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Subject: Arkansas Nuclear One - Unit 2
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Response to NRC Questions On ANO-2 Application Of CEOG Joint Application Reports On Allowed Outage Time Extensions

Gentlemen:

Attached are responses to your questions on the Arkansas Nuclear One, Unit Two (ANO-2) technical specification change requests concerning increased allowed outage times for our Low Pressure Safety Injection (LPSI) trains, Safety Injection Tanks (SITs) and Emergency Diesel Generators (EDGs). These change requests were submitted to you by letters dated May 19, 1995 (2CAN059501, 2CAN059502 and 2CAN059503) pursuant to Combustion Engineering Owners Group (CEOG) Joint Applications Reports: CE NPSD-995 (LPSI), CE NPSD-994 (SITs), and CE NPSD-996 (EDGs).

The attached responses are provided for your use in reviewing the technical specification change requests. These positions reflect current management philosophies and work practices at ANO and will evolve with the implementation of the maintenance rule, industry practices and Entergy management philosophies. These positions should not be considered specific commitments.

These questions were addressed during an on-site meeting with the NRC on January 25, 1996. During this meeting an additional request was made for an electronic copy of the cut sets utilized for the development of our site specific probabilistic numbers. These cut sets were provided at the end of the meeting.

If we can be of assistance or provide you with any additional information please contact me.

A001

Very truly yours,

Dwight C. Mims

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Responses to NRC Questions on ANO-2 Application of CEOG Joint Application Reports on Allowed Outage Time Extensions

Question 1:

We are assuming that the PRA used in the ANO-2 "at power" analysis is the IPE PRA submitted to the NRC in response to Generic Letter 88-20. Is this assumption correct?

Response to Question 1:

Yes. The AOT analyses were performed using the cutsets reported in the ANO-2 IPE PRA Summary Report submitted to the NRC in letter 2CAN089201 in response to Generic Letter 88-20. It should be noted that when the sequence cutsets referenced in this report were combined into a single file, some cutsets were found to be non minimal and, as such, were eliminated (i.e., subsumed) from the combined cutset listing. The result of the subsume process indicates that the total CDF reported in the ANO-2 IPE PRA Summary Report IPE was conservatively about 0.2% high. Note that no credit was taken for the AAC EDG in either the IPE PRA analysis or in the present AOT extension analysis.

Question 2:

The extended AOTs will be used, at least for Low Pressure Safety Injection (LPSI) trains and Emergency Diesel Generators (EDGs), to conduct on-line preventive maintenance (PM). Please indicate whether or not the system trains are presently being taken out simultaneously with other safety system equipment for "on-line" PM purposes.

Response to Question 2:

Protection of Safety Function is the key philosophy employed. For instance, typically a Containment Spray Pump will not be removed from service simultaneously with a Containment Cooling Group since both serve to protect the Containment Safety Function. Likewise a LPSI pump may not be removed from service while HPSI maintenance is in progress since both are a part of Emergency Core Cooling (Core Heat Removal, RCS Inventory Safety Functions). In addition, only non-significant maintenance is normally allowed during EDG maintenance windows. REF. 2OPG-005 Page 22 Section "On-Line Maintenance" Paragraph 2.

Question 3:

What is the projected average corrective maintenance (CM) and preventive maintenance (PM) downtime for the equipment for which extended AOTs are being requested?

Response to Question 3:

Currently, CM and PM activities are performed on each EDG during each refueling outage (18-month frequency). These activities are worked around the clock and typically take approximately five-six days, depending largely upon the amount of CM required. The amount of CM will vary from cycle to cycle, based on equipment condition, industry issues, etc.

18 Mo. EDG Surveillance Items

1. Remove, inspect and re-install exhaust manifolds
2. Open, clean and inspect control side air box
3. Open, clean and inspect opposite control side air box
4. Main bearing parting line checks (upper and lower mains)
5. Connecting rod bearing parting line checks (upper and lower rods)
6. Crankshaft deflection readings (lower crank)
7. Crankshaft thrust readings (lower crank)
8. Cams, cam bearing, and tappet follower inspection
9. Timing chain inspection and adjustment (if necessary)
10. Check injector timing and adjustment (if necessary)
11. Remove, pop-test/reset and re-install injection nozzles
12. Inspect gear drive to cooling pumps and oil pump
13. Water hydro of block, liners and piping
14. Cylinder inspection, exhaust port inspection
15. Vertical drive inspection
16. Vertical drive backlash on gear drive
17. Scavenging blower, clean, inspect, and measure rotor clearances
18. Engine to generator alignment check
19. Upper piston wrist pin clearance measurement
20. Change air intake filter
21. Drain crankcase, clean, inspect, and re-fill with new oil
22. Change and inspect oil filter
23. Change and inspect oil strainer
24. Change and inspect fuel oil filter
25. Clean and inspect fuel oil strainer
26. Inspect interstage coolers (clean as necessary)
27. Jacket water heat exchanger, clean and inspect
28. Air cooler heat exchanger, clean and inspect
29. Lube oil cooler, clean and inspect
30. AMOT valves (temperature control valves) control element replacement
31. Install/remove test cock valves

