

**February 7, 2007**

**MEMORANDUM TO:** Sunil Weerakkody, Branch Chief  
Fire Protection Branch  
Division of Risk Assessment  
Office of Nuclear Reactor Regulation

**FROM:** Paul W. Lain, Sr. Fire Protection Engineer */RA/*  
Fire Protection Branch  
Division of Risk Assessment  
Office of Nuclear Reactor Regulation

**SUBJECT:** SUMMARY OF JULY 24, 2006, CONFERENCE CALL REGARDING  
PILOT PLANT (SHEARON HARRIS) TRANSITION TO NATIONAL FIRE  
PROTECTION ASSOCIATION STANDARD (NFPA) 805

On January 24, 2007, the Nuclear Regulatory Commission (NRC) staff from Headquarters and Region II, with support from Pacific Northwest National Laboratory and Sandia National Laboratory, participated in a teleconference with Progress Energy's National Fire Protection Association (NFPA) 805 transition team regarding the development of their fire probability risk assessment (PRA). A list of meeting attendees is attached to this memorandum (enclosure 1). The subjects of the discussion were the analyses and supporting procedures for performing plant partitioning and fire frequency calculations. Progress Energy recorded the NRC issues, answering those that they could, and are retaining the rest for subsequent disposition. The Staff's comments are listed in the attached tables (enclosure 2) and communication of their resolution will be discussed at the next observation visit.

Enclosure:  
As stated

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DATE	01/26/2007	01/26/2007	02/07/2007

FPA 805 PILOT CONFERENCE CALL  
LIST OF ATTENDEES  
July 24, 2006

**NRC/HQ**

R. Gallucci  
S. Dinsmore  
J. Circle  
P. Lain  
D. Frumkin

**NRC/RII**

W. Rogers  
N. Merriweather  
K. Miller  
B. McKay

**PNNL**

T. Blackburn  
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**PROGRESS ENERGY**

K. Hefner  
J. Ertman  
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R. Davis  
A. Holder

**Duke Power**

B. Weaver

## NRC COMMENTS ON HNP-F/PSA-0071: HARRIS FIRE PRA – FIRE IGNITION FREQUENCY CALCULATION

Section 3.0:

Assumption 3: NUREG/CR-6850, Section 6.3.2, second assumption specifically refers to "quantity", which is not referenced in assumption 3. {pnnl}

Assumption 6: This uses the phrase "out of project scope," which sounds like a contractual or procedural exclusion. There should be a technical basis for excluding locations, not just that they are "out of scope." {pnnl}

Assumption 7: Is there a potential for "masking" (overestimating the CDF from some fire compartments/scenarios such that others may not appear as risk significant when they should) due to the double counting? How will you ensure that the double counting does not lead to masking? {ray}

Assumption 8: It appears that switchyard components should be binned with Yard Transformers (bin 27, 28 or 29). Per Table 6-2 in the NUREG, the "Transformer Yard" may also be referred to as the "Switchyard." {pnnl}

Section 4.1:

[1] This section defines the global boundary by referring to "equipment credited in the Fire PRA model." NUREG/CR-6850, Section 1.5.1, states, "define this boundary so that all locations with the potential to contribute visibly to fire risk are captured." The global boundary should be defined in the context of this NUREG definition rather than "credited equipment."

[2] The asterisked note is confusing in that it appears to apply to all "areas" because it starts out with the word "areas," which is also used in the lead in the sentence above the bullets. In reading the note, it seems to apply only to the Emergency Service Water Intake Structure. {pnnl}

Section 4.2:

For the Paint Shop example, what is the basis for concluding that spread of a potential fire to another area is very unlikely? Should this basis be discussed in Attachment 2? {ray}

Section 4.3:

[1] Do all fire compartments have physical boundaries (walls, ceilings, floors, etc., whether or not fire-rated)? Is spatial separation used as a pseudo-boundary for any compartments? {ray}

[2] This section uses the phrase "credited in the Fire PRA." See previous comment [1] on Section 4.1. {pnnl}

[3] The 3rd paragraph refers to "a couple of compartments [that] are separated by non-fire-rated barriers." Recommend that the sentence specifically name these compartments so that the reader can easily find them in the tables. {pnnl}

Table 4.2:

[1] Under Justification, the word "concreted" is used many times. What does "concreted" mean? Is this the same as a concrete wall? NUREG/CR-6850, Section 1.5.2, states that a non-rated "well sealed concrete wall with a minimum thickness of 4 inches would be considered an adequate partition ..." How does "concreted" compare with this statement? {pnnl}

[2] Compartment 1-A-34-RHXA Justification states "... but non-rated walls on elevation 236." The table should justify why the non-rated walls are adequate. {pnnl}

