SUMMARY OF BASELINE RISK INDEX FOR INITIATING EVENTS: ANNUAL GRAPHS THROUGH FISCAL YEAR 2010

The Baseline Risk Index for Initiating Events (BRIIE) addresses the initiating event (IE) cornerstone in the U.S. Nuclear Regulatory Commission's Reactor Oversight Process for monitoring commercial nuclear power plants. It is based on plant performance for the 10 initiator events listed in the table below.

INITIATOR	ACRONYM	APPLICABLE PLANTS
General transient	TRAN	Both plant types, separately
Loss of condenser heat sink	LOCHS	Both plant types, separately
Loss of main feedwater	LOMFW	Both plant types
Loss of offsite power	LOOP	Both plant types
Loss of vital alternating current bus	LOAC	Both plant types
Loss of vital direct current bus	LODC	Both plant types
Stuck-open safety/relief valve	SORV	Both plant types, separately
Loss of instrument air	LOIA	Both plant types, separately
Very small loss-of-coolant accident	VSLOCA	Both plant types
Steam generator tube rupture	SGTR	Pressurized-water reactors (PWRs) only

The BRIIE program, described in NUREG/CR-6932, "Baseline Risk Index for Initiating Events (BRIIE)," issued June 2007, consists of two levels or tiers. The first tier considers individual IEs and evaluates performance based on statistical prediction limits. This evaluation is for the ongoing monitoring and early detection of possible industry-level deficiencies. A second tier is a risk-based integrated measure evaluated for each plant type. Because four of the initiators have separate data for each plant type, there are a total of 14 Tier 1 graphs.

The units for the Tier 1 IE frequency graphs are event counts for a fiscal year divided by the industry critical time for the year. The Tier 1 graphs also show the average frequency for an established "baseline period" and 95-percent prediction limits for a future year if occurrences continue at the same rate as in the baseline period. If industry data shift as time progresses, the baseline periods used to determine the prediction limits may no longer be relevant. The periods were originally developed to describe, roughly, calendar years 1998–2002.

In early 2010, the events were reviewed, and several events in the loss of condenser heat sink and loss of main feedwater categories were reclassified to more accurately reflect the actual impact on the plant. After the data were reclassified, the existing baseline periods were checked to see if any trends were present that would make the periods no longer appropriate for describing the ongoing data. Because such trends were not found, the baseline periods were not changed. However, new prediction limits were identified for these categories with reduced data that are more appropriate for the way ongoing events are now classified and that allow the Tier 1 BRIIE assessment to remain realistic and not overly conservative.

The prediction limits depend on the expected critical years of reactor operation in the upcoming year and on the baseline occurrence rate for each indicator. A rate can exceed a limit by having more events than expected or by having the same number of events and less critical time than expected. In recent years, U.S. nuclear power plant availability has been approximately 90 percent at the industry level. This figure enters into the calculations that determine the bounds on the number of events that might be expected.

For all of the initiators, the 2010 occurrence rates are lower than the associated Tier 1 prediction limits.

The Tier 2 integrated index includes, for each plant type, the relative contribution of each initiator to the risk of core damage, based on the events that occurred in each fiscal year. The event frequencies are converted to core damage frequency (CDF) estimates by multiplying by Birnbaum risk coefficients. These coefficients are industry averages of the contribution to core damage from each initiator as reflected in the industry standardized plant analysis risk models.

Figure 15 shows annual differences in estimated industry CDF compared to the established baseline levels of these quantities. The combined industry BRIIE value for 2010 (-3.39×10^{-6} per reactor critical year) indicates better than baseline industry performance and is well below the established reporting threshold of $\Delta CDF = 1.0 \times 10^{-5}$ per reactor critical year.