32. Firing pressure and compression readings
33. Install heat shields and strongbacks
34. Install air box covers
35. Install crankcase covers
36. Inspect/replace starting air filters
37. Inspect torsional dampers
38. Inspect and clean crankcase ejector
39. Check foundation bolts for tightness
40. Change governor oil, flush, set mechanical and electrical controls
41. Calibration check of pressure and temperature instruments

Low Pressure Safety Injection (LPSI) system components, such as LPSI pumps, have maintenance performed on them as CM needs dictate. The last two major maintenance evolutions on LPSI pumps 'A' and 'B' took 158 hours and 133 hours, respectively.

Question 4:

The NRC staff has developed a "three-tiered" approach for reviewing risk-informed improvements to TS. Tier 1 involves setting an upper limit on AOTs based on Δ CDF and containment performance. Tier 2 involves predetermined restrictions on high-risk configurations by limiting simultaneous equipment outages. Tier 3 involves performance of a real-time assessment of the overall impact on the safety of proposed configurations prior to performing maintenance activities which will remove equipment from service. Please provide information on how you would address Tiers 2 and 3 for the proposed AOT extensions.

Response to Question 4:

In reference to the Tier 2 approach, the same philosophy as described in Response to Question 2 above is maintained. Though the maintenance window for a proposed component may be greater in length, this same window also allows for the compiling of activities, resulting in the component being removed from service less frequently. These factors should allow for adjustment of equipment outage schedules such that philosophies based on Safety Functions are maintained. REF. 2OPG-005 Page 22 Section "On-Line Maintenance" Paragraph 2

In reference to the Tier 3 approach, the following bullet items discuss areas considered prior to the removal of any important piece of equipment from service. The focal point of these assessments is the Operation's Liaison.

- Risk is assessed for each and every work activity scheduled. The risk of an activity is weighed against the benefit to be gained from task performance and the consequences should the performance of the activity suffer undesirable results. A risk-gain-consequence matrix may be referred to as an aide in risk-based decision making efforts. This same matrix is used to determine risk associated with multi-component windows since both the risk and consequence factors increase with each additional component removed from service. REF. 2OPG-005 Pages 6-8 Section "Risk Assessment"

- A system priority chart is used in weighing the risk of a component outage. The chart, developed by engineering using PRA programs, is based on Core Damage Frequency. REF. 2OPG-005 Page 9

- When an activity poses risk to nearby in-service components, a risk assessment form is initiated requiring approval by the Operation's Manager prior to activity commencement. REF. 2OPG-005 Attachment 3

- The safety significance of a component when related to present plant configuration is also assessed during the evaluation. REF. 2OPG-005 Page 9 Paragraph 3

- Aggregate assessments (the total risk based on the status of all plant equipment collectively) are performed each day and as configuration changes warrant. REF. 2OPG-005 Page 11 Section "Aggregate Assessment"

- Key personnel are responsible for monitoring overall plant risk. Changes in plant conditions or component status that indicate a significant increase in risk not pre-planned is immediately reported to the Assistant Operation's Manager (and/or Operation's Manager). Engineering groups also provide input and PRA models to risk evaluations. The Operation's Shift Superintendent always maintains the authority to stop or prevent work that increases overall risk and is an additional line of defense. REF. 2OPG-005 Page 11 Section "Aggregate Assessment" Paragraph 2

Question 5:

Are compensatory measures presented for the AOT extensions currently followed, or would they be implemented when the AOT extensions are granted?

