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WCAP-15830-P, Rev 1/WCAP-15830-NP, Rev. 1
Project Number 694

December 21, 2007

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Document Control Desk
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Washington, DC 20555-0001

Subject: Pressurized Water Reactor Owners Group
Response to Additional Requests for Information for WCAP-15830-P, Revision 1, "Staggered Integrated ESF and LOOP Surveillance Testing at CE NSSS Plants," (OSC-0367)

References:

1. WOG Letter, F. Schiffley to Document Control Desk, "Submittal of WCAP-15830-P, Revision 1, "Staggered Integrated ESF and LOOP Surveillance Testing at CE NSSS Plants," WOG-07-339, July 27, 2007.

2. NRC Letter, T. Mensah (NRC) to G. Bischoff (W), "Request for Additional Information Re: Pressurized Water Reactor Owners Group (PWROG) Topical Report (TR) WCAP-15830, Rev. 1, "Staggered Integrated ESF [Engineered Safety Feature] Testing," TAC No. MD6206, November 1, 2007.

3. NRC Letter, S. Peters (NRC) to G. Bischoff (W), "Request for Additional Information Re: Pressurized Water Reactor Owners Group (PWROG) Topical Report (TR) WCAP-15830, Rev. 1, "Staggered Integrated ESF [Engineered Safety Feature] Testing," TAC No. MD6206, December 13, 2007.

In July 2007, the Pressurized Water Reactor Owners Group (PWROG) submitted WCAP-15830-P, Revision 1, "Staggered Integrated ESF and LOOP Surveillance Testing at CE NSSS Plants" for NRC review and approval (Ref. 1). In November 2007 and December 2007 the NRC

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provided Requests for Additional Information (RAIs) on WCAP-15830 (Ref. 2 and 3). Enclosures 1 and 2 to this letter provide the responses to the RAIs in Ref. 2 and 3. The PWROG response to the RAIs also includes mark-ups to WCAP-15830-P which are provided Enclosure 3 and will be incorporated into the approved version of WCAP-15830.

Enclosure 3 contains information proprietary to Westinghouse Electric Company LLC and is supported by an affidavit signed by Westinghouse, the owner of the information (Reference 1). The affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission and specifically addresses the considerations listed in Section 2.390, paragraph (b)(4), of the Commission's regulations. Accordingly, it is respectfully requested that this information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR Section 2.390 of the Commission's regulations.

If you have any questions concerning this matter, please feel free to call Ken Vavrek at (412)-374-4302.

Sincerely yours,

for

Frederick P. "Ted" Schiffley, II, Chairman
Pressurized Water Reactor Owners Group

FPS:JPM:las

Enclosures (3)

cc: PWROG Steering Committee
PWROG Operations Subcommittee
PWROG Risk Management Subcommittee
PWROG Project Management Office
S. E. Peters, NRC O-7E3
J. R. Congdon, Westinghouse
D. J. Finnicum, Westinghouse
M.B. Cerrone, Westinghouse
J.A. Gresham, Westinghouse
P.J. Hijeck, Westinghouse

PWROG Response to Staff Request for Additional Information
WCAP-15830 Rev.1, "Staggered Integrated Engineered Safety Features and Loss of Off-site Power Testing at CE NSSS Plants"
Project No. 694

Reference: Letter, Mensah, T. M. (NRC) to Bischoff, G (PWROG), "Request for Additional Information Re: Pressurized Water Reactor Owners Group Topical Report WCAP-15830, Rev 1, "Staggered Integrated ESF Testing, TAC No. MD6206" dated November 1, 2007.

Electrical RAI 1:
TR WCAP-15830, Rev. 1, references the Institute of Electrical and Electronics Engineers (IEEE) Standard 387-1995, "IEEE Standard Criteria for Diesel-Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations," Regulatory Guide (RG) 1.9, Revision 3, "Selection, Design, Qualification and Testing of Emergency Diesel Generator Units as Class 1E Onsite Electric Power Systems at Nuclear Power Plants," and RG 1.108, "Periodic Testing of Emergency Diesel Generator Units Used as Class 1E Onsite Electric Power Systems at Nuclear Power Plants." All of these documents specify performing the integrated engineered safety feature (ESF)/loss of offsite power (LOOP) test each refueling outage.

Justify why deviation from the aforementioned industry standard and regulatory guidance documents is acceptable.

Response:
The recommended diesel generator testing interval for integrated Engineered Safety Feature/Loss of Off-site Power (ESF/LOOP) testing listed in Table 3 of IEEE Std. 387 was unilaterally revised from annually to every 18 months and later to every 24 months to coincide with the extended fuel cycle lengths adopted by utilities. Only when the surveillance test interval (STI) was increased from 18 to 24 months were utilities requested to demonstrate that instrument drift remained acceptable during the time interval.