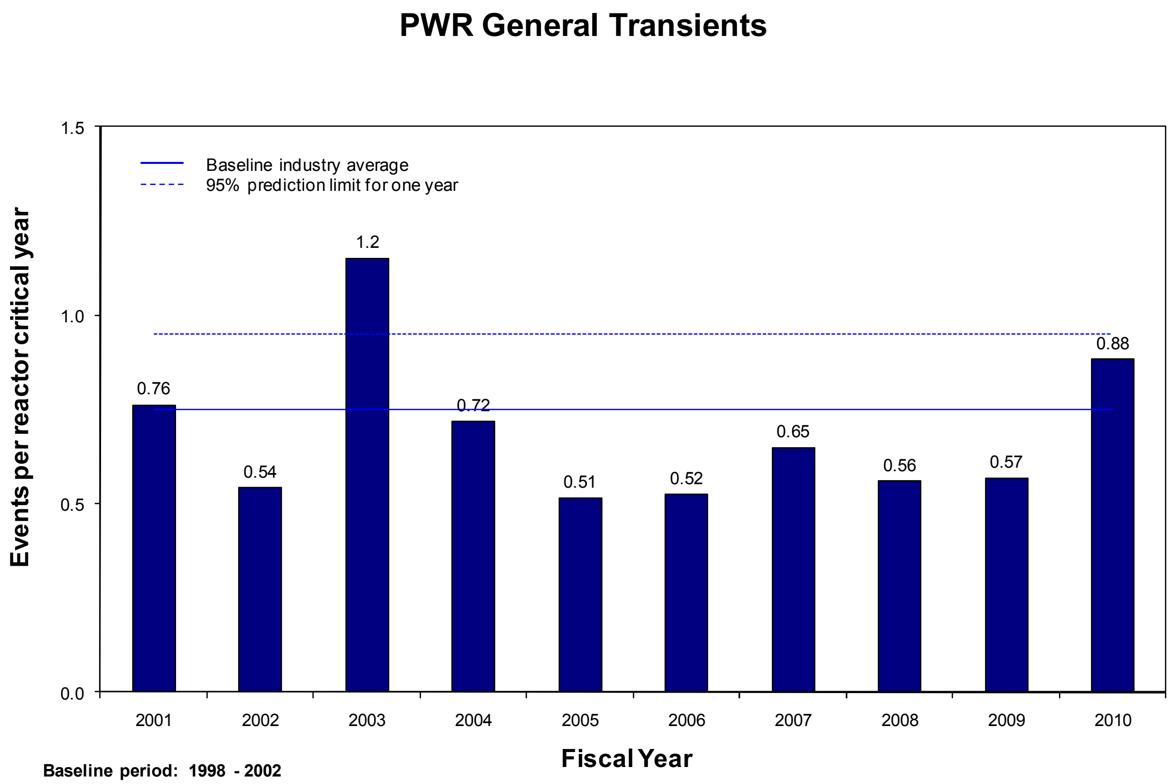

Figure 1 Pressurized-water reactor (PWR) general transients

BWR General Transients

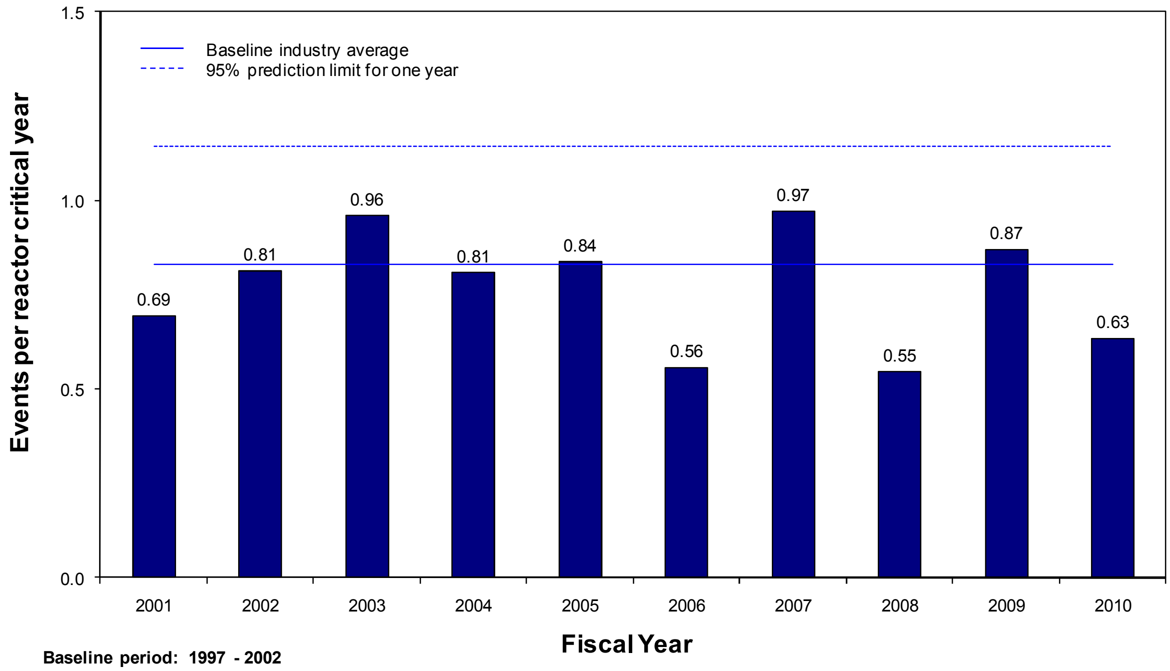

Figure 2 Boiling-water reactor (BWR) general transients

PWR Loss of Condenser Heat Sink

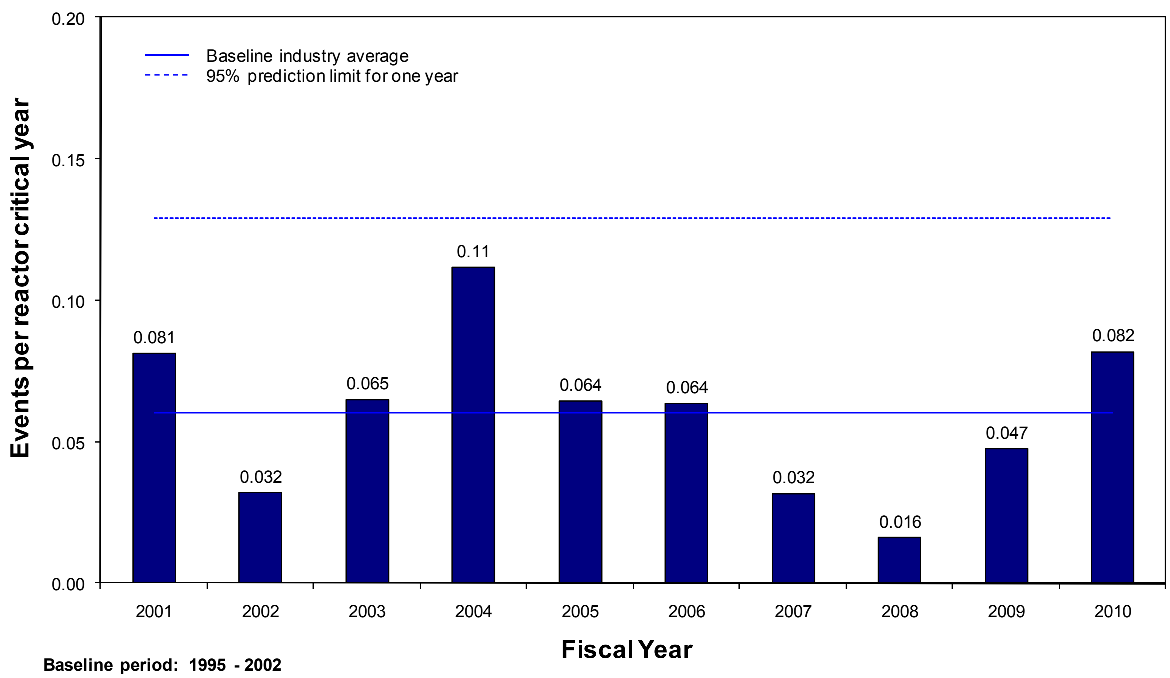

