January 10, 2005

TO: Mark H. Salley
Fire Research Team Leader
Probabilistic Risk Analysis Branch
Division of Risk Analysis and Applications
Office of Nuclear Regulatory Research

FROM: Sunil D. Weerakkody, Chief **//RA//**
Fire Protection Engineering and Special Projects Section
Plant Systems Branch
Division of Systems Safety and Analysis
Office of Nuclear Reactor Regulation

SUBJECT: Review of NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities"

The Division of Systems Safety and Analysis (DSSA) has completed its review of NUREG/CR-6850. This memorandum contains comments provided by the Plant Systems Branch (SPLB), Probabilistic Safety Assessment Branch (SPSB), and DSSA's Senior Level Expert in Probabilistic Risk Assessment (PRA). These comments reflect only areas where the reviewers believed enhancements could be made, i.e., positive comments were not included. Overall, the DSSA staff believes that this report is a significant step forward towards implementation of the risk-informed, performance-based alternative to Appendix R, namely 10 CFR 50.48[c]. It also provides methods that the licensees may use for risk-informed license amendments (e.g., using Regulatory Guide 1.174) as well as state-of-the-art fire PRAs. Comments from the individual reviewers on specific items are attached. A selected summary of the more high-level comments on Volume 2, "Detailed Methodology," follows.

1. General:

   Use dual units throughout the document, i.e., first SI units with English units in brackets. The NRC's metrication rules require the use of metric units for all measures, followed by the English equivalents in parentheses. For example, on page 8-2 the value of temperature is provided in SI units only while on page 8-7 temperature value is provided in English units.

2. General:

   During the development of several Phase 3 fire analysis reviews within SPSB, NUREG/CR-6850 was cited by the supporting contractor as the reference for specific data sets, such as fire frequencies and severity factors. The values cited in these reviews do not appear to be directly taken from NUREG/CR-6850, but instead from the database that was used for its development. Is this database going to be released for either general use or internal-NRC use? Without access to the database, we are put in an untenable position of trying to justify numbers, contained in NRC analyses, to NRC management and licensees

for which we and the licensees have no ability to trace and understand the application of these values from the NUREG/CR-6850 database to the Phase 3 products.

3. Page 3-10, Section 3.5.2.1, Item 7:
   Past non-conservative assumptions, with no simultaneous failures, should also be revisited (i.e., do not limit review only to past conservative assumptions).

4. Page 5-7:
   For unavailable trains (as represented by their major components), some PRAs incorporate average test/maintenance (T/M) unavailabilities, i.e., average train unavailabilities derived from plant-specific data. Rather than set these values to 1.0 if unaffected by the fire, it would be appropriate to leave them at their nominal T/M values since the fire may or may not occur when the train is out-of-service for maintenance. An “a priori” setting of these failures to 1.0 or TRUE would overestimate the ICDP and ILERP for a fire initiator that does not affect those trains per se.

5. Page 6-2:
   The 37 bins cited in Table 6-1 do not appear to be all inclusive. For example, some plants have gas turbines instead of diesel generators. In the FP SDP, frequencies are listed in Table A4.1 for gas turbine generators, but not in NUREG/CR-6850 Table 6-1. (See General Comment 2 regarding availability of the database.)

6. Page 11-12:
   Section 11.3.7, Assumptions, First Bullet. In this assumption, the analysis is limited to a single fire occurring at any given time; this is not a valid assumption. Often fire in one compartment spreads to an adjacent compartment very rapidly, resulting in multiple fires.

7. Page 19-2:
   The CCDP is conditional not only on the fire initiator but also on non-detection/non-suppression of the fire, etc. Generally, it is conditional on all aspects specific to the fire (ignition, detection/suppression, severity) and any damage done to components directly by the fire. Only the non-fire-induced failures and aspects remain for the CCDP.

8. Table 7-2:
   The screening criterion for a compartment is CDF < [highest fire ignition frequency] * [CCDP for case where the general plant transient internal initiating event is set to 1.0 and ...]. The text points to Appendix D as a basis, where the discussion argues that a total fire induced CDF of 1E-06 can be regarded as very small. The formulation of the cumulative screening criterion attempts to scale this to the plant-specific CDF using a factor of 10% for the fire-induced

CDF. The development of the criterion for individual fire compartments is not clear.

- What does the "highest fire ignition frequency" refer to? Higher with respect to what? I did a quick search but did not find the term in Section 6, though I may have missed it.

- What is the justification for combining the highest fire ignition frequency with arguably the lowest CCDP to set the screening criterion?

While the use of screening criteria may be acceptable for an evaluation of CDF/LERF, it may not be appropriate for all applications. In particular, applications that lead to modifications to the CCDP/CLERP or an increase in the frequency of damaging fires may need to be revisited. There should perhaps be a note to this effect.

9. Volume 2, Appendix V, Discussion of Individual Task Uncertainties:

Most of the discussion in Appendix V addresses issues such as completeness, level of detail, whether approximations are appropriate (related to level of detail), and whether methods have been applied correctly. The strategy given to address these "not-quite and largely unquantifiable uncertainties," i.e., use quality reviews, while certainly appropriate, is not what is traditionally called "uncertainty" in the context of a PRA uncertainty analysis. This term is typically reserved for addressing the degree of belief that a particular model is more credible than another model, or to address the uncertainty in parameter values. However, there is relatively little guidance on how to address these "traditional" uncertainties. For example, there is no discussion on "developing multiple models for an issue" (page 15-4), unless it has been covered in the individual chapters or appendixes (in which case it would help to have cross-references). In addition, there is not much guidance in the HRA chapter on characterizing the uncertainty.

Contact: Ray Gallucci, 301-415-1255
NRR/DSSA/SPLB

| | | | | |
|---|---|---|---|---|
| DISTRIBUTION: | R Gallucci | D Frumkin | R Wolfgang | N Iqbal |
| JS Hyslop | J Hannon | R Perch | F M Reinhart | G Parry |
| M Tschiltz | M Johnson | S Black | D Lew | SPLB-B R/F |

DOCUMENT ACCESSION NO: ML043490032 Attachment - ML043490017

| OFFICE | NRR:DSSA:SPLB | | NRR:DSSA:SPLB | | NRR:DSSA:SPSB | | NRR:DSSA:SLA | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| NAME | Gallucci:sf | | Weerakkody | | Reinhart | | Parry | | | |
| DATE | 01/10 /05 | | 01/10/05 | | 01/11/05 | | 01/11/05 | | | |

Official Record Copy