3/4.10 SPECIAL TEST EXCEPTIONS

3/4.10.8 DIESEL OPERABILITY EXCEPTION - MODES 1, 2, 3 & 4

LIMITING CONDITION FOR OPERATION (LCO)

3.10.8 The requirements of Specification 3/4.7.4 and LCOs supported by this Specification may be suspended for 7 days/train/cycle AND Specification 3/4.8.1.1 may be suspended for 21 days/train/cycle provided:

a. The requirements for two (2) of the onsite power sources specified in Specification 3.8.1.1.b AND the two (2) supporting ECW loops specified in Specification 3.7.4 are OPERABLE;

b. The circuits required by Specification 3.8.1.1.a are OPERABLE;

c. The equipment specified in ACTION 3.8.1.1.d is OPERABLE;

d. The circuit between the 138 kV offsite transmission network, via the Emergency Transformer, and the onsite Class 1E Distribution System shall be functional and available;

e. The technical support center diesel generator and the positive displacement pump are functional and available;

f. Planned maintenance on the equipment specified in ACTION 3.8.1.1.d is suspended;

g. Maintenance in the switchyard is controlled

APPLICABILITY: MODES 1, 2, 3, and 4.

DIESEL OPERABILITY EXCEPTION - MODES 1, 2, 3 & 4

LIMITING CONDITION FOR OPERATION (LCO)

ACTION:

a. With any specified condition(s) not met, then restore the specified condition(s) within 24 hours or place the unit in the following MODE, as applicable,:

1. At least HOT STANDBY within the next 6 hours,

2. At least HOT SHUTDOWN within the next 6 hours, and

3. At least COLD SHUTDOWN within the next 24 hours.

OR

b. With any specified condition(s) not met, then exit this Special Test Exception and enter the appropriate Technical Specification Action Statement.

SURVEILLANCE REQUIREMENTS

4.10.8.1 Perform Surveillance Requirements 4.8.1.1.1.a for the Standby and Auxiliary Transformers at least once per 8 hours.

4.10.8.2 Verify Emergency Transformer breaker alignment correct and indicated power available at least once per 8 hours.

3/4.10 SPECIAL TEST EXCEPTIONS

BASES

3/4.10.8 DIESEL OPERABILITY EXCEPTION - MODES 1, 2, 3 & 4

This Special Test Exception (STE) permits an essential cooling water loop to be inoperable for a cumulative 7 days per train per fuel cycle and a standby diesel generator to be inoperable for a cumulative 21 days per train per fuel cycle. In both cases, it is intended that if the essential cooling water is inoperable, the associated standby diesel generator is also inoperable. This exception is to be used for planned maintenance and testing only if all of the necessary compensatory actions are in place. If any condition of the LCO is not met during the time a standby diesel generator and/or the essential cooling water is inoperable under this special test exception, a maximum of 24 hours would be permitted to restore the condition before a plant shutdown or exiting the special test exception is required. In addition, a risk assessment must be performed in accordance with the South Texas Project Configuration Risk Management Program (CRMP). Based on the results of the assessment, the 24 hour allowed outage time may be further restricted. The intention of this action is to allow a component in one of the other two trains to be inoperable for 24 hours, if the risk assessment determines 24 hours is acceptable, during this special test exception. If unable to return the inoperable equipment to operable status within the 24 hour time limit or if the time limit determined by the risk assessment is shorter, actions must be taken in accordance with the STE and the STE CRMP.

The CRMP specifies the process for assessing and monitoring changes in core damage probability or large early release probability while in certain planned and unplanned maintenance configurations. Large Early Release Probability (LERP) is defined as a large (>3") and early containment failure or bypass that possess a significant potential for short term health impact. Early containment failure includes failures occurring before or within 2 hours of reactor vessel breach and before the effective implementation of the off-site emergency response and protective actions. Generally, the CRMP process is initiated once a planned maintenance schedule has been approved for a selected period of time (typically one work week). The planned maintenance schedule is evaluated to identify the plant configurations that result from the scheduled work activities. A risk profile for the selected time period is then generated by quantifying the PSA for each identified plant configuration. Risk thresholds are used to determine when management/supervisory oversight or compensatory actions are warranted.