Figure 3 PWR loss of condenser heat sink

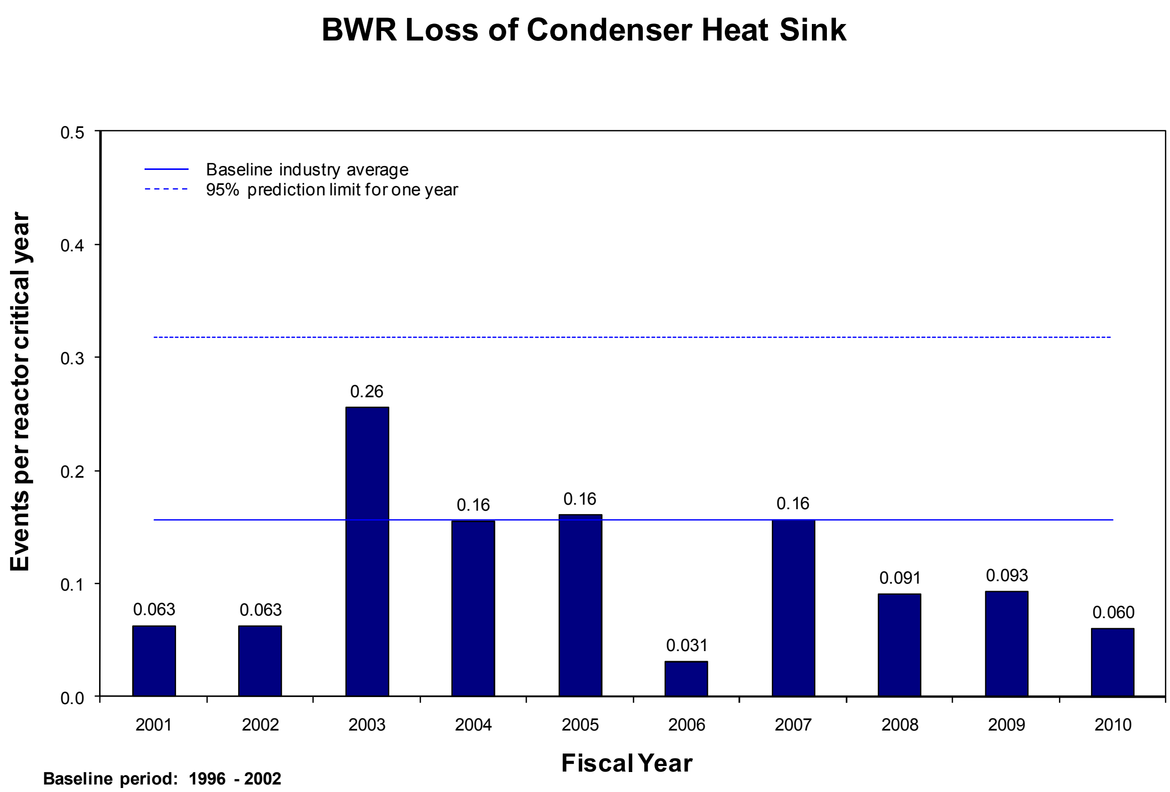

Figure 4 BWR loss of condenser heat sink

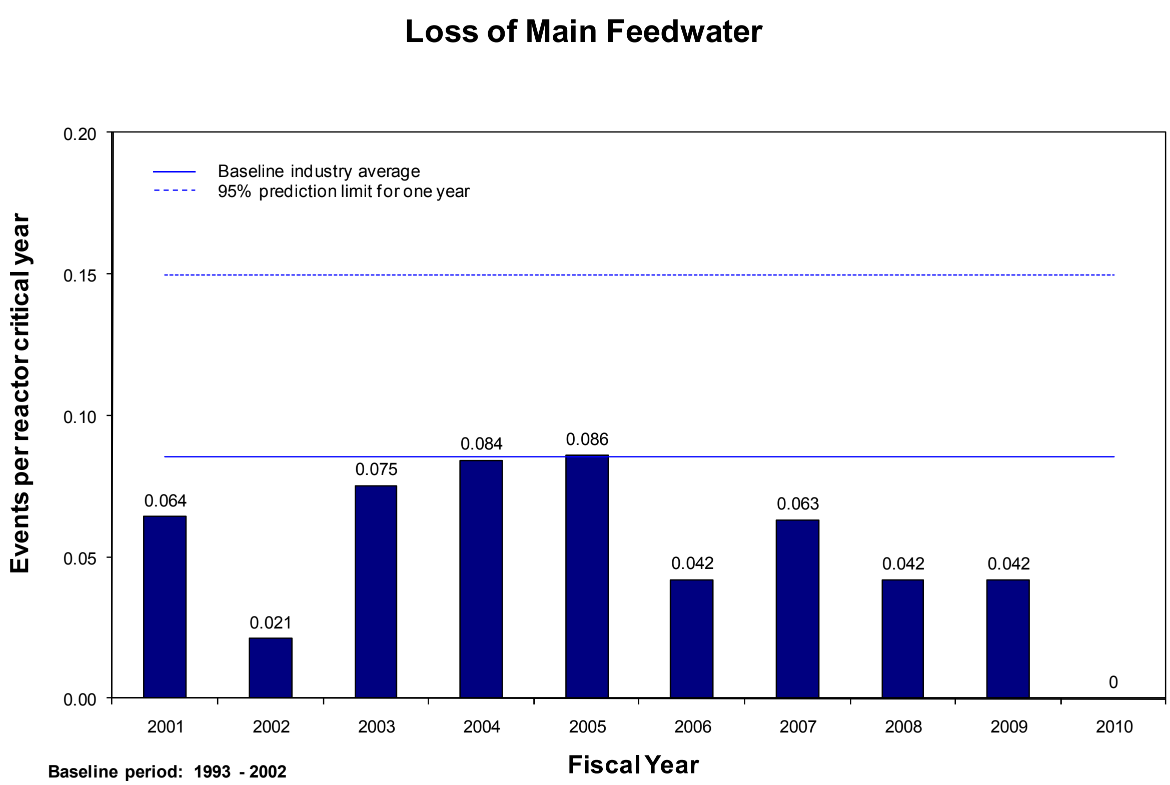

Figure 5 Loss of main feedwater

Loss of Offsite Power

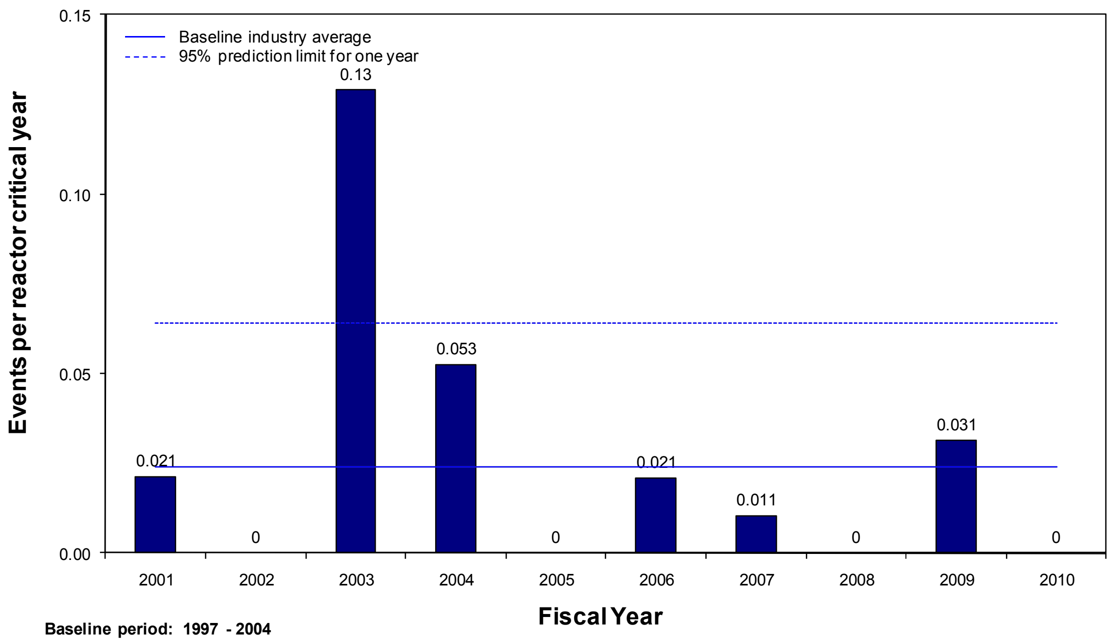

Figure 6 Loss of offsite power

Note that the prediction limit for loss of offsite power was calculated under the assumption that the nine such events that occurred during the 2003 blackout were a single event. This treatment results in a more conservative prediction limit.