Response to Question 5:

Cited compensatory measures are currently in place and adhered to. Activities that increase risk or involve Tech Spec AOTs are performed expeditiously and usually worked around the clock. Work activities are presently scheduled according to surveillance intervals and are grouped to avoid "safety function" related components being removed from service simultaneously. In addition, removal of any Tech Spec component from service requires an Inoperable Equipment Checklist be completed. This form ensures checks are documented concerning redundant equipment operability/status including offsite power supplies and provides for contingency planning, if necessary. Tools and parts are required to be verified and pre-staged where most AOTs are invoked. The removal of such equipment is also emphasized during Operation's crew briefings (responsible craft personnel often attend these briefings). Briefings include discussions on remaining operable equipment and contingency planning, as appropriate. In the case of EDG outages, activities in the switchyard or near offsite power sources are restricted, and diesel maintenance is delayed, if possible, with inclement weather approaching the site. In addition, all surveillance and special testing is minimized during EDG outages. REF. 2OPG-005, OP 1015.017A, and OP 1015.033

Question 6:

If the CCDF is calculated with respect to a component that is not in the cutset list due to applying cut-off probabilities to cutsets, the application states that the eliminated cutsets containing the components are retrieved and CCDF is calculated. How is the analyst assured that all cutsets containing the components of interest are retrieved? Please explain the process used in this case.

Response to Question 6:

This question relates to the "completeness" of the cutsets used to represent the core damage frequency, that is, the degree to which component failure/unavailability events are represented in the CDF cutset listing. This issue was addressed by using the CDF cutsets generated in the ANO-2 IPE analysis to calculate the delta CDF values associated with the "at power" ANO-2 conditions. These cutsets were reviewed in detail as part of the ANO-2 IPE analysis and were assessed to provide an adequate assessment of the potential risk-significant plant vulnerabilities. Specifically, for the AOT extension analyses, these cutsets contained component failures representative of SIT, LPSI, and EDG failures and/or maintenance unavailability's and contained these failures to a degree consistent with their expected relative risk importance.

In order to further assure that the calculated "at power" CCDF was conservative, the AOT extension analysis was not based solely on the effect of changing the value of Test and Maintenance (T&M) events. Rather the AOT analysis utilized the T&M events and basic events representative of the failure of each system train which occur in the most likely cutsets. For example, in the EDG AOT extension analysis, the following events were selected in the CCDF analysis: ETM2DG1XXX (EDG1 unavailable due to test and/or maintenance) and ETM2DG2XXX (EDG2 unavailable due to test and/or maintenance) were selected and events EDG2DG1XXA (EDG1 fails to start), EDG2DG1XXF (EDG1 fails to run), EDG2DG2XXA (EDG2 fails to start), EDG2DG2XXF (EDG2 fails to run) were also selected. The largest delta CCDF associated with each of these failure modes and that associated with the most risk-significant train was selected as the conservatively high estimate of the delta CDF associated with AOT extension. This approach assures that the calculated delta CDF is conservatively maximized.

Question 7:

You are comparing delta's in risk from "at power," transition, and shutdown to make your case that the net effect of the AOT extensions reduces risk. What assurance do you have that each element of the comparison is equally "best-estimate" or equally conservative? Subtracting a best-estimate delta from a conservative delta could result in values for net effect that are only artifacts of the process and not real. For example for the LPSI System AOT analysis, the shutdown portion appears to be conservative while the "at power" analysis appears to be best-estimate. Please discuss how you assure that the elements are all based on the same assumptions.

Response to Question 7:

The AOT analysis specifically accounts for the risk impact of taking equipment out of service during "at power," transition, and shutdown periods of time. For a given AOT extension, there is theoretically an increase in the "at power" component of risk and decreases in the transition and shutdown components of risk. The AOT extension analysis recognized these effects and thus assessed the delta CDF associated with each of these three risk components. Although all three components were calculated, the conclusions of the AOT risk impact analysis are based on the "at power" delta CDF results.

The degree of conservatism and plant-specificity associated with delta CDF estimates for each of these time periods varies. The delta CDF associated with the "at power" period was plant-specific and was calculated in a manner which maximized its value. The transition and shutdown risk impacts were quantified on a more generic basis and in a manner which minimized their delta CDF values. This approach maximizes the overall risk increase associated with moving equipment maintenance from shutdown to "at power" conditions. It is noteworthy that, in order to avoid misrepresenting the overall risk impact of the increased AOT, the "at power," transition, and shutdown risk results were not numerically combined.

Question 8:

Explain how you addressed uncertainties in your calculations of "at power," transition and shutdown risk.

Response to Question 8:

Uncertainties were not explicitly addressed as part of AOT risk impact analysis. However, since the risk analysis is based on the change in risk, and since the uncertainty distributions associated with the current and extended AOT conditions are expected to be very similar in shape (i.e., the moments higher than two are expected to be essentially identical), the uncertainty associated with the delta CDF is expected to be very small in comparison to the uncertainty associated with the individual CDF estimates. An uncertainty analysis performed on a CE reference plant demonstrates the similarity of the moments higher than two. These moments are presented in the Table below.