[3] The names are not consistent with guidance in Section 1.5.2 of NUREG/CR-6850, which notes that it desired that fire compartment names use the fire area (or zone) designations identified in the fire protection program. It gives an example of when a fire area is portioned into three fire compartments. Table 4.1 in HNP-F/PSA-0071 uses compartment names identical to fire area names when there is direct mapping. However, it is difficult to understand the logic behind the compartment naming in Table 4.2 when the one-to-one mapping does not occur. For example, compartment "1-A-BAL-A" contains many of the fire zones contained in fire area "1-A-BAL-A", but so does compartment "1-A-34-RHXB." Sometimes the names in Table 4.2 are entirely new, other times they map to a fire zone, and sometime to a fire area, even when some zones in the area are not included. This is confusing and not consistent with the guidance. {pnnl}

Table 5.1:

In the Justifications at end of table, 23.a states that transformers were in out of scope areas. See previous comment on Assumption 6 of Section 3.0. {pnnl}

Section 5.2.1:

[1] When determining the total number of components of each type for frequency apportioning, do you include components outside the global analysis boundary as well as components in qualitatively (or for other reason) screened areas within the global analysis boundary? If not, why not? {ray}

[2] For the four Diesel Fuel Oil Tank compartments, is the presence of diesel fuel oil as a combustible being handled via the transient source allocation as opposed to the fixed source allocation? If not, how is the potential for a diesel oil fire due to, say, a leak from a tank or attached piping being treated? {ray}

Section 5.2.2:

[1] The equations for fire ignition frequency provided in FPIP-0206 and used in calculation HNP-F/PSA-0071 do not use the same nomenclature for describing compartment (J) and locations (L). The array designators are sometimes included and other times dropped while retaining the "J" and "L" descriptions of compartments and locations. The equations are similar and the intent is apparent, but they do not work as written and annotated in FPIP-0206. {pnnl}

**NRC COMMENTS ON HNP-F/PSA-0071: HARRIS FIRE PRA – FIRE IGNITION FREQUENCY CALCULATION**

[2] This section says about occupancy weighting, "The dissemination of the weight factors is not normally distributed, but it does accurately reflect the occupancy variation among compartments at the plant." It is unclear what is being described here. Is there a Normal Distribution (versus lognormal) being applied? Is this weighting factor usually the same for all compartments at a plant? {pnnl}

[3] Regarding the categorization of cable run and junction boxes as transients, cable run (self-ignited cable fire) and junction box sources are placed in the transient bin since cable loading is used for each as a scaling factor. However, transient analysis relies on one or more factors: maintenance, occupancy, and storage. Since cable run and junction boxes are fixed sources and do not rely on the above factors, we recommend categorizing cable run and junction boxes as fixed sources. {js}

Table 5.3:

[1] Why is the Storage Weighting Factor for 12-O-TA and 12-O-TB "1" when you use "3" for 1-D-DTA and 1-D-DTB? The descriptions from Table 6-3 of NUREG/CR-6850 seem to indicate 3 is appropriate for all four compartments. {ray}

[2] The justifications provided in Attachment 3 for the values in Table 5.3 do not match the criteria established in NUREG/CR-6850. For example, 12-I-ESWPA lists storage as "Little or no storage" for justification of use of a "1" in this compartment. Table 6.3 of NUREG/CR-6850 lists a "1" for storage as "Compartment where no combustible/flammable materials are stored." How is "little" equivalent to "no"? {pnnl}

Section 6.1:

This claims that "the sum of all compartments is also equal to the sum of all the given generic frequencies, excluding those not used." However, numerical values for this check are not provided. {pnnl}

Attachment 2:

For Buildings Screened from analysis, the Justification column includes the same statement for every item, "Fire will not lead to plant trip or affect any PSA equipment or safe shutdown." This just restates the criteria provided in section 4.5 of NUREG/CR-6850. Justification should be provided as to why the location could not contribute to fire risk, as required in NUREG/CR-6850, Section 1.5.1. {pnnl}

General comment:

The procedure (FPIP-0206) and calculation (HNP-F/PSA-0071) "invent" a lot of terminology that is defined in the guidance documents. Use of the reference criteria and terminology would make the material a lot easier to review and understand. {pnnl}

**NRC COMMENTS ON FPIP-0206: FIRE PRA FIRE IGNITION FREQUENCY PROJECT INSTRUCTION**

Section 9.2.2:

[1] Appendix M of NUREG/CR-6850 states that "Switchgear, load centers, and bus bars/ducts (440V and above) are subject to a unique failure mode and, as a result, unique fire characteristics. In particular, these types of high-energy electrical devices are subject to high-energy arcing fault (HEAF)." Similarly, NRC Inspection Manual Chapter 609, Appendix F, states that "Both switchgear and load centers (440V and above) are subject to a unique failure mode and, as a result, unique fire characteristics. In particular, these types of high energy electrical distribution and switching panels are subject to electrical arcing failures." Unless Harris has no switchgear between 440V and 1000V, what is the basis for considering HEAFs only in switchgear rated above 1000V? Is a distinction being drawn between "catastrophic" faults (above 1000V) and "non-catastrophic" (440V-1000V)? {ray}