Loss of Vital AC Bus

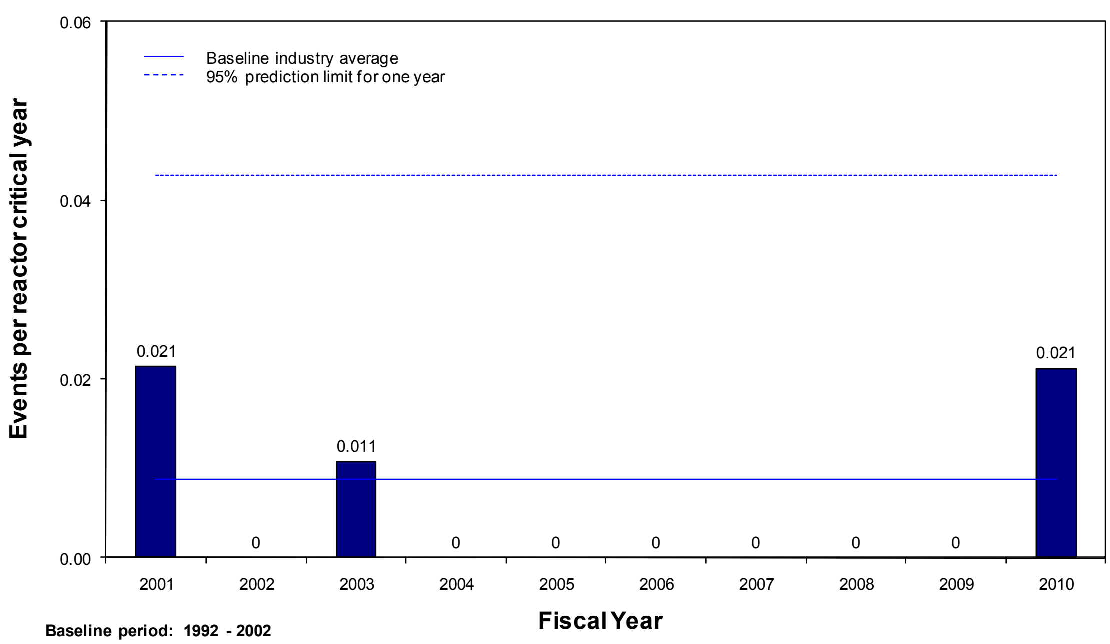

Figure 7 Loss of vital alternating current bus

Loss of Vital DC Bus

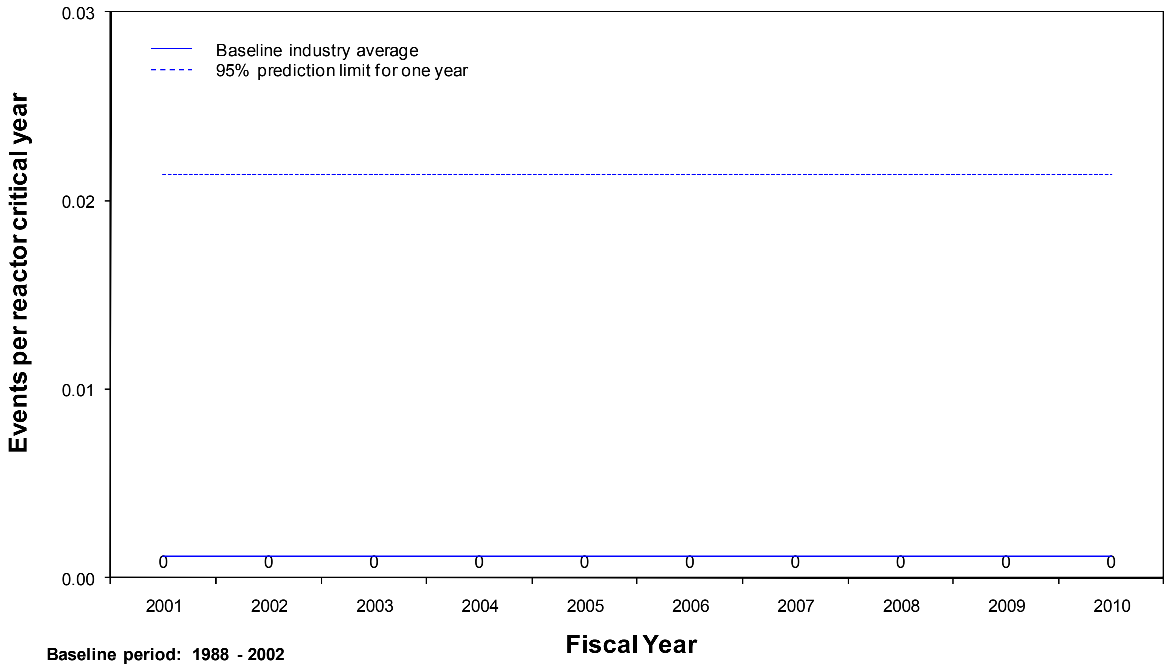

Figure 8 Loss of vital direct current bus