Moment	Term	Current AOT	Extended AOT
2	Standard Deviation	6.74E-5	6.74E-5
3	Skewness	22.7	22.6
4	Kurtosis	716	715

Question 9:

What review of the PRA was made to ensure that the PRA represents the as-built, as-operated plant, and contains the fine structure (resolution) necessary to evaluate the proposed TS requirements? Were any changes made to the PRA due to such reviews? If yes, please provide a list of these changes.

Response to Question 9:

As noted in response to Question 1, the AOT extension analysis is based on the ANO-2 PRA/IPE model. This model represents the plant at the time of the IPE submittal. Changes to the plant since the development of this model are judged to have had no significant negative impact on plant risk based on the 10CFR50.59 review process. This process assures that the probability and consequences of an accident have not increased, that the probability and consequences of a malfunction of equipment important to safety malfunction have not increased, that no new accident types and no new equipment malfunctions have been created, and that the margin to safety has not been reduced. All 10CFR50.59 evaluations that are prepared at ANO are reviewed by the site SRC 50.59 Safety Evaluation Subcommittee. The chairman of this committee for the time period of interest (and currently) is the Manager of the Nuclear Engineering Design (NED) section of Design Engineering. The NED section is responsible for the ANO-1 and ANO-2 PSA models. Therefore, the chairman is cognizant of changes that may affect the PSA models. Also, the NED section reviews all design changes initiated by Design Engineering for effects on the PSA models. Periodic model updates are planned and the impact of these changes to the model results and conclusions will be reviewed and revised, as appropriate.

The PRA models the ANO-2 plant on the component level and models the dependence of these components on the support systems required for their successful operation (AC and DC power, instrument air, room cooling, etc.). Thus, the model contains the fine structure (resolution) necessary to evaluate the proposed TS requirements. No changes to the PRA model (such as, added additional modeling details) were deemed necessary for the AOT extension analysis. It was also deemed unnecessary to requantify the PRA model for the AOT applications, since the cutsets quantified as part of the IPE were found to be sufficiently complete for the AOT applications, as discussed in the response to Question 6.

Question 10:

An increased AOT is expected to reduce the number of entries in LCO action statements by allowing a more complete maintenance program during a single AOT. Please provide a detailed example to show the rearrangement of maintenance activities for your plant with the increased AOTs.

Response to Question 10:

ANO does not currently make multiple entries into LCO action statements in order to complete EDG maintenance activities. Our current philosophy is that we do not enter LCOs to complete 18-month PMs on EDGs. Instead, the PM work, as well as the CM work that was not immediately necessary, are packaged as an "EDG outage" during each refueling outage. In order to optimize the "EDG outage," special emphasis is placed on this work as a critical project. Preparation for the "EDG outage" includes:

- dedicated project lead for the 18-month work
- integrated multi-discipline detail schedule of activities (work activities are scheduled as parallel path, where possible)
- dedicated "around-the-clock" resources
- procedure review/revision for efficiency/enhancements
- hands-on verification and staging of parts
- staging of tools
- coordination of barriers and personnel for Foreign Material Exclusion control
- screening of other job orders on the EDG or in the vicinity for impact

This approach is used for work on all our safety-related equipment when the work requires that we enter a Tech Spec LCO. REF. 2OPG-005, page 20

Since our maintenance activities are, for the most part, already arranged in an integrated manner, the intent is not to rearrange our maintenance activities, but to schedule them while at power.

Question 11:

Please explain how extension of the AOT reduces the need for simultaneous common system PM operations.

Response to Question 11:

An extension of the AOT would allow the flexibility to schedule work activities in series. This would ensure the minimum number of components are inoperable at a given time. However, this lengthens the amount of time a system is out of service. In general, ANO works activities in parallel, as much as possible, in order to minimize the amount of time the system is out of service. Guidelines are used to determine how many separate components/sub-systems can be out of service at any given time (reference Operations Liaison Desk Guide).

Question 12:

Is repair time data available for the events described in Table 5.2-1 of the SIT report?

Response to Question 12:

The events described in Table 5.2-1 occurred at San Onofre, Palo Verde and Millstone. Repair time data for these events is not available at ANO.

Question 13:

Given the use of the current PRA estimate to justify the requested extended AOTs, will you periodically reexamine your "living PRA" to ensure that the extended AOT is not significantly different than you estimated during future plant operation?

Response to Question 13:

Yes, as part of our risk management program at ANO, we plan to maintain a "living PSA model." As part of this program, we plan to periodically review the impact on the ANO-2 PSA model of changes in the plant hardware or procedures, its operating experience, industry experience, in our understanding of postulated plant accidents and of the plant response to these accidents. Should such a review indicate that a revision of the model and of the model results is appropriate, the PSA model will be revised and requantified, as appropriate.