3/4.10 SPECIAL TEST EXCEPTIONS

BASES

3/4.10.8 DIESEL OPERABILITY EXCEPTION - MODES 1, 2, 3 & 4

The purpose of this exception is to allow pre-planned testing and maintenance of the standby diesel generator and the essential cooling water and to allow credit for the performance of surveillances prescribed in SR 4.8.1.1.2 while in Modes 1, 2, 3 and 4. The STE is not intended to be used as a means to start planned outage maintenance prior to the start of the planned outage. As much as is practical, the plant should be maintained in a steady state condition for the duration of the STE. Time permitting, evolutions, including mode changes, should be evaluated in accordance with the CRMP.

The emergency transformer will be administratively dedicated to the ESF bus with the inoperable standby diesel generator. This means that the breaker alignment will enable the emergency transformer to supply power to the affected bus if a loss of offsite power were to occur. It is also intended to allow the use of the emergency transformer to supply any ESF bus during a loss of offsite power if the Shift Supervisor determines this is necessary. No pre-planned maintenance will be performed on the technical support center diesel, the positive displacement pump or the emergency transformer during the use of this STE. In addition the Shift Supervisor will control all work that is performed in the switchyard in accordance with established station procedures.

The analytical basis for the STE is a combination of deterministic and probabilistic methods. From a deterministic, design basis perspective, STP maintains the capability to mitigate most design basis events with one of its three ESF trains. This is a condition that is conservatively postulated to result from an accident while the STE is in effect with a loss of off-site power and a subsequent failure of one of the remaining ESF diesel generators and assumed failure of the emergency transformer.

Since maintenance and testing activities are explicitly included in the PSA analysis, it is possible to determine the impact of equipment outages on the probability of core damage or radiological release events for those systems and components within the scope of the PSA. Generally, the impact of unavailable equipment is seen as a reduction in the defense-in-depth which causes an increase in probability of core damage or radiological release. The time and duration of planned equipment outages can be assessed and incorporated into the PSA analysis. The incremental risk associated with the STE has been determined to be small, which is attributable to the redundancy and capability of the STP design as noted above. The CRMP provides the process for controlling plant configurations to keep the risk acceptably small.

ATTACHMENT 3

ANSWERS TO NRC QUESTIONS ON THE 21 DAY DIESEL SUBMITTAL

Q1. In your submittal of May 1, 1995, you proposed to extend the allowed outage time (AOT) from 3 days to 21 days once per fuel cycle for each standby diesel generator (SDG) to perform preventive maintenance. Explain why 21 days is required to perform maintenance on the SDGS. Current staff thinking is that an AOT for the SDGs of more than 14 days should only be considered on a one-time basis. This time period is based on industry experience, that a maximum of 216 hours (13.5 days, consisting of two shifts, each shift working 8 hours) is sufficient for a major SDG overhaul. Justify your request for 21 days rather than 14 days.

A1. This submittal requests a Special Test Exception (STE) that can only be used once per cycle per train. The STE duration is supported by the STP specific Probabilistic Safety Assessment (PSA). The anticipated time duration for an 18 month or 5-year diesel surveillance is eight days; however, a ten year surveillance is expected to require at least 14 days. This 14 day duration will consume two-thirds of the AOT time of 21 days. While our estimated duration for a ten year surveillance is consistent with the industry average and appear to support a 14 day AOT, we do not believe a 14 day AOT provides sufficient margin for the resolution of findings which may be identified during the inspection. By normal South Texas Project (STP) practice, actual LCO work (excluding return to service activities) is scheduled for no more than 50% of the Limiting Condition for Operation (LCO) allowed outage time, except for special circumstances to allow for correction of issues identified during the LCO. It is STP's intention to limit the duration of the STE to as few days as possible to perform the required surveillance work. Consequently, the use of the full 21 days adds to the conservatism of the PSA evaluation.

Q2. Section 2.3.3, "Model for Emergency Transformer", discusses changes to previous PSA models. Expand upon the discussion provided and include a quantitative discussion on how industry data on offsite power losses were reclassified to quantify two different types of offsite power events. Also provide additional information on the emergency transformer power source and explain how this source would be connected to the safety busses when one SDG is inoperable for 21 days.