PWR Stuck Open SRV

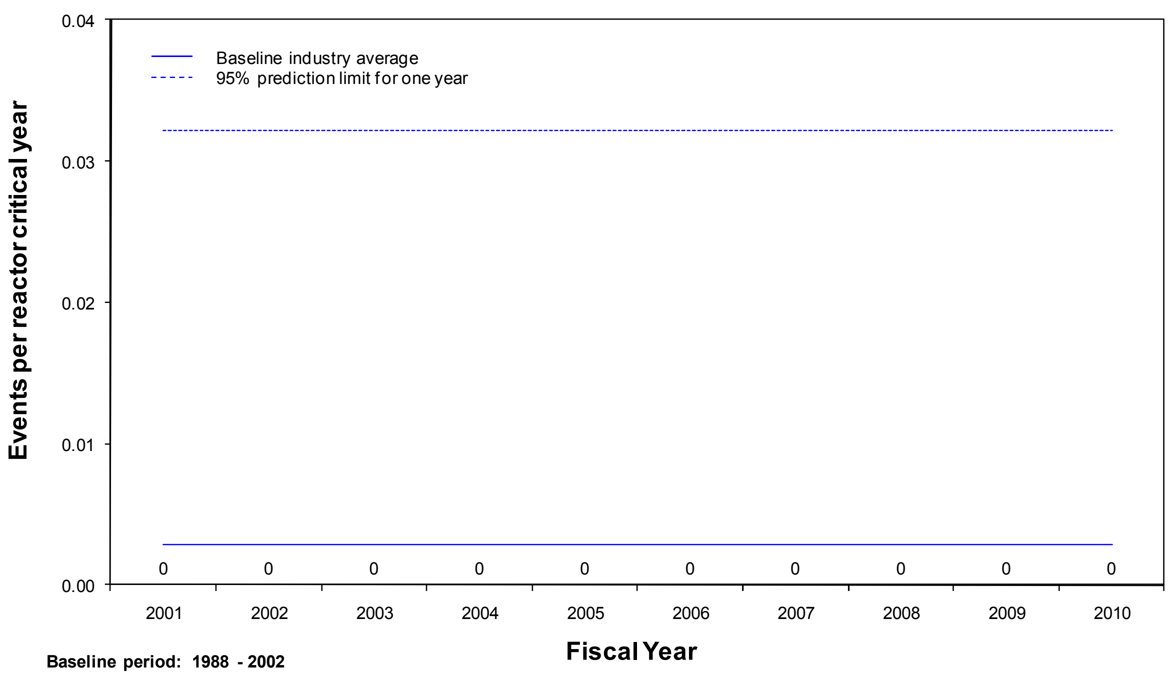

Figure 9 PWR stuck-open safety/relief valve

BWR Stuck Open SRV

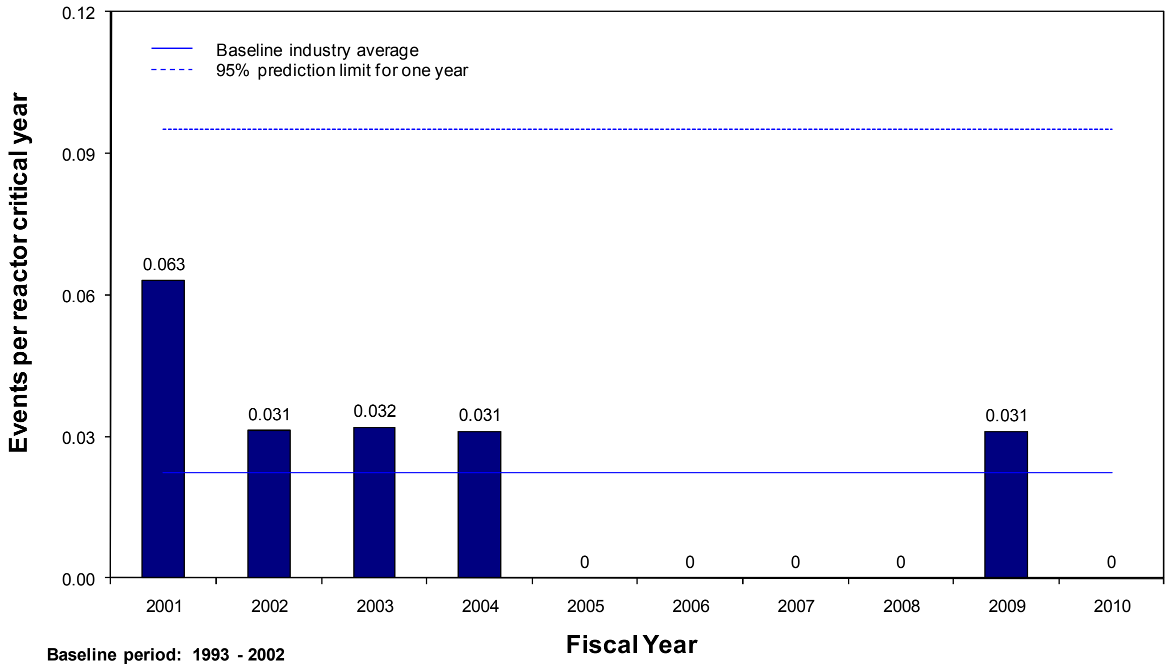

Figure 10 BWR stuck-open safety/relief valve