In addition, Entergy plans to implement on-line safety monitors at both ANO units. These monitors will be used as an additional tool to optimize scheduling plant equipment maintenance and to operate the plant in a manner which minimizes plant risk on a real time basis.

Question 14:

In your submittal of May 19, 1995, you proposed to extend the AOT from 3 days to 7 days and once per fuel cycle allowance for an AOT of 10 days for each EDG to perform PM or CM. It is not clear why 7 day AOT time is needed for every EDG AOT. The NRC staff has been considering the extensions of EDG AOTs on a plant-specific basis if the primary intent of extending EDG AOT is to perform the 18-month manufacturer-recommended maintenance such as teardowns or preplanned PM or modification that would otherwise extend beyond the original AOT. Please state your reason for extending your current EDG AOT. Your response should also include instances where your current AOT was insufficient to perform PM or CM.

Response to Question 14:

ANO's primary intent for proposing an extension of the AOT to 7 days is to be able to perform the 18-month manufacturer-recommended maintenance while at power. The current AOT of 3 days is not sufficient to perform the collective PM and CM that is performed on an EDG once per cycle. The intent would be as follows:

- prepare for an "EDG outage" that includes all 18-month maintenance
- perform the "EDG outage" while at power (expected duration 5-6 days)
- unless unforeseen circumstances lengthen the duration beyond 7 days, the work was completed in the 7 day LCO. The 18-month maintenance on the other EDG would then be performed during the same cycle during a 10 day once-per-cycle maintenance window.
- if the work goes beyond 7 days on the first EDG, the work is considered to be in the 10 day once-per-cycle maintenance window and therefore, work on the other EDG would not be scheduled until the refueling outage.

Question 15:

The staff is presently concerned that the extensions of EDG AOTs may increase the mean CDF for the station blackout (SBO) events, and impact resolution of the SBO issue. Provide the calculated CDF for SBO sequences without the proposed AOT extension and the CDF for SBO sequences with the proposed AOT extension. Also provide the overall unavailability of the EDGs used in the PRA to calculate the CDFs for the SBO sequences requested.

Response to Question 15:

The SBO issue was resolved by installation of the Alternate AC (AAC) EDG. The maintenance unavailability time associated with the safety related EDGs is not a factor in resolution of the SBO issue. Therefore, an increase in the maintenance unavailability time will not affect the SBO issue.

The conditions that define Station Blackout (SBO) for purposes of responding to this question are:

- Loss of Offsite Power and
- Loss of on-site AC

Therefore, only the cutsets that include the above failure conditions will be evaluated.

The CDFs for the SBO sequences are as follows:

Unavailability	CDF
Current IPE value (without extension)	1.252E-06/yr
Current AOT (3 days each EDG per yr)	1.565E-06/yr
Proposed AOT (7 days each EDG per yr)	2.083E-06/yr
Proposed AOT (7 days & 10 days per yr)	2.296E-06/yr
Realistic Time OOS (5 days per yr)	1.824E-06/yr

The current maintenance unavailability is 1.6E-03 for each EDG which is equivalent to 14.016 hours per year.

Question 16:

Provide a discussion of the loss of offsite power events at your facility and include a quantitative discussion on how industry data on offsite power losses compares with your facility

Response to Question 16:

The data that is utilized to calculate the loss of offsite power frequency is data compiled through 1988. In this time frame there has been one total loss of off-site power event at ANO. The industry frequency value for LOSP events is calculated to be 5.84E-02/yr (Ref. 1). The individual frequency that applies to ANO 2 is determined using the following formula:

$LOSP_{frequency}$ = Total # of events/Site yrs through 1988

The total # of events is 1. (Reference 1)
The Site Years through 1988 is 14.6 (Reference 1)

$\therefore LOSP_{frequency} = 1/14.6 = 6.85E\text{-}02/yr$

A comparison of the values reveals that the ANO frequency is greater than the industry frequency when the "through 1988" data is utilized. ANO considers this situation acceptable since one data point does not provide sufficient statistical confidence and no other LOSP events have occurred at ANO since 1988.

Reference 1	NSAC/144 April 1989, Losses of Off-Site Power at U.S. Nuclear Power Plants All Years Through 1988

Question 17a:

The TS should include verification that the required systems, subsystems, trains, components, and devices that depend on the remaining EDGs as a source of emergency power are operable before removing an EDG for PM. In addition, positive measures should be provided to preclude subsequent testing or maintenance activities on these systems, subsystems, trains, components, and devices while the EDG is inoperable.