WCAP-15830 establishes a generic methodology that can be used by individual utilities to justify performing integrated surveillance tests on a staggered basis. This report is the most comprehensive study performed to date to show that extending the integrated ESF/LOOP STI from every refueling [18 months] to every other refueling on a staggered basis [36 months] creates no significant increase in plant risk. Therefore, implementation of WCAP-15830, Rev 1 supports the NRC mission of protecting public health and safety by showing that emergency diesel generator performance continues to meet requirements when the specified surveillance testing is performed at intervals of 36 months.

Electrical RAI 2(a) and (b):
The proposed methodology suggests that reliance on the requirements of the maintenance rule will satisfy the monitoring requirements. Table 7.1-1 of the proposed methodology indicated that a total of 38 significant (Group I and II) failures occurred at the 6 demonstration units over the past 24 integrated ESF/LOOP tests.

a) Clarify how using the Maintenance Rule, as the required performance monitoring program, meets the intent of RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant- Specific Changes to the Licensing Basis," and RG 1.177, "An Approach for Plant-Specific, Risk-Informed Decision-making: Technical Specifications" (i.e., demonstrating how the referenced past integrated ESF/LOOP test failures have been satisfactorily handled).

b) If applicable, describe the acceptance criteria that would require return to a sequential integrated ESFAS/LOOP test each refueling cycle.

Response:
Re-analysis of utility corrective action reports associated with the integrated ESF/LOOP tests reported in Table 7.1-1 found that the number of tests performed was under-reported and the number of Group I and II equipment failures was over-reported. The focus of this review was to determine if any of the equipment failures were Category A components and if any were time-dependent. Revised results, shown in Table 7.1-1a (previously 7.1-1), found that a total of sixteen Group I and II equipment failures were identified at the six demonstration units during sixty-two integrated ESF/LOOP tests. The number of Group I and II failures is significantly lower than originally reported because the second review went further to identify and understand the root cause of the event as opposed to limiting the analysis to the symptoms described in the utility event report. Also, the actual number of integrated ESF/LOOP tests performed (62) was significantly under-reported in Table 7.1-1 due to counting the events on the basis of the plant site rather than on a unit and train-specific basis.

This re-analysis went further to determine the root cause of the failures and the WCAP-15830 category to determine if any of the Category A component failures were related to equipment aging. The results, Table 7.1-1b, show that of the sixteen Group I and II equipment failures, only two were Category A components. Neither of the Category A component failures was determined to be age-related. Further, only one of the sixteen Group I and Group II failures was found to be age-related, and that failure did not occur in a Category A component.

Review of the utility event reports also found the total number of verifications shown in Table 7.2-1 was significantly under-reported. Again, this adjustment resulted from incorrectly attributing the failures discovered during testing on a site basis rather than on the correct basis of plant and train. The data in Table 7.2-1 shows additional evidence that the integrated ESF/LOOP test has been instrumental in discovering few significant Group I and II equipment failures relative to the number of verifications performed.

Application of the Maintenance Rule (10CFR50.65) is not considered a substitute for testing or a justification for increasing the test interval. Rather, the performance of any safety-related or important to safety system or component that exhibits a change in its failure rate as a function of the test interval should be monitored through the maintenance rule program. The purpose of placing such system or component in the maintenance program is to enhance oversight, not to impact the test interval.

Electrical RAI 3:
Please describe the problem with cycling components during the integrated ESF/LOOP testing.

Response:
Necessary cycling of components when the plant is being aligned for the integrated ESF/LOOP test, during test performance, and during restoration following the test is not considered a problem. However, as explained in Section 2.1 of WCAP-15830, experience shows that plant transients, incidents of mass addition, equipment wear and tear, radiation exposure and human performance errors do occur during this time frame due to large outage work load, abnormal plant configurations, and test complexity. Therefore, it is prudent to minimize such negative effects by limiting testing to only those cases were it is known to be necessary and beneficial to safe operation of the plant and ensuring the health and safety of the public. The TR concludes that integrated testing of both ESF/LOOP trains each refueling outage is unnecessary, but this must be proven on a plant-by-plant bases by following the methodology presented in the report.

Electrical RAI 4:
In the proposed methodology, Westinghouse Electric Company (Westinghouse) stated that no time dependent failure mechanisms have been found in the components tested by the Integrated ESF/LOOP test. The proposed methodology assumes that the standby failure rate remains constant such that doubling the time between tests will double the standby failures. In the January 10, 2007, meeting between Westinghouse and the NRC staff (ML070170036), Westinghouse representatives stated that the failure rate would remain constant for 24 months, increase by a factor of 2 between 24 and 30 months and increased by a factor of 6 between 30 and 36 months. As further emphasized in Appendix B of WCAP-15830, Rev.1, please confirm that the proposed methodology will require similar treatment for extending the standby failure rate between 18 and 36 months.