PWR Loss of Instrument Air

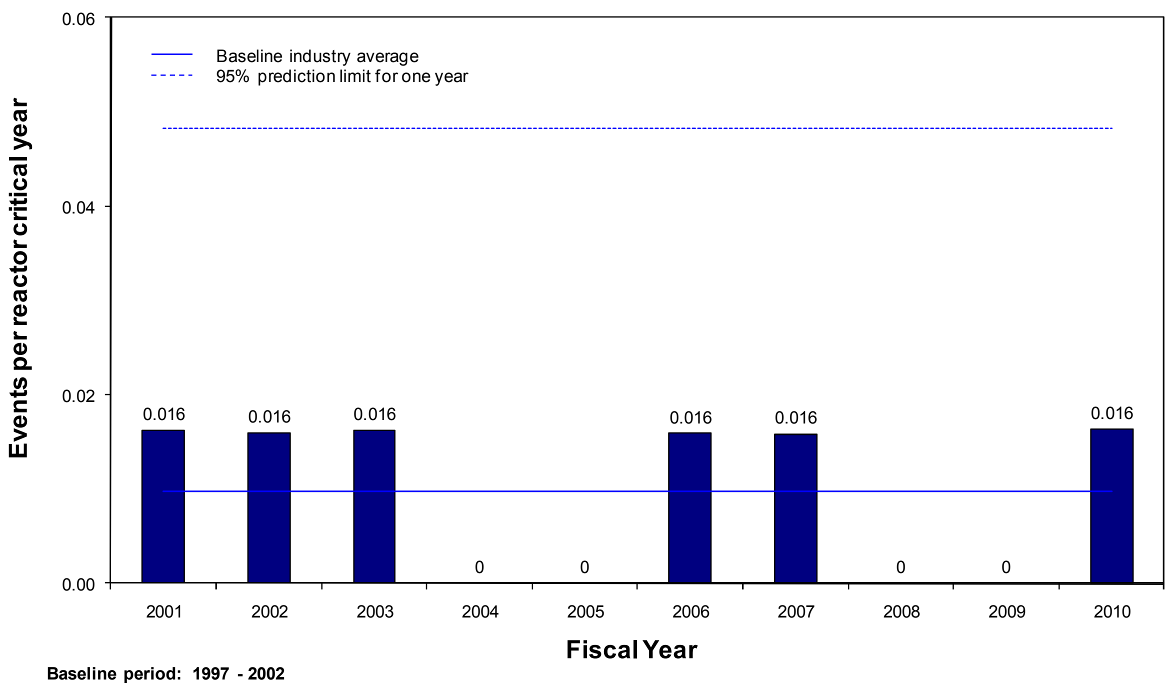

Figure 11 PWR loss of instrument air

BWR Loss of Instrument Air

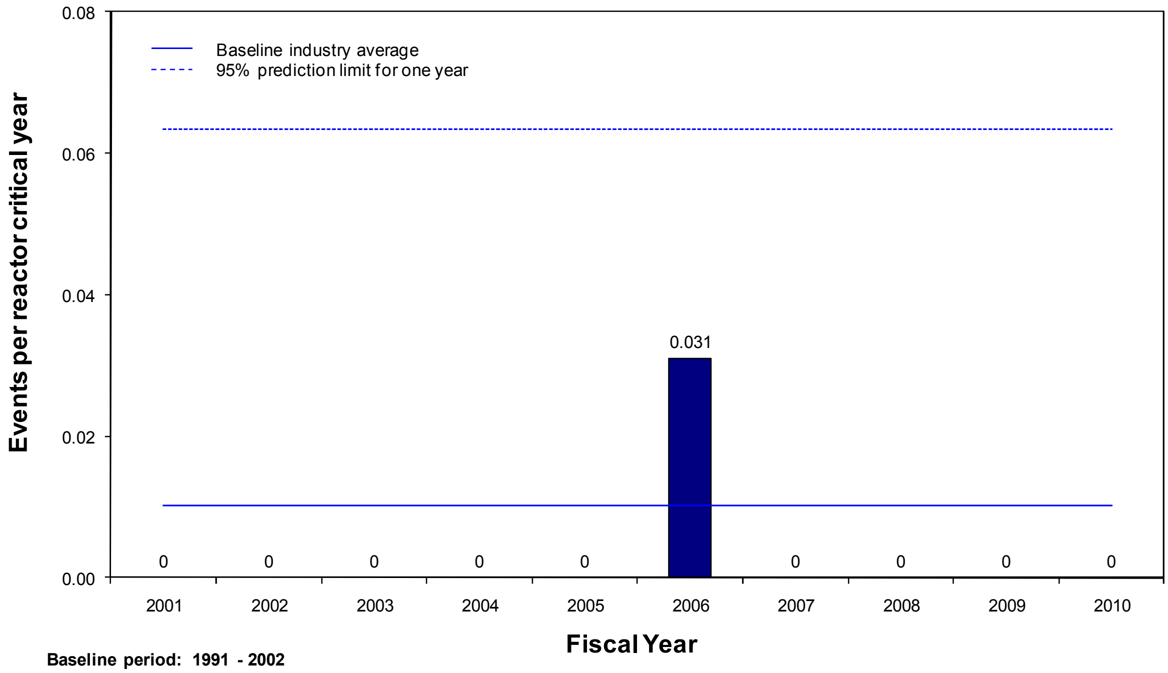