Response to Question 17a:

The following bullet items address this concern:

- Weeks are divided up by trains (Red, Swing, Green, Swing, etc.) Only red train components are scheduled for maintenance during a red train week. The Swing week (located between each Red and Green week) allows for unanticipated delays where, for instance, Red maintenance may not have been fully completed within it's allotted time frame. Surveillance and other testing is also accurately scheduled during their respective train week or window. REF. 2OPG-005 Page 23 Section "Red Train/Green Train Considerations"

- The channel (or color) of the window is displayed on monitors located throughout the plant and on the main status board in the Control Room Extension as a visual aide to deter wrong train activities.

- An Inoperable Equipment Checklist must be completed prior to removing any Tech Spec equipment from service. This checklist specifically allocates redundant equipment status checks prior to work on any EDG or offsite power source. REF. OP 1015.017A

- During a given EDG window, the opposite train is designated as "protected." Activities are restricted near protected equipment while the EDG is out of service. This prevents any and all testing or other activities from taking place on the redundant train of equipment. In some cases, barriers are posted at access points to redundant equipment to deter work in non-authorized areas. REF. 2OPG-005 Attachment 1

Question 17b:

The overall unavailability of the EDG should not exceed the value that was used in the PRA supporting the proposed AOT. Also the EDG unavailability should be monitored in accordance with the maintenance rule performance criteria.

Response to Question 17b:

The overall unavailability used in the PRA supporting the EDG AOT was 219 hours/EDG/year. ANO Unit 2 maintains an overall unit average goal of EDG unavailability of 2.5%. The 2.5% unavailability goal is based on an INPO performance indicator and is equivalent to 219 hours/EDG/year. This performance indicator is monitored and the results are reported to station management.

Implementation of the maintenance rule for the EDG system is required to be completed by July 1996. The performance criteria for unavailability is currently to be set at less than 300 hours unavailability per EDG per cycle. The current cycle at ANO-2 is 18 months. On an annual basis this unavailability would be equivalent to 200 hours/EDG/year.

Question 17c:

For those plants that have an AAC source, it may be appropriate to demonstrate, before taking an EDG out for an extended period, that the AAC source is functional by verifying that the power source is capable of being connected to the safety bus associated with the inoperable EDG, and verifying this capability of being connected to the safety bus periodically thereafter.

Response to Question 17c:

The AAC source at ANO is surveillance tested at regular intervals and, as a matter of prudence, maintained operable during any EDG outage or ongoing switchyard activities. However, risk calculations indicate that the extended AOT is justifiable with or without AAC source availability. REF. OP 1015.033

Question 17d:

Voluntary entry into a limiting condition for operation (LCO) action statement to perform PM should be contingent upon a determination that the decrease in plant safety is small enough and the level of risk the plant will be at is acceptable for the period and is warranted by operational necessity, not by convenience.

Response to Question 17d:

Removal of any safety related component from service should illustrate gain in component safety, longevity, and/or performance. This gain is weighed against overall risk and possible consequences as discussed in bullet item #1 under Response to Question 4 above. REF. 2OPG-005 Pages 6-8 Section "Risk Assessment"

Question 17e:

Voluntary entry into an LCO action statement should not be abused by repeated entry into and exit from the LCO.

Response to Question 17e:

This philosophy is strictly adhered to. In cases where a component or system might be removed from and restored to service repeatedly (provided same failure mode was evident in each case), the AOT is tracked such that the accumulated total time would not exceed the given AOT.

Question 17f:

Removal from service of safety systems and important non-safety equipment, including offsite power sources, should be minimized during the outage of the EDG PM.

Response to Question 17f:

EDG outage windows contain very little if any significant maintenance other than that of the EDG itself. Switchyard activities are procedurally restricted during EDG maintenance windows. REF. 2OPG-005 and OP 1015.033

Question 17g:

Voluntary entry into an LCO action statement should not be scheduled when adverse weather is expected.

Response to Question 17g:

Neither switchyard activities nor EDG maintenance is normally permitted during unstable weather conditions. This ensures the availability of electrical power to all operable equipment should an accident or transient develop. REF. 2OPG-005 Page 13 Section "On-Line Weather Monitoring" and OP 1015.033

Question 18:

Indicate if your plant has any excess capacity in the onsite power system.