Response:
Staff approval of the increase in surveillance test interval from 18 to 24 months inherently accepts the assumption that equipment failure is proportional to the interval between tests as discussed in Section 6.1.3 of WCAP-15830. However, because of limited operating experience data for test intervals between 24 and 36 months, Westinghouse chose to perform a sensitivity analysis to evaluate the potential impact on the risk evaluation if the equipment entered the wear-out portion of the bathtub curve at 24 months. This sensitivity analysis assumed that the failure rates would remain constant for 24 months, increase by a factor of 2 between 24 and 30 months and increase by a factor of 6 between 30 and 36 months. This increase in hazard rate was very conservative because it was applied to all Category A components. The specifics of this sensitivity analysis were selected in discussions with staff consultant M. A. Stutzke.

Electrical RAI 5:
The methodology does not address some of the more common examples of time dependent failures. These examples include, but are not limited to:

- Relay coil insulation degradation caused by normally energized relays.
- Normally open contact degradation (increasing contact resistance caused by oxidation or contamination).
- Relaxation of spring tension

Please justify why these failure modes were not considered time dependent failure mechanisms.

Response:
Normally energized safety-related electrical components such as under-voltage relays or contactors are routinely cycled during surveillance testing. Insulation degradation would mostly likely result in relay failure which would be detected by plant operators if the relay were to go to the deenergized state. Under-voltage relays, the most common energized relays in class 1E circuits, are routinely tested for setpoint accuracy.

There is no historical evidence of normally open relay contact resistances being a problem in ESFAS circuits. The population of applicable relays is sufficiently large that if there were to be a problem with a 36 test period, it would be seen occasionally at 18 months. Increase in relay contact resistance is most commonly associated with operational degradation which is not an issue with ESFAS relays. The results of the sensitivity study discussed in the response to RAI #4 shows that, even if some time dependency occurs, the results of the probabilistic study is not significantly impacted.

Extending the test interval does not alter the duty cycle for a relay or contactor. These components are routinely deenergized and tested during a refueling outage. Therefore, a staggered test interval would not increase the potential for aging-related failure of relay coil insulation degradation, contact degradation or relaxation of spring tension. The most adverse impact would be an undetected failure of a component in the un-tested train. However, such impact is shown by reliability analysis to be of low potential and with consequences that remain within the acceptance criteria of RG 1.174. Also, if relay testing shows signs of

an increasing failure rate with time, then such relays should be tracked as part of the Maintenance Rule program.

Electrical RAI 6(a) through (c):
Non safety-related circuit breakers connected to the safety-related bus failing to open have the same potential consequence as loss of a diesel generator itself.

a) Clarify why the methodology addresses the following circuit breakers differently:
   - Non safety-related loads
   - Offsite Power Supply breakers
   - Bus tie breakers

b) Describe how circuit breaker lockout (such as caused by an energized 86 or 52y device) is treated in the Failure Mode Effects Analysis.

c) Confirm that each licensee proposing to adopt this methodology must perform a component specific (e.g., circuit breaker) industry experience search and factor the results into the plant specific analysis. The search must address different failure mode industry experience for the licensee's specific circuit breaker manufacturer and circuit breaker types.

Response 6(a):
WCAP-15830 Rev 1 uses a conservative approach to modeling breaker failure by treating failure of certain non-safety breakers as causing failure of the EDG. Probabilistic results shown in WCAP-15830 R01 demonstrate that breaker failures do not cause an unacceptable increase in the change of CDF or LERF.

All breakers with safety significance should be treated the same way in the PRA model. Such treatment may differ from plant to plant depending upon specific arrangements and the approach to modeling adopted by a utility. Details of breaker modeling are plant-specific and will be provided in the plant-specific application to stagger the time interval for integrated ESF/LOOP testing. Appendix D provides an example of the treatment of bus tie (and bus feeder) breakers at Waterford Unit 3.

Response 6(b):
Circuit breaker lockouts are normally deenergized and it is extremely unlikely that they would be activated except by a valid failure. Historically, they have shown no time-dependent failures. Type 52y devices are activated (energized) by breaker failures which are modeled. Type 86 devices are associated with faults which would be detected during surveillance testing which occurs more frequently than the integrated ESF/LOOP test.

Response 6(c):
Each licensee proposing to adopt the staggered integrated ESF/LOOP methodology must first perform a plant specific analysis of time-dependent and maintenance related breaker failures. Should the failure frequency of a Category A non-safety related breaker be found to be time-dependent or related to maintenance, then the utility must address such failures before they can implement staggered integrated ESF/LOOP testing. Random failures that occur during testing or on demand do not have any relevance to test interval and need not be included in the analyses. Industry experience shows that breaker failures are more a function of maintenance than of manufacturer.

Electrical RAI 7:
Failure modes for two-out-of-three circuits were not considered in the methodology other than as random failures with no consequence. The potential exists that the additional eighteen months between tests

could introduce common mode failures previously not seen. Describe why these failures were not addressed as common mode failures.

