Licensee Event Reports (LERs) and Monthly Operating Reports (MORs), as shown in Figure 2.

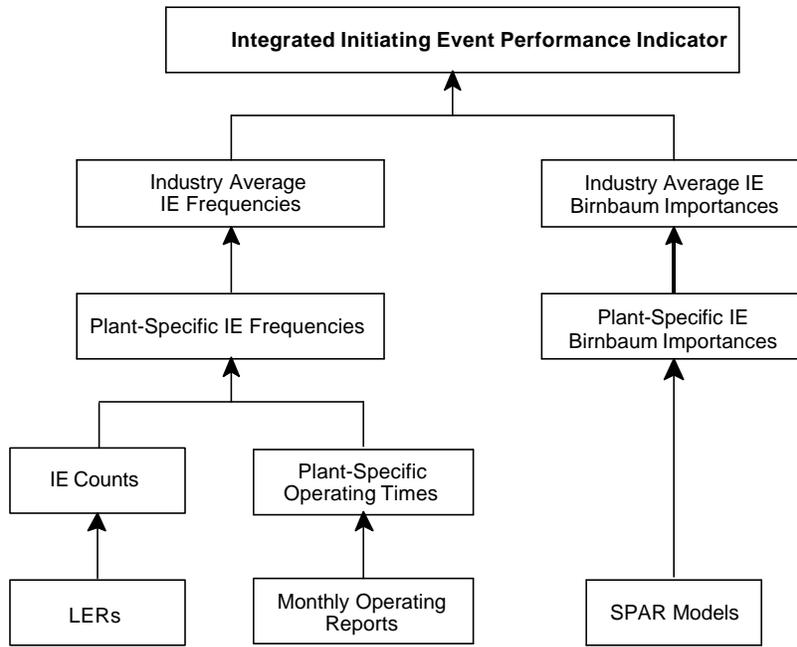


Figure A3-2 IIEPI data sources

An example of the IIEPI for PWRs is shown in Figure 3 for illustration only. These example calculations show the feasibility of the indicator. No attempt has been made to validate or verify these results.

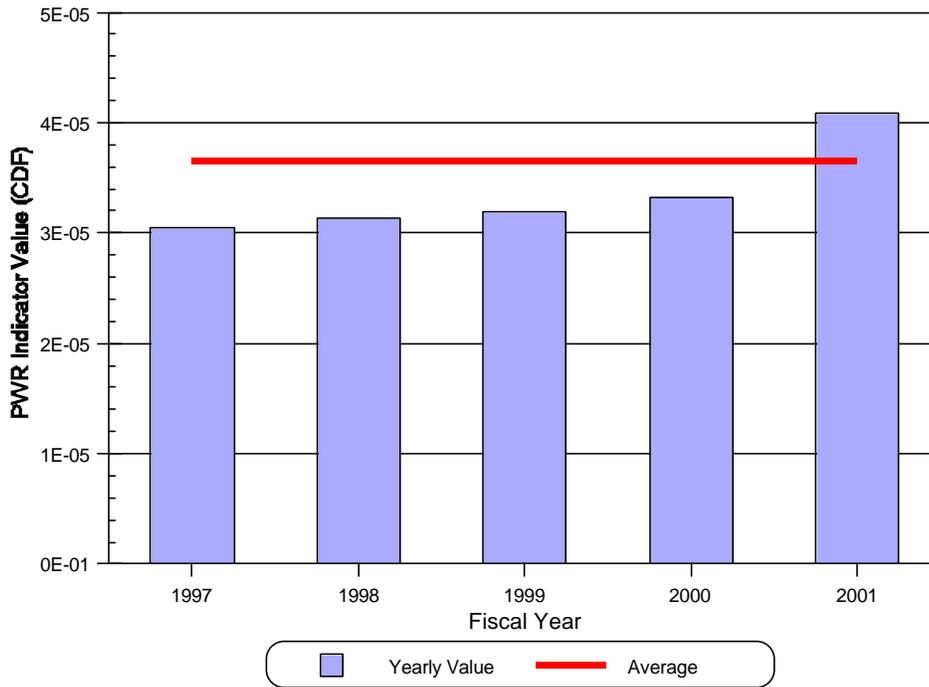


Figure A3-3 Example calculation for the IIEPI for PWRs