A2. The 138kV emergency transformer is supplied from a radial line out of Central Power and Light Company's Blessing Substation. The 138kV supply is capable of furnishing the full load rating of the 138kV emergency transformer. The 138kV transmission line does not cross over or under any high-voltage lines connecting the 345kV switchyard to the plant and the emergency transformer is physically separated from both the No. 1 and No. 2 standby transformers by a minimum of 800 feet. This will ensure that a single accident in the 138kV emergency transformer will not jeopardize the standby transformers. During the routing of the 138kV line from the Blessing Substation to the STP switchyard, the 138kV line does cross under two of the eight 345kV lines approximately 2 miles from the switchyard. In the unlikely event of earthquakes, high winds, tornados, or other natural phenomena, both the 345kV and 138kV lines could fail.

The PSA models analyzed the risk significance from two different types of initiating events that interrupt power from the offsite grid.

- Loss of 345kV Power (LOSP): This initiator accounts for events that disable the normal power supply from the 345kV switchyard. These events do not include failures that simultaneously disable the 138kV power supply to the Emergency Transformer. Therefore, LOSP initiating events disable power from the Unit Auxiliary Transformer and the Standby Transformer, but they do not directly disable power from the Emergency Transformer. The Emergency Transformer power supply may remain available, or it may fail independently after the LOSP initiating event occurs.

- Loss of 345kV and 138kV Power (LOSPX): This initiator accounts for events that simultaneously disable all offsite power supplies from the 345kV switchyard and the 138kV line. Therefore, LOSPX initiating events disable power from the Unit Auxiliary, Standby, and Emergency Transformers.

The PSA models did not analyze any initiating events that involve loss of only the 138kV power supply. The Emergency Transformer does not normally supply any plant loads: therefore, loss of 138kV power, by itself, will not cause a plant trip, and is not an initiating event for the PSA.

Event data from NSAC-203 was screened to develop the initiating event frequencies used in this study. The events in NSAC-203 include only those failures that are reported as a "loss of offsite power." In particular, NSAC-203 does not include complete documentation of all failures of transmission lines, switchyard equipment, transformers, etc. that do not cause a "loss of offsite power" event. However, a number of plants in the NSAC-203 database did include alternate non-GDC-17 power supplies similar to the 138kV line and Emergency Transformer at STP. Most of the event descriptions for these plants clearly indicate whether the alternate non-GDC-17 supply remained energized during the "loss of offsite power" event. Based on this information, it was concluded the NSAC-203 database can be used to derive valid conservative estimates for the frequency of events involving combined failures of the GDC-17 and non-GDC-17 power supplies. These events correspond directly to the two initiating events (i.e., LOSP and LOSPX) that were used in the PSA models.

The unavailability of the Emergency Transformer supply was quantified using generic failure rate data for the transmission lines, buswork, circuit breakers, motor-operated disconnect switches, and large transformers.

The mean frequency of initiating event LOSPX in the PSA models is 1.4E-02 events per year. This means the expected frequency of an event simultaneously disabling the 345kV and 138kV power supplies is approximately one event in 70 years of plant operation.

The mean frequency of initiating event LOSP in the PSA models is 2.20E-02 events per year. This means the expected frequency of an event that will disable only the 345kV power supply is approximately one event in 45 years of plant operation.

The estimated mean unavailability of the Emergency Transformer power supply in the PSA models is 5.84E-03. This means the Emergency Transformer is not available approximately 0.6% of the time, or approximately 2 days per year during plant operation.

The estimated unavailability of the Emergency Transformer power supply in the PSA models was not based directly on the data from NSAC-203. The NSAC-203 data was used to estimate the frequency of common cause events that simultaneously disable the 345kV and 138kV offsite power supplies.

Plant Operating Procedure, 0POP05-EO-EC00, "Loss of All AC Power", provides the actions necessary to respond to a loss of all AC ESF power. In step 5, if the standby diesel generator does not start from the control room or locally and no manual energizing of the AC ESF bus is possible, then the emergency transformer is used to energize the AC ESF bus. The emergency transformer will carry any one ESF bus in each unit.

Q3. Footnote 10 to Surveillance Requirement 4.8.1.1.2 states, "Credit may be taken for events that satisfy any of these Surveillance Requirements", however no discussion is provided in your submittal for this change. Explain how this footnote would be used to satisfy surveillance requirements.