Response:
The potential for common mode failure is unrelated to the number of circuits involved. Therefore, the impact on plant safety or operation caused by two out of three, two out of four, or one out of two trip circuits failing is not affected by time and, thereby, is not a function of the ESF/LOOP surveillance test interval. In addition, common mode failures are addressed in WCAP-15830 R01 and shown to be within the acceptance criteria of RG 1.174.

Review of corrective action program data associated with integrated ESF/LOOP testing from the demonstration plants shows that comparatively few equipment failures have occurred and of these only one was due to age related causes. Most failures were random or directly related to human performance issues. Thus, existing data does not support the assumption that extending the surveillance test interval warrants treating failures as common mode failures. Such test programs and years of operational experience are factored into the results shown in WCAP-15830 Rev 1.

Deterministic evaluations indicate that common mode failures, which principally relate to set-point calibration, should be evaluated to ensure that utilities do not introduce common mode failures by extending the test interval. Utilities also factor defense against such safety related system/equipment common mode failure into their overall maintenance and corrective action programs.

Electrical RAI 8:
Please discuss the potential for partial loss of redundancy for the ESF/LOOP actuation for an additional 18 months caused by the proposed staggered testing frequency.

Response:
The premise for increasing the test interval is to demonstrate that such change has no impact on component performance and to show that implementing such change remains acceptable on the basis of probabilistic risk. The potential for partial loss of redundancy due to ESF/LOOP testing being performed on a staggered basis is no different than if those tests are performed at 18 month or 36 month intervals. Surveillance testing performed on a refueling interval has shown no evidence that testing one channel causes a loss of the redundant channel. Therefore, there is no empirical basis for assuming that performing surveillance testing on a staggered basis will increase the likelihood of failure of a redundant channel.

Electrical RAI 9:
Provide assurance that the refueling interval functional testing of the sequencers includes the actuation of the output relays.

Response:
The sequencer output relays are typically only tested by the integrated ESF/LOOP test. Consequently, sequencer relays are Category A component and must be included in the risk model. Therefore, sequencer output relays are treated in the risk analysis, and are evaluated in the deterministic analysis. The deterministic analysis is used to reinforce the conclusions of the corresponding risk analysis and to provide the necessary balance between risk and deterministic arguments required by RG 1.174.

Electrical RAI 10:
Identify and describe all tests of the governor change-over from droop to isochronous other than during the integrated ESF/LOOP test.

Response:
The two modes of EDG governor operation are tested and realigned with plant operating requirements as required during the all EDG surveillance testing. Challenges to the governor functions are basically the same in either mode.

The change-over from droop to isochronous may not be performed more frequently than the integrated ESF/LOOP test if licensees also perform TS SR 3.8.1.16 during the integrated test. Recent experience indicates that failures in the droop mode are more likely. Operation in the droop mode is regularly tested. The risk and affect of potential failures in the isochronous mode would have to be analyzed on a plant specific basis.

Electrical RAI 11:
In Section 8.0 of WCAP-15830, Rev. 1, Westinghouse concludes that the proposed methodology is acceptable from a risk perspective. Consistent with RG 1.174 and RG 1.177, the risk-informed process includes both a risk and a deterministic component. Please describe why the proposed methodology is acceptable from a deterministic perspective.

Response:
The deterministic evaluation is a detailed individual component analysis according to their potential for failure. This evaluation ensures that all failures modes included in the risk evaluation are considered and that valid risks are assessed. If age-related failures are identified by the deterministic evaluation, then such failures will be incorporated into the risk evaluation. Therefore, deterministic evaluations verify that the same conclusions (minus the risk values) are reached as compared with the results from risk evaluations.

Electrical RAI 12:
In Section 5.3 of TR WCAP-15830, Rev 1, Westinghouse states that each licensee must initiate a maintenance program to remove all time dependent failure modes. Please describe the basic contents of the proposed maintenance program and whether it will include a detailed time-dependent failure modes and effects analysis to identify components that must be tested periodically in addition to staggered testing.

Response:
A detailed time-dependent failure mode analysis is only required if a licensee identifies components that are not tested by the scheduled surveillance activities. The failure modes analysis should include data gathering and evaluation, and test interval assessment. Specific maintenance program activities to address time-dependent failure modes and effects analysis are not provided in WCAP-15830 since such activities are unique to each utility implementing a staggered surveillance test interval.

PWROG Response to Staff Request for Additional Information
WCAP-15830, Rev.1, "Staggered Integrated Engineered Safety Features and Loss of Off-site Power Testing at CD NSSS Plants"
Project No. 694

Reference: Letter, Peters, S. E. (NRC) to Bischoff, G (PWROG), "Request for Additional Information Re: Pressurized Water Reactor Owners Group Topical Report WCAP-15830, Rev 1, "Staggered integrated ESF Testing, TAC No. MD6206" dated December 13, 2007.