Response to Question 18:

A review of the safety related EDG loading calculation indicates there is excess capacity in the onsite EDG power system. The conclusion of the calculation is "Based upon the above loading results, the maximum 2 out of 24 hour (i.e., short time) rating of 3135 kW for diesel generator No. 1 (No. 2) will not be exceeded by the load it is presently supplying."

The site also has an Alternate AC (AAC) EDG that was installed in response to the SBO rule. The AAC EDG is available for use by either ANO1 or ANO2. The AAC EDG has the capacity (plus margin) to supply either 4160 VAC safety grade bus for either ANO unit

Question 19:

Provide a list of typical PM or CM that can take over 72 hours to complete and explain how this task is accomplished within the current LCO. Include in your response the type of PM (which is required for your EDGs) that you intend to do during power operation and specify the time it takes to accomplish it.

Response to Question 19:

The list of typical PM and CM performed on each EDG, as provided in response to question 3, is not accomplished in the current LCO. Currently, this work is accomplished during refueling outages. The list provided in response to question 3 is typical of the type of maintenance we intend to perform while at power.

Question 20:

In the PRA, when an EDG is taken out of service, did you assume the whole ESF electrical power division to be inoperable for the purpose of calculating the increase in CDF? If not, why not?

Response to Question 20:

It is not assumed that the whole ESF electrical power division is inoperable when an EDG is unavailable. This is because there are multiple possible sources of power: the EDGs and the Offsite Power Source(s). If one EDG is unavailable, the Offsite Power Source(s) are still available and therefore, power is available to the ESF electrical power division. However, if the offsite power sources are lost, then the PRA model accounts for this and would evaluate the loss of the ESF electrical power division concurrent with the unavailability of one EDG. The PRA model accounts for "other" power source failures by utilizing the failure rates for the appropriate components.

Question 21:

Provide the major electrical component failure rates used in your PRA.

Response to Question 21:

The fault trees associated with the event "EDG fails to deliver power to the bus" were reviewed in order to determine major electrical components. The major electrical equipment failure rates are as follows:

Component	TC Code	Failure Mode	Failure Rate	Data Type
DC breaker	CDR_E	Transfers open	3.80E-06	Generic
Relay	REE_E	Fails to operate on demand	7.65E-05	Generic
Solenoid Valve	SVC_E	Fails to close	2.83E-03	Generic
Solenoid Valve	SVN_E	Fails to open	2.83E-03	Generic
Relay	REK_E	Operational failure - LO trip	3.94E-07	Generic
Relay	RER_E	Operational failure - Sync	3.94E-07	Generic
DC Bus	BDF_D	Fault	4.50E-08	Generic
DC Breaker	CDR_D	Transfers open	3.80E-06	Generic
Relay	REE_D	Fails to operate on demand	7.65E-05	Generic
Diesel Generator	DGF_E	Fails to run	4.09E-03	Plant Specific
AC Breaker	CBR_E	Transfers open	8.06E-07	Plant Specific
Diesel Generator	DGA_E	Fails to start	3.07E-03	Plant Specific

Question 22:

How do you define core damage in your PRA?

Response to Question 22:

In the ANO-2 PRA, core damage is defined to occur when the clad temperature reaches 2500 °K (4038.7 °F), the melting temperature of the zircalloy fuel cladding. This definition is similar to that used in other PRAs. The time at which this point occurs in an accident varies with the accident conditions. Recoveries applied to these accidents account for delays in system actuation, operation, and effect (i.e., time to reverse the core heatup).

Question 23:

Table 6.3.2-1 of the SIT report indicates a Success Criteria. Is this the success criteria that the plant was licensed to or is this a different criteria that was developed for the PRA? If it is not the criteria the plant was licensed to, what is the basis for its use in the PRA?

Response to Question 23:

The SIT success criteria shown in Table 6.3.2-1 for ANO-2 was used for the PRA analysis. The success criteria is based on engineering judgment and was confirmed by MAAP analyses. These analyses indicated that 3 of 4 tanks, two actually discharging into the vessel and the contents of one lost out the break, provided acceptable results. This differs from the analyses used to license the plant which rely on all four tanks, three into the vessel and one lost out the break.

Question 26:

Does the PRA take credit for any analyses that have not been approved by the NRC staff?

Response to Question 26:

The ANO-2 PRA assesses the severe accident risk associated with the operation of ANO-2 in a realistic manner. The formulation of this realistic assessment involved consideration of design basis analyses, best-estimate analyses, and engineering judgment. The design basis analyses are generally staff-approved; the latter have generally not been approved by the NRC staff.

The exclusive use of staff-approved analyses, which are generally synonymous with design basis analyses, are typically conservative in nature and, as such, may not produce realistic results. Thus, it is appropriate in a PRA analysis to employ best-estimate analyses and engineering judgment.