Figure 12 BWR loss of instrument air

Very Small LOCA

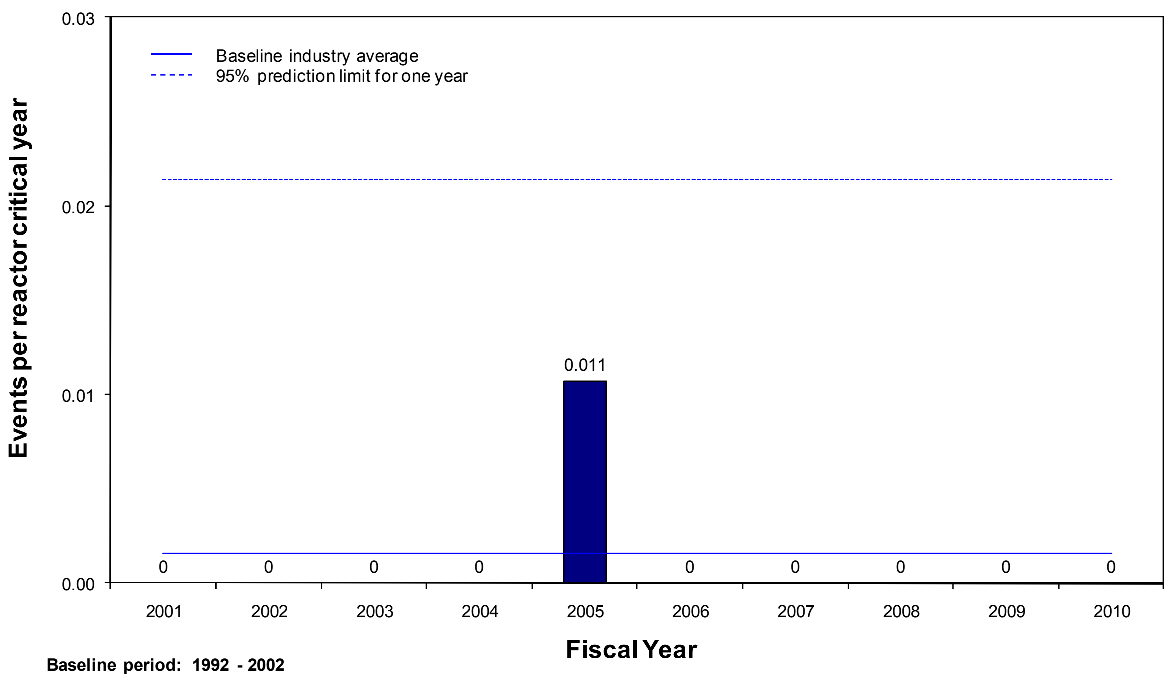

Figure 13 Very small loss-of-coolant accident

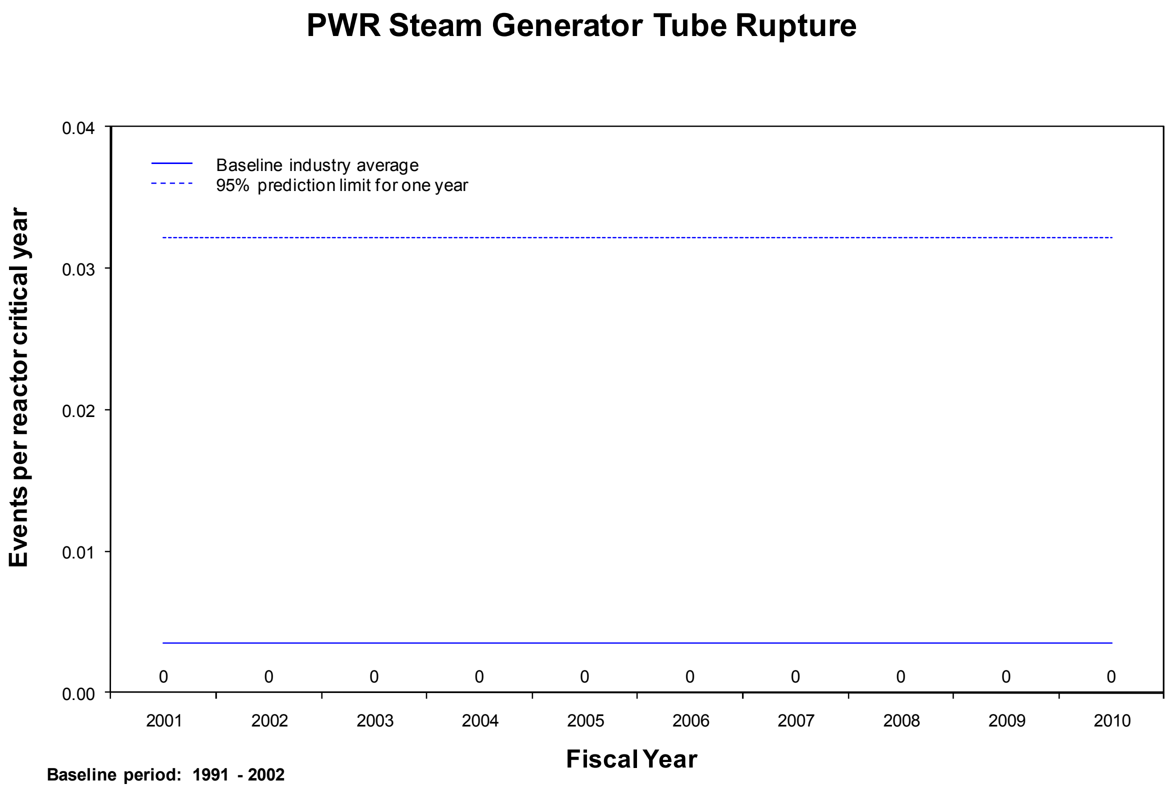

Figure 14 PWR steam generator tube rupture