[2] The statement is made that HEAFs are identified only for greater than 1KV in this process document. However for frequency worksheets, 480-V switchgear are assigned to HEAF. This issue is being addressed under the FAQ process. {js}

Section 9.2.4:

Regarding the Junction Box Frequency issue, the Table assigned a value of 0 for junction box frequency in this section. According to NUREG/CR-6850, junction boxes are assigned a generic frequency of 1.9E-3. In Section 5.0, where frequency analysis is actually done, 1.9E-3 is actually used for junction boxes. {js}

Section 9.4.1:

The phrase "unusual fire occurrence patterns at the plant" seems to be treated as equivalent to what Chapter 6 of NUREG/CR-6850 would cite as more than "a small number of fire events in the plant," as justification for plant-specific Bayesian update of the generic fire frequencies in the NUREG/CR. If this is true, then the term "pattern" may be misleading. If not, then the lack of plant-specific Bayesian updating may be inappropriate. {ray}

Section 9.4.2:

With regard to Bayesian analysis and the values found in NUREG/CR-6850, Table C-3, this section notes "it is recommended that the distribution type be assumed to lognormal." NUREG/CR-6850, Section 6.5.3 and Section C.2, already assume the Table C-3 values are lognormal. Deviation from this underlying assumption would need to be justified. {pnnl}

**NRC COMMENTS ON FPIP-0206: FIRE PRA FIRE IGNITION FREQUENCY PROJECT INSTRUCTION**

General comment:

[1] "Should" and "shall" are defined in Section 3.0 of each procedure, but then are not necessarily used in the procedures. Procedures often use common, but undefined synonyms, e.g., "will" and "must." {pnnl}

[2] "Should" is used in the procedures in places where it would be more appropriate to use "shall." While flexibility is required and the use of "shall" would limit these procedures, they seem too flexible and draw attention to what should be non-issues. For example, in FPIP-0206, Section 9.2, a reviewer would be interested as to when an identified ignition source would not be assigned to an appropriate bin or when the number of ignition sources in a compartment would not be counted. More interesting is the example from PI-FPIP-NGG-0200, Section 9.4, concerning the apparent option to have the person performing a walkdown also do the validation of the walkdown. {pnnl}

**NRC COMMENTS ON HNP FIRE PRA COMPONENTS SELECTION (TASK 2) REPORT**

Sections 2.5 and 2.5.1:

"Initiating" Events PRA should be "Internal" Events PRA. {ray}

Table 1:

When dismissing PRZR level and pressure transmitter failures as applicable to the Fire PRA model, based on subsumation by other initiators, are basic events for these failures still being added to the PRA model to reflect fire-induced probabilities (in addition to presumably already present ones due to "random" causes)? {ray}

Section 2.5.2.1:

When stating that "initially, none of these [Tables 2 and 3] systems would be summarily counted as 'failed' in a fire scenario," presumably this still allows for "automatic" failure of the components/systems given a specific fire scenario (i.e., basic events pre-set to TRUE/FAILED via a FLAG file per fire initiator). {ray}

Section 2.5.2.2:

This section (and Step 2.2?) does not exist. {ray}

Section 2.5.2.4:

If spurious operation led to the same failure mode as one already modeled via a basic event in the Internal Events PRA, was a new basic event added for the spurious operation failure mode, with a unique, fire-induced probability? {ray}

Table 3:

What does it mean to have a system in SSEL, but to have too little equipment to credit its function? For example, Main Feed is in SSEL; however, the main feed pumps, feed reg. valves, etc., are not in SSEL. Why is the Main Feed listed in SSEL? What does this mean? {js}

Section 2.5.3:

"... most cases the transient is [DELETE] event is initially assumed ..." {ray}

Section 2.5.4:

[1] Was the Internal Events PRA queried for potential component combinations whose multiple spurious operation could have adverse consequences? Was this covered in Section 2.5.6 (Step 6)? {ray}

[2] In the component list, regarding single spurious operation for non-SSEL items, Section 2.5.2 indicates that spurious actuations are in the internal events PRA model. A few SSEL equipment spurious actuations are added to the PRA model for that equipment in common to both the SSEL and internal events PRA (Att. 3). Were the PRA systems relying on equipment not in common with the SSEL examined for additional spurious actuations beyond the original internal events PRA model? If not, what was the justification? {js}

Section 2.5.7:

While Attachment 1 contains the RAW-ranked PRA components without cable routing currently in the Internal Events PRA, should not a similar list be generated for the F-V-ranked components? RAW correctly ranks components for which an assumption of failed (vs. the currently used failure probability) will increase the current CDF. However, there may be components with currently high failure probabilities contributing significantly to CDF (and possessing high F-V's, but low RAWs) which could still contribute significantly to fire CDF that are not risk-significant in RAW space. Both the RAW and F-V importance lists should be reviewed. {ray}

**NRC COMMENTS ON ENGINEERING CHANGE – EC 54965 R0**

Methodology:

With regard to "brainstorming" in the multiple spurious approach, what structure was followed to identify those combinations of multiples incorporating non-safe-shutdown equipment? {js}

Attachment P - Evaluations:

(1) "Not a concern in this fire area using current licensing basis, alternate shutdown is provided." This "Discussion" is cited throughout the Evaluations table. Is this *a priori* dismissal of potential spurious actuations in the fire

### **NRC COMMENTS ON ENGINEERING CHANGE – EC 54965 R0**

compartment/area? For the fire PRA, the probability of failure of alternate shutdown needs to be considered (i.e., crediting of alternate shutdown is not a given as in deterministic space) and, unless the joint likelihood of its failure coupled with the spurious actuations is very low, the spurious actuations should not be *a priori* dismissed based on "current licensing basis."

(2) There are other such "Not a concern" citations throughout the table, and the same caveat applies as well (cannot *a priori* dismiss because something else is credited unless the joint failure probability is very low). (3) Similarly, "credit" for "manual action in control room" is cited, and the same question applies - does this indicate *a priori* dismissal of the spurious actuation from the fire PRA? (4) "Cable protection" is also cited among the Discussions, to which this same concern applies. (5) What are the implications of the Discussion citation "Modeled in CAFTA fault tree model, dispositioned in FSSPMD?" Are the spurious actuations candidates for the fire PRA? {ray}

### **NRC COMMENTS ON PI-FPIP-NGG-0202: FIRE PRA PLANT BOUNDARY DEFINITION AND PARTITIONING PROJECT INSTRUCTION**

Section 3.2:

[1] "A Fire Compartment is a location ... bounded by features for which there is reasonable confidence ... of preventing the spread of fire." Does "reasonable confidence" imply physical barriers (not necessarily fire-rated), or is spatial separation (or some other "non-barrier-type" protection) credited in any cases? Section 9.3 seems to imply that some compartments may have non-physical boundaries. On the other hand, Section 9.3.5 seems to imply the presence of a physical barrier in all cases. {ray}

[2] "Fire Compartment" is defined in FPIP-0202, FPIP-0206 and FPIP-0201 using one definition, and PI-FPIP-NGG-0200 using slightly different wording. While similar, neither definition uses that from NUREG/CR-6850, "a fire compartment is a well-defined volume within the plant that is expected to substantially contain the adverse effects of fires within the compartment." These two definitions are not equivalent, especially considering the difference between "preventing the spread of fire" and "substantially contain the adverse effects of fires" {pnnl}

Section 9.2.3:

If a building or structure is screened based on the bullets, does this include consideration of the potential for fire spread from the screened location to adjacent locations for which one or more of the bullet requirements would not be satisfied (i.e., for which plant trip, shutdown, mitigation capability, etc., may be required)? {ray}

Section 9.3:

If multi-compartment analysis (MCA) is used to evaluate breach of a fire compartment boundary, does that imply the presence of an actual physical barrier (even if non-fire-rated), or is MCA being used to compensate for the creation of "pseudo-compartments", separated only by spatial or other non-physical barriers? Section 9.3.5 seems to imply the presence of a physical barrier in all cases. {ray}

### **NRC COMMENT ON WALKDOWN PACKAGE FOR 1-A-SWGRA**

Hand-written list and schematic indicate presence of "MUX Units" (CIO-11H0052 and CIO-11H0056), but neither is shown in the EXCEL/ACCESS equipment list table. {ray}

### **NRC COMMENT ON PI-FPIP-NGG-0200: PI-FPIP-NGG-0200 FIRE PRA WALKDOWN INSTRUCTIONS PROJECT INSTRUCTION**

"Should" is used in the procedures in places where it would be more appropriate to use "shall." While flexibility is required and the use of "shall" would limit these procedures, they seem too flexible and draw attention to what should be non-issues. For example, in FPIP-0206, Section 9.2, a reviewer would be interested as to when an identified ignition source would not be assigned to an appropriate bin or when the number of ignition sources in a compartment would not be counted. More interesting is the example from PI-FPIP-NGG-0200, Section 9.4, concerning the apparent option to have the person performing a walkdown also do the validation of the walkdown. {pnnl}