Examples of the use of design basis analyses, best-estimate analyses, and engineering judgment in the ANO-2 PRA follow:

- Design basis — EFW and Containment Spray success criteria are based on design basis accident analyses.
- Best-Estimate — SIT success criteria are based on MAAP analyses.
- Engineering Judgment — HPSI success criteria are based on engineering judgment accounting for DBA analysis. Once through cooling success criteria are based on extrapolation of NUREG and CEOG analyses and engineering judgment confirmed by MAAP analyses.

<u>Generic Questions for the CEOG as a Whole</u>

<u>Question 27:</u>

Does the statement on page 28 of the LPSI System Report, "Given the fact that the frequency of requiring LPSI at power is on the order of 1 x 10-4 per year (the frequency of a Large LOCA event) ..." include consideration of the mitigation of non-large LOCAs? If so, describe these initiators and their contribution to the 1 x 10-4 per year total.

<u>Response to Question 27:</u>

The 1 x 10-4 per year value is a representative value for LOCAs in excess of about 4.3 inches in diameter. These events will encompass all LOCAs for which the LPSI is considered to have a role in preventing core damage. Since availability of the LPSI is not required for LOCAs of smaller size, that frequency is not included.

Question 28:

On page 11 of the EDG Report it is stated that plants with 3-day AOTs have a mean yearly scheduled maintenance unavailability of about 77 hours per EDG per year compared to 132 hours per EDG for plants with a 7-day EDG AOT. Both groups show similar yearly repair time outages for unscheduled maintenance (46 versus 51 hours). The above suggests that the longer the EDG AOT, the longer it takes to perform CM or PM. The above numbers also suggest that the plants with 72-hour AOTs manage their time better and have less total unavailability than the plants who have 7-day AOTs. Based on the above, explain why the difference in mean yearly scheduled maintenance unavailability exists.

Response to Question 28:

Plants in the group appear to adequately manage the EDG outages and generally fall within the average range for the industry. The differences in the data may reflect the presence of several unrelated issues including how the data was collected, what is the cause of the unscheduled maintenance (precautionary vs. functional failure), and plant maintenance philosophy.

In addition, in interpreting the data in the provided tables the following should be noted:

1. Plants licensed with a 3 day EDG AOT are typically of newer design and construction than those licensed with the 7 Day EDG AOT. Thus, the increased average maintenance associated with these EDGs may be partially associated with EDG age and/or design.

2. Many EDG maintenance activities can approach or exceed the 72 AOT if performed "at power". Plants with longer AOTs for the EDG will likely perform a few additional PM activities "at power". Thus, plants with licensed three day AOTs typically perform less maintenance "at power" than those with longer AOTs.

It should also be noted that some plants with 3 day AOTs have mean EDG PM and CM unavailability's that exceed those of the plants licensed with 7 day AOTs.

Question 29:

On page 11 of the EDG Report it is stated that CM is performed on an EDG at a mean frequency of 3.3 times per year with a mean duration of 23.3 hours and a standard deviation of 46.7 hours. A mean duration of 23.3 hours with a standard deviation of 46.7 hours amounts to 70 hours which suggests that 84% of the plants are able to finish EDG repair in 70 hours, and therefore 72 hour AOT appears to be adequate for majority of the plants. Based on the above, why should the 7-day AOT be allowed on a generic basis?

Response to Question 29:

The observation is correct. The existing AOT is adequate for most purposes. It is not the intention of the extended AOT to prolong maintenance to the full extension of the AOT. The AOT extension allows CM to be performed with adequate margin so that 16% of the time plants do not have to request exigent NOEDs.

Question 30:

On page 9 of the CEOG report it is stated that the industry mean PM on an EDG was 24.6 hours with a standard deviation of 37.6 hours. This suggests that maintenance done at power frequently exceeds one-half of the AOT and in about one-quarter of the occurrences exceeds the typical 72-hour AOT. How many CE plants have exceeded the typical 72-hour AOT and how many plants required discretionary enforcement for such situations to continue plant operation in the past 5 years?

Response to Question 30:

Three CE plants (or 20% of the CE plants) have 7 day AOTs. These plants may schedule PM activities that exceed 72 hours without violating the system AOT. In one instance, a plant with a 7 day AOT requested and received an exigent one time extension to 10 day EDG AOT to complete a CM operation "at power".

As was noted in the Joint Applications Report, at one site with a 3 day EDG AOT, over the past five years, the units have approached the 72 hour AOT during PM activities nine times and exceeded the AOT once.