PRA RAI 1:

Section 1.1.4 of the topical report (TR) regarding Key Safety Principle 4 was revised to state that two effects are considered with regards to risk impacts: 1) the total or aggregate risk impact for all probabilistic risk assessment (PRA) events for each individual surveillance frequency change, and 2) the cumulative risk impact from all surveillance frequency changes. It is not apparent to the NRC staff exactly to what these two risk impacts refer or how they are different, nor is it apparent in the details of the TR risk assessment methodology that two such impacts are separately calculated. Please explain the intent of these two risk impacts and identify how the detailed methodology implements this requirement.

Response:

Total risk impact, as related to this report and demonstration plant PRAs, is addressed in Section 6.2.2, "Scope of PRAs." Each utility will need to show that their PRA meets RG 1.200 and is compliant with the ASME PRA standard, RA-Sb-2005, with respect to key areas of technical adequacy for the application. This includes addressing the aggregate risk impact in the application and how future STI changes and the associated cumulative risk impact will be monitored.

The aggregate risk impact for all PRA events in each surveillance frequency change is the dominant element when extending the surveillance test interval. The cumulative risk impact is a secondary consideration to ensure that interactive effects are not overlooked when focusing on the details of individual component failures.

PRA RAI 2:

Section 1.1.5 of the TR regarding Key Safety Principle 5 was revised to state that, "...output of performance monitoring will be periodically re-assessed by the applicant and appropriate adjustments made to the surveillance frequencies." The NRC staff cannot identify where in the methodology this is implemented, nor is it clear if the intent is to require submitting changes to Technical Specifications (TSs) to "undo" the TR-based changes. Please clarify the intent of this statement and identify how the detailed methodology implements this requirement.

Response:

Section 1.1 briefly describes how the five key safety principles discussed in RG 1.174 are met when the integrated engineered safety feature and loss of off-site power tests are performed on a staggered basis. Item 5 of Section 1.1 addresses Key Safety Principle 5 of RG 1.174, which advises that "the impact of the proposed change should be monitored using performance measurement strategies." Monitoring and follow-up requirements must be completely addressed at the time of Licensee Amendment Request (LAR) submittal to show compliance with current RG 1.200 requirements.

Pursuant to 10CFR 50.65, licensees are required to assess the performance of plant structures, systems and components to ensure their operability and, with reasonable assurance, establish that they are capable of fulfilling their intended safety function. The purpose of Section 1.1, Item 5 is to ensure that utilities are aware of the need to include engineered safety feature and off-site power systems components that are

tested on a staggered basis in their performance monitoring program. Such monitoring programs are utility-specific, therefore details of the monitoring program implemented by a licensee to address staggered integrated testing will be provided in the licensee-specific application.

Licensees must amend affected Technical Specifications in order to implement a staggered integrated ESF/LOOP testing program. The intent of WCAP-15830 Rev 1 is to provide a risk-informed justification to support such licensee amendment requests. WCAP-15830 may also support changes to the Standard Technical Specifications. However, such changes to the Standard Technical Specifications are not addressed in WCAP-15830 and will be submitted independently by the improved Technical Specification Task Force.

PRA RAI 3:

Section 2.3.2 of the TR was revised to refer to initiative 4B of the risk-informed technical specifications and Nuclear Energy Institute (NEI) document NEI 06-09. Since this initiative and guidance document applies to changes to completion times and not surveillance test intervals, the NRC staff does not understand the purpose of this reference. Please explain the relationship of this reference to the TR.

Response:

Reference to NEI document NEI 06-09 will be deleted.

PRA RAI 4:

Section 4.1 of the TR was revised to identify that the impact on plant risk is negligible in part because the operability and reliability of affected components is demonstrated by other surveillance tests performed "on the same or more frequent basis." However, Section 4.3.1 requires identification of tests performed "more frequently" for Category C components. Figure 4.3-1 also identifies Category C as based on surveillance test performed "more frequently". Please review the TR and clarify the intent of Category C components.

Response:

"Other Tests," as used in the definition of Category C components and applied in the demonstration plant applications must satisfy the following criteria: 1) be required by the Technical Specifications (TS) and not purely under administrative control, and 2) be performed on a frequency of once per refueling cycle or less, i.e., within the refueling interval.

PRA RAI 5:

Section 4.1 of the TR was revised to state both that the methodology is only applicable to plants with an 18-month refueling cycle, and that the methodology is applicable to plants with a 24-month refueling cycle provided additional analyses are performed, but these additional analyses were not defined. Please resolve this inconsistency, and if necessary identify the scope of any additional analyses required.

Response:

As described in Section 4.1, the generic methodology of WCAP-15830, Rev 1 may be applied to surveillance tests performed on a staggered basis for plants with a 24-month refueling cycle. The objectives and methods of the risk analysis are the same. However, additional sensitivity analyses will be required to show that the impact on plant risk associated with a 24-month surveillance test interval is acceptable. The specific sensitivity analyses to be required is plant-specific and will depend on the scope of the applicant's integrated ESF/LOOP test and their Category A components.

The objective of the deterministic analysis of Category A components for a staggered 24-month STI application is the same as for 18-month, i.e., to determine whether or not there are time dependent failure modes. If any time-dependent failure modes are identified, the plant must establish a preventive maintenance program to remove the time dependent failure mode and confirm that the component's hazard rate remains constant. In addition, the time dependent failure mode must be included the plant risk model. Data obtained from performing integrated ESF/LOOP tests on a staggered 18-month interval will also support analyses and implementation of longer, e.g. 24-month, staggered test intervals.

PRA RAI 6:

Section 4.3.1 of the TR was revised to allow identification of "alternate special effects testing that could be performed during the refueling cycle that would permit changing the component from Category A to Category C." Please elaborate as to what "special effects testing" might refer. Further, in other sections of the TR regarding Category C, it is stated that only those tests required by TSs are credited to place a component into Category C. However, Section 4.3.1 seems to imply that a licensee could implement special limited tests to justify the categorization. Please clarify Section 4.3.1 and assure it is consistent with other sections of the TR with regards to component categories and TS required testing.

Response:

Staggered ESF/LOOP surveillance testing requires that all active components be cycled as part of the test. However, some components tested as part of the ESF/LOOP test are also covered by other more frequent tests. A feature of these other tests is that the functions of individual components can be tested without actuating an entire train or sub-train. Examples include valve stroke testing and engineered safety features actuation system relay testing.

Section 4.3.1 clarifies that for Category C components, "To be conservative, only TS required tests were accepted as an overlapping test. No credit was taken for testing performed by programs under utility administrative control (i.e., the maintenance rule). Credit for such testing is evaluated in the Category A component deterministic evaluations performed later in the process." This conservative approach was used in WCAP-15830 assuming that plant specific applications may need to use separate tests to justify placing certain components in Category C.

The intent of the discussion on alternate testing in Section 4.3 is to indicate that, should a subset of Category A component be found to drive the unavailability for the extended test interval, then an alternate test for these components should be considered. If such a separate effects test can be performed for these components, then the staggered ESF/LOOP surveillance test would no longer be the sole test for demonstrating the operability of these components. Accordingly, Section 4.3.1 will be revised to state "alternate *separate* effects testing" rather than "alternate *special* effects testing" may be performed.

PRA RAI 7:

Section 4.2.2.2 of the TR was revised to add a step 7 to recalculate Core Damage Frequency (CDF). However, the PRA model is not revised for Category A3 and A4 components until a subsequent step in the process. Please clarify why CDF is recalculated at this point.

Response:

Section 4.4.2 describes the procedure for requantifying the baseline PRA model for the extended staggered test interval. In all cases, recalculating the CDF is the last step in the process and does not apply solely to Section 4.4.2.2. Section 4.4.2 will be modified to state that the CDF must be requantified once the requisite changes to the Category A-1, A-2, A-3 and A-4 components have been incorporated into the PRA model.

PRA RAI 8(a) through RAI 8(j):

Section 9.0 of the TR was added to identify activities which are required to be addressed by licensees in their submittals for implementation. The NRC staff requests further clarifications on such items:

Response:

Section 9.0, "Additional Implementation Guidance" summarizes details that must be addressed by each licensee when implementing staggered surveillance testing. The objective is to ensure that items not specifically addressed (or partially addressed) in WCAP-15830 are captured in one place and to emphasize specific guidance found to be important during discussions with the staff. Further, several Section 9.0 items relate to NEI-04-10 methodology and R.G 1.200 guidance to fulfill commitments made during previous meetings with the staff.

RAI 8(a):

Section 9.0.2 requires Category A components to be classified as Risk Significant by the Maintenance Rule (Title 10 of the *Code of Federal Regulations,* Section 50.65). This is not addressed in any other section of the TR. Since the Maintenance Rule does not use the term "Risk Significant" nor provide for classification of components, this activity needs further clarification as to the specific basis for this activity and its relationship to the surveillance test interval revisions.

Response:

Implementation guidance contained in Section 9.0 is intended to assist utilities in setting up monitoring activities related to staggered testing. Specific activities will be selected by each utility to be consistent with their implementation plan and existing maintenance activities. WCAP-15830 is not intended to prescribe specific surveillance program activities, rather, use of "risk significant" is meant to advise utilities to enter needed components into their maintenance rule program. The actions to be performed by a utility should a Category A component failure be identified during staggered integrated testing are intended to provide reasonable assurance that the system remains capable of fulfilling its intended safety function.

The intent of activity 9.0.2 is to ensure that applicants verify that all Category A components are covered by the Maintenance Rule, because all Category A components are risk-significant. The wording of 9.0.2 will be revised to clarify the intent.

RAI 8(b):

Section 9.0.3 requires specific actions in the event of failures of components during testing on an extended interval. This level of detail seems to be inappropriate in that it reflects activities which are already required by the TSs (e.g., retesting failed components) or which are overly proscriptive (e.g., requiring immediate testing of redundant components if a potential common-mode failure is determined, even though the plant would be in a shutdown mode where the components are not necessarily required to be operable.) This activity needs to be simplified to identify the specific unique new requirement being imposed, and not be overly prescriptive in specifying corrective action requirements.

Response:

Section 9 provides guidance to utilities on actions to be performed in the event that failure of a component is identified during staggered integrated ESF/LOOP testing. This guidance emphasizes the use of existing plant-specific maintenance and corrective actions programs, and re-test of components using existing procedures. Therefore, the guidance provided in Section 9 is intended to compliment those actions

already performed by utilities. Detailed guidance provided in Section 9.0.3 responds to an earlier staff request for actions to be taken when a failed component is identified during staggered integrated ESF/LOOP testing.

RAI 8(c):

Section 9.0.4 requires additional testing for Category A components with evidence of increasing failure rates. Given that these components may only be tested every 36 months after implementation, it is not clear how the available data generated could ever support a determination of an increasing failure rate. Therefore, this activity may not be possible to implement as written, and should be revised to provide an acceptable alternative.

Response:

Component failure data acquired under the Maintenance Rule (inspections and preventative maintenance) and as a consequence of staggered testing when compared to the failure data obtained prior to implementing a staggered test interval will clearly show whether a failure trend exists. Adopting a staggered test interval pursuant toWCAP-15830 does not imply that the prior performance data and testing history should be ignored. Additional performance data will be added each time the surveillance test is performed which, for at least one ESF/LOOP train, will occur every 18 months.

RAI 8(d):

Section 9.0.6 restates some of the specific elements of the TR methodology for adjusting the baseline PRA model. Please explain why these specific items are singled out in Section 9.0.

Response:

A principal element when implementing staggered integrated ESF/LOOP testing is updating the plant PRA model to include necessary Category A components. Reiteration of this requirement is provided for completeness and emphasis in response to an earlier staff request.

RAI 8(e):

Section 9.0.7 mixes PRA technical adequacy per Regulatory Guide 1.200 and evaluation of external events risk and shutdown risk. Please explain why these specific requirements are singled out in Section 9.0.

Response:

Item 7 advises that the impact due to external events and shutdown risk may be considered quantitatively or qualitatively by each utility. The salient point is that the technical adequacy of each utility's PRA must meet the guidance provided in RG 1.200. Reiteration of this requirement is provided for emphasis in response to an earlier staff request.

RAI 8(f):

Section 9.0.9 identifies items that are requirements per Regulatory Guide 1.174, includes an apparently unrelated statement regarding Mean Time Between Failure, and prescribes the use of a simplified Large Early Release Frequency (LERF) model per NUREG/CR-6595. The grouping of these items in item 9 is not understood. Furthermore, it is not clear why these particular elements are being singled out in Section 9.0 nor is it clear why a simplified LERF model is required. Please clarify the intent of this information.

Response:

WCAP-15830 employs a risk-based analysis to validate the change from sequential to staggered surveillance testing. Item 9 reiterates the need to evaluate changes in CDF and LERF, and to provide numerical uncertainty analyses for CDF and LERF to ensure that changes in risk meet the acceptance criteria of RG 1.174. Specifying NUREG/CR-6595 is intended as advice to utilities on an acceptable model for performing LERF studies. The statement "MTBF is essentially the inverse of the failure rate" is unneeded and will be deleted.

RAI 8(g):

Section 9.0.10 requires a sensitivity study to address key assumption 2 of Section 1.3 regarding constant failure rates. However, no requirement for sensitivity studies to address key assumptions 1 and 3, i.e., limitation of demand failures and zero impact on Common Cause Failure (CCF) probability has been provided. Please provide this information.

Response:

The purpose of Item 10 is to validate the assumed component failure rate as a function of time. This requires utilities using staggered testing to perform a sensitivity analysis to evaluate the potential impact of aging-related increases in the average failure rate for the time period beyond 24 months. The sensitivity analysis assumes that step increases in the time-dependent component failure rate are applied at 24 and 30 months. As discussed in Section 1.3, changing from sequential to staggered testing does not increase the likelihood of a common cause failure. Similarly, the assumed step change in time-dependent failure rate after 24 months does not apply to CCF probabilities.

RAI 8(h):

In Section 9.0.13, please elaborate on what "process elements" refers, and its relationship to NEI 04-10.

Response:

NEI 04-10 provides the technical methodology to support risk informed technical specifications initiative 5B. This initiative provides a risk-informed method for licensees to establish a Surveillance Frequency Control Program (SFCP) in the administrative section of TS and to move control of STI changes from the TS to the utility. The NEI 04-10 methodology includes determining the cumulative risk impact of future STI changes, updating the PRA, and for imposing corrective actions, if necessary, following implementation. To be consistent with 5B initiative requirements, WCAP-15830 requires that these plant-specific process elements be addressed by licensees requesting STI changes to implement staggered ESF/LOOP testing.

RAI 8(i):

Section 9.0.14 requires use of a multi-disciplinary team to evaluate the proposed changes; these are not reflected in the detailed methodology. Please elaborate on the use of this team and what actions it would take per this TR.

Response:

NEI 04-10 guidance includes using an expert panel (multi-disciplinary team) to review the results of qualitative and quantitative analyses and of the cumulative impact relative to the modeling and consideration of test strategies for staggered versus sequential testing. The panel functions as the approver of the STI change. To be consistent with 5B initiative requirements, WCAP-15830 recommends use of a similar approach when evaluating and approving applications for staggered ESF/LOOP testing. Whether or not to use an expert panel and details of its makeup and role are plant specific.

RAI 8(j):

Section 9.0.15 addresses a "reliability review" per NEI 04-10; NEI 04-10 does not use this term, and is not clear to what this refers or requires. Please explain this relationship.

Response:

Part B.3 of the Sample Surveillance Frequency Evaluation Form (Appendix A of NEI-04-10) is entitled; "Reliability Review." This review is part of the Qualitative Analysis and documents the review of performance (operation and maintenance) history for components associated with the proposed STI change. To be consistent with initiative 5B requirements, WCAP-15830 requires that these same process elements be addressed by applicants implementing staggered ESF/LOOP testing.

PRA RAI 9(a):

In order to facilitate staff review of licensee submittals referencing the TR, the staff intends to require the following specific information be submitted to supplement the requirements of Regulatory Guides 1.174 and 1.177. The PWROG should consider including this guidance in the TR.

- The licensee's basis for its plant-specific PRA model conformance to Regulatory Guide 1.200, including identification of any gaps to capability category II of the internal events PRA standard and any unresolved open items (e.g., facts and observations from the peer review), and the basis for why those gaps and open items do not adversely affect the risk evaluations conducted to support the proposed changes to surveillance test intervals.
- Disposition of plant changes (e.g., procedure changes, operational changes, plant modifications) not yet incorporated into the PRA model, as well as any PRA deficiencies not yet resolved, with regards to their potential adverse impact on the risk evaluations conducted to support the proposed changes to surveillance test intervals.
- For each plant component that impacted the risk evaluation:
  - i. The specific subcategory (A-1 through A-4) to which it was assigned,
  - ii. The PRA basic event to which it was mapped,
  - iii. The probability of the PRA basic event before the proposed change,
  - iv. The probability of the PRA basic event after the proposed change, and
  - v. For subcategories A-3 and A-4 components, how the PRA model was adjusted to reflect the proposed STI change.
- Rationale for each plant component eliminated from further consideration in the risk evaluation because the integrated engineered safety feature test does not test a risk-significant failure mode (Category B components).
- Description of the post-implementation monitoring and performance measurement strategies, including the corrective action plans for unacceptable performance.

Response:

Guidance as requested above by the staff will be added to Section 9.0 of WCAP-15830, Rev 1.

PRA RAI 9(b):

In order to facilitate NRC staff review of licensee submittals referencing the TR, the NRC staff intends to require the following specific information be submitted to supplement the requirements of Regulatory Guide 1.174 and 1.177. The PWROG should consider including this guidance in the TR.

- Validation of, or plant-specific sensitivity studies to address, the key assumptions of the TR:
  - i. Only on demand failures are of interest for the proposed change.
  - ii. The likelihood of a component demand failure is proportional to the Surveillance Test Interval.
  - iii. The likelihood of CCF is unchanged.

Response:

The integrated ESF/LOOP test, item "i" above, only applies to on-demand, i.e., change-of-state demand, for an active component. Any failures encountered during testing of such components are intended to be monitored through the plant maintenance program. A plant-specific sensitivity study of the on-demand failure rate of active ESF/LOOP components will be added to Section 9.0 to validate the key assumptions.

The component demand failure rate, item "ii," is composed of two elements; an on-demand rate and the standby failure rate. The on-demand failure rate is an "instantaneous" quantity and is not affected by the time period between events. Therefore, as shown in Section 6.2.6, the risk model is conservative since all component demand failures are assigned to the standby failure rate.

The likelihood that CCF is unchanged, item "iii," is based on the standard analysis assumptions presented in NUREG/CR-5485 and NUREG/CR-5497. Section 9.0 will be modified to include confirmation by utilities implementing a staggered integrated ESF/LOOP test interval that the CCF remains unchanged.