A3. This footnote is intended to allow surveillance credit for events, either planned or unplanned, that satisfy the surveillance requirements of the Technical Specification. These events may include the performance of the surveillance tests during the special test exception, performance of the surveillance testing during shutdown, or an actuation of the system due to a valid signal that fulfills the surveillance testing requirements. This footnote is part of the current Technical Specification NUREG

1431, Rev. 1 standard wording. This footnote will not have any impact on the normal performance of surveillance requirement testing.

Q4. The staff is presently concerned that the extensions of SDG AOTs may increase the mean core damage frequency (CDF) from station blackout (SBO) events, and impact the resolution of unresolved safety issue A-44. Provide the calculated CDF for SBO sequences without the proposed special test exception, and the CDF for SBO sequences with the proposed special test exception. Also provide the overall unavailability of the SDGs used in the PSA to calculate the CDFs for the SBO sequences requested.

A4. The primary objective of this STE is to permit concurrent planned maintenance to be performed on each DG and ECW train once per fuel cycle. This will extend the ECW and DG system AOTs for each train to 7 days and 21 days, respectively, once per fuel cycle. The current 72 hour AOT for both systems will be retained for other planned maintenance activities during the rolling maintenance cycle (voluntary LCO entry) and all unplanned and corrective maintenance (involuntary LCO entry).

The PSA does not model the station blackout event as a single initiating event. Instead, several initiators can contribute to a station blackout scenario (SBO). These are: Loss of all Offsite Power (LOSPX), Loss of 345kV Offsite Power (LOSP), Loss of Power from the Main Transformer (LOMT), General Transient Induced Loss of 345kV Power (TLOSP), General Transient Induced Loss of 345kV & 138kV Power (TLOSPX). These initiating events make up the spectrum of SBO scenarios in the PSA sequence database.

The STP PSA is a "Living PSA" which is revised as necessary to reflect current plant design and practices. The current PSA calculation, includes the incorporation of recently approved risk-based allowed outage times for several Technical Specifications, an update of the PSA plant specific and generic failure rate database and the incorporation of the emergency transformer. The impact of these changes further refines the PSA model in order to more accurately reflect plant risk. The initiating event contributions for comparison in the PSA sequence database are:

• SBO Frequency - 1992 Level 2 (IPE) PSA	1.79E-05
• SBO Frequency - 1993 Risk Based Evaluation	1.28E-05
• SBO Frequency without Special Test Exception	3.73E-06
• SBO Frequency with Special Test Exception	5.28E-06

The diesel generator system unavailability modeled in the STP PSA is shown below and includes all planned and corrective maintenance. Also, included in this value is the unavailability due to maintenance (corrective and planned) on the essential cooling water system. This information accounts for the dependency of the diesel generators on the essential cooling water system. All other diesel generator dependencies are accounted for in the PSA.

• Unavailability with Special Test Exception	1618 hours
• Unavailability without Special Test Exception	700 hours

Q5. The staff is currently in the process of granting a 14-day AOT to a plant that has installed a weather-proof tie-line from a hydro station used as an AAC source which will substitute for the inoperable SDG. The staff believes that a 14-day AOT is adequate to perform any preventive SDG maintenance, including a major overhaul, provided the following conditions are met. Provide a discussion of how you would satisfy each condition listed below.

Q5a. The Technical Specifications (TSs) should include verification that the required systems, subsystems, trains, components, and devices that depend on the remaining SDGs as a source of emergency power are operable before removing an SDG for preventive maintenance (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 SDG is inoperable.

A5a. Prior to using the STE, all required systems and trains will be verified operable using the normal administrative controls. In addition, prior to entry into the LCO allowed outage time, a PSA analysis of the planned work will be performed. During the STE LCO, planned maintenance and testing on required redundant systems and trains will not be scheduled, while the SDG is inoperable, unless required to comply with Technical Specifications.

Q5b. The overall unavailability of the SDG should not exceed the value that was used in the PRA supporting the proposed AOT. Also, the SDG unavailability should be monitored and controlled in accordance with the maintenance rule performance criteria.

A5b. The primary objective of this STE is to permit planned maintenance to be performed on each DG and ECW train once per fuel cycle. This will extend the ECW and DG system AOTs for each train to 7 days and 21 days, respectively, once per fuel cycle. The current 72 hour AOT for both systems will be retained for other planned maintenance activities during the rolling maintenance cycle (voluntary LCO entry) and all unplanned and corrective maintenance (involuntary LCO entry).

The PSA model conservatively assumes utilization of all 21 days of the requested STE once per Diesel Generator per fuel cycle. In actuality, this will not be the case. For example, the current 72 hour LCO for planned maintenance on the Diesel Generator has a mean average, including return to service activities, of 42.6 hours, which is approximately 59% of the total LCO period. By conservatively assuming in the PSA the whole 21 days is utilized, the overall DG unavailability due to planned maintenance activities should not be exceeded.

STP is in the process of implementing 10CFR50.65, the Maintenance Rule, and has been utilizing the PSA during this process. The Diesel Generator System has been determined to be a risk significant system and will have performance criteria set in accordance with the program. Therefore, Diesel Generator unavailability and reliability will be monitored and controlled in accordance with the maintenance rule performance criteria. Prior to entry into the LCO allowed outage time, a PSA analysis of the planned work will be performed. After the work is completed, a revised PSA analysis will be performed to reflect the actual work duration.

Q5c. The TSs should contain requirements to demonstrate, before taking an SDG out for an extended period, the emergency transformer source is functional by verifying the power source is capable of being connected to the safety bus associated with the inoperable SDG, and verifying capability of being connected to the safety bus every 8 hours thereafter.

A5c. These actions are contained in the requested STE as Action d. of the LCO and surveillance requirement 4.10.8.2.

Q5d. Voluntary entry into a limiting condition for operation (LCO) action statement to perform preventive maintenance (PM) should be contingent upon a determination that the decrease in plant safety is small enough and the level of risk the plant would be at with the AAC power source (or, in this case, the emergency transformer) is acceptable for the period and is warranted by operational necessity, not by convenience.

A5d. The primary objective of this STE is to permit planned maintenance performance on each DG and ECW train once per fuel cycle. This will extend the ECW and DG System AOTs for each train to 7 days and 21 days, respectively, once per fuel cycle. The current 72 hour AOT for both systems will be retained for other planned maintenance activities during the rolling maintenance cycle (voluntary LCO entry) and all unplanned and corrective maintenance (involuntary LCO entry).

The primary motivation behind STP's request for this STE is the desire to achieve a more balanced allocation of component maintenance tasks between full power operation periods and refueling outages. In addition, accounting for unique plant features will relieve an undue burden on the resources required to test and maintain plant equipment caused by the application of standard Westinghouse (W) Technical Specifications on STP.

The current 72 hour AOT for both the diesel generator (DG) and essential cooling water (ECW) systems is still applicable for corrective and preventative maintenance activities. As a result of the proposed change, some of the preventative maintenance for the ECW and DG Systems currently performed during refueling outages could be performed with the plant at power. Considering the risk impact of the proposed change, the requested STE will not result in a significant increase in the risk of a severe core damage event. In fact, when considering the positive effects of removing a significant amount of diesel generator and essential cooling water maintenance from the refueling outages, the proposed change will improve plant safety during refueling outages. This is due to the increased likelihood the ECW and DG Systems having a higher availability during shutdown conditions and an enhanced station focus on equipment within the scope of the proposed STE relative to the scope of equipment within a refueling outage.

Q5e. Voluntary entry into an LCO action statement should not be abused by repeated entry into and exit from the LCO.

A5e. As stated in the bases of this submittal, this special test exception permits an essential cooling water loop to be inoperable for a cumulative 7 days per train per fuel cycle. It also permits a standby diesel generator to be inoperable for a cumulative 21 days per train per fuel cycle. In both cases, if the essential cooling water is inoperable, the associated standby diesel generator is also inoperable. This exception is to be used for the cumulative number of days specified per train per fuel cycle and for planned maintenance and testing. This exception is permitted only if all of the necessary compensatory actions are in place. STP intends to only use this STE once per train per cycle. However, since there is a maximum cumulative number of days allowed per diesel per fuel cycle, repeated entry into and exit from this STE will not occur.

Q5f. Removal from service of safety systems and important non-safety equipment, including offsite power sources, should be minimized during the SDG PM.

A5f. It is the intention of STP to eliminate planned maintenance on risk significant systems during the STE and to minimize all other work on important non-safety equipment, including offsite power sources during the use of the STE. Since this STE will be used approximately four times per 12 months, planning for the 21 day AOT will be performed well in advance. Transmission and Distribution will be involved in this planning process to ensure all work to be performed is preplanned and no risk significant work is scheduled in the switchyard during the use of the STE. If a situation requiring corrective maintenance should occur during the use of the STE, a risk analysis will be performed to determine the actions necessary to ensure plant safety.

Q5g. Voluntary entry into an LCO action statement should not be scheduled when adverse weather is expected.

A5g. Current plant procedures will prevent voluntary entry into this LCO during expected adverse weather conditions.

Q5h. If an SDG is removed from service for preplanned maintenance, the TSs should include provisions for demonstrating the operability of the remaining SDGs by testing at least once within the subsequent 24 hours after the first 7 days of the 14 days AOT period unless the required monthly testing of the SDGs coincides with the first 7 day period. This demonstration of operability is necessary to provide assurance that the remaining SDGs are operable because of their increased importance due to the inoperability of one SDG over this extended period. This operability test does not require paralleling to the grid and loading the SDG.

A5h. STP will demonstrate the operability of the remaining standby diesel generators prior to entry into the STE as part of the prerequisites. However, the STP believes the operability testing of the standby diesel generators after the first 7 days of the STE is not necessary and is inconsistent with the latest guidance provided in NUREG 1431, Rev. 1 and recently approved amendments to the STP Technical Specifications. The NUREG 1431, Rev. 1 guidance and the recently approved STP Technical Specification amendments are intended to resolve the unnecessary starting and resultant wear on OPERABLE standby diesel generators caused by Technical Specification requirements.

In addition to the previous responses, Houston Lighting & Power 's Configuration Risk Management Program will be used to assess the risk associated with any configuration change occurring during the duration of the STE. This program augments the required 24 hour ACTION and may impose shorter duration/more restrictive actions if calculated risk exceeds program criteria.

The STP Probabilistic Safety Assessment (PSA) is a plant-specific integrated risk analysis model which estimates the frequency of a core damage or radiological release event resulting from various initiating events (e.g., turbine trip, reactor trip, steam generator tube rupture). The PSA incorporates plant-specific design features and equipment dependencies along with operator actions to identify equipment and events necessary to prevent or mitigate a core damage or radiological release event.

Since maintenance and testing activities are explicitly included in the PSA analysis, it is possible to determine the impact of equipment outages on the probability of core damage or radiological release events for those systems and components within the scope of the PSA. Generally, the impact of unavailable equipment is seen as a reduction in the defense-in-depth which causes an increase in probability of core damage or radiological release. The time and duration of planned equipment outages can be assessed and incorporated into the PSA analysis. The results can be used to represent the conditional core damage probability or conditional large early release probability for the given planned maintenance configuration(s).

The CRMP specifies the process for assessing and monitoring changes in core damage probability or large early release probability while in certain planned and unplanned maintenance configurations. Large Early Release Probability (LERP) is defined as a large (>3") and early containment failure or bypass that possess a significant potential for short term health impact. Early containment failure includes failures occurring before or within 2 hours of reactor vessel breach and before the effective implementation of the off-site emergency response and protective actions. Generally, the CRMP process is initiated once a planned maintenance schedule has been approved for a selected period of time (typically one work week). The planned maintenance schedule is evaluated to identify the plant configurations that result from the scheduled work activities. A risk profile for the selected time period is then generated by quantifying the PSA for each identified plant configuration. Risk thresholds are used to determine when management/supervisory oversight or compensatory actions are warranted.

Adherence to the work schedule as planned and represented by the associated risk profile ensures that the cumulative effects of equipment out of service is maintained at appropriate levels. If an unplanned event renders additional systems or equipment within the scope of the PSA inoperable, then a re-analysis of the condition may be required and a revised risk profile generated. If the revised risk profile indicates that a threshold has been or will be exceeded, then station management would be notified and compensatory actions developed, as appropriate. After the unplanned event has been evaluated, additional information relative to returning equipment to service or revising the plant condition or configuration, if appropriate, may also be identified to operations personnel.

Q6. With regard to the three-train system at STP, please clarify if any one train is sufficient to mitigate the consequences of all design basis accidents (DBAs). If any one train is not sufficient for all DBAs, please identify the scenarios where one train would not be sufficient?

A6. Only one safety train being available to mitigate accident consequences has the potential to impact the following Design Basis Accidents:

A. Steam system piping failures (UFSAR Section 15.1.5)
B. Feedwater system pipe break (UFSAR Section 15.2.8)
C. Loss of Coolant accident (UFSAR Section 15.6.5)

Houston Lighting & Power has not performed analysis of these Design Basis Accident (DBA) events with only one safety train available. The following is discussion, based on engineering judgement, of these accidents assuming only one safety train is available. The discussion shows only a small population of LOCA events have an increase in consequences with only one safety train available.

STEAM SYSTEM PIPING FAILURES

The Steam System Piping Failure (Steam Line Break) analysis assumes two safety trains actuate to demonstrate compliance with design and licensing limits. A reduction in the number of safety trains to one could potentially impact the following aspects of the analysis: Departure from Nucleate Boiling (DNB), containment structural integrity, and equipment qualification. The following is a discussion of each of these topics.

The analyses of record for the DNB evaluation assumes a double ended steam line break inside containment from zero power conditions. The safety injection system is used to mitigate the return to power and to prevent the fuel from experiencing DNB conditions for this scenario. With only one train of safety injection, the return to power would increase slightly above the level in the analysis of record, thereby decreasing the margin to DNB. However, the increase in power would also result in a slightly higher RCS pressure, increasing the margin to DNB. Based on these competing effects and available margin to DNB, HL&P believes that DNB would not occur with only one train of safety injection available.

The containment structural integrity analysis of record assumes a double ended steam line break inside containment from full power conditions. The containment spray system and Reactor Containment Fan Coolers (RCFCs) are used to maintain the containment pressure and temperature conditions within the design basis of the containment structure limits for this scenario. With only one train of containment spray and RCFCs, the ability to reduce containment pressure and temperature conditions is also reduced. A review of the analyses of record shows sufficient margin exists with only one safety train to ensure containment pressure and temperature stay below the containment structural integrity limits.

The equipment qualification analysis of record for the steam line break event assumes a spectrum of breaks from several power levels. Like the containment structural analysis, assuming only one safety train available will reduce the ability of the containment spray and RCFCs to maintain pressure and temperature below the equipment qualification limits. However, a review of analysis of record shows sufficient margin exists to accommodate the increase in pressure and temperature. Therefore, one safety train is sufficient to insure there is no increase in consequences of the steam line break accidents.

FEEDWATER SYSTEM PIPE BREAK

STP has four Auxiliary Feedwater (AFW) trains feeding four steam generators. The actuation circuits for AFW Trains A and D are powered from Safety Train A. AFW Trains B and C are powered from Safety Train B and C respectively. The current analysis assumes Safety Train A fails, disabling the automatic actuation of AFW trains A and D. AFW Train D can still be actuated by operator action. Train B is assumed to fill steam generator B. Train C is assumed to feed the faulted steam generator and not provide any cooling of the Reactor Coolant System. The acceptance limit for this accident is the pressurizer does not go water solid within 30 minutes with no operator action.

The results of the analyses would be impacted only if Safety Train C was the safety train being assumed available. Under this condition, the scenario would assume no AFW to the steam generators. This could decrease the time required for the pressurizer to go water solid to less than 30 minutes without operator action. However, operators would have sufficient time to align AFW Train C to other steam generators using the Emergency Operating Procedures. Therefore, operators actions would ensure no increase in consequences from this event.

LOSS OF COOLANT ACCIDENT

The Loss of Coolant Accident addresses several aspects of plant design. Aspects which may be impacted by having only one safety train include: (1) compliance with 10CFR 50.46 requirements, (2) compliance with 10 CFR part 100 and General Design Criteria (GDC) 19 requirements, (3) containment structural requirements, and (4) equipment qualification. The following is a discussion of each of these topics.

The analysis of record demonstrating compliance with 10 CFR 50.46 requirements assumes a large break LOCA in a cold leg of the Reactor Coolant System. For this accident, one safety train fails to start, one train of safety injection injects into the broken loop and into containment, and one train provides flow to the reactor core to mitigate the consequences of the event. One train of safety injection flow to the reactor core is sufficient to ensure 10 CFR 50.46 requirements are satisfied. For this scenario, the consequences of a LOCA would not be satisfied if the break was in the cold leg of the available safety train. A break in any other location would produce acceptable results. In addition, the reduction of SI flow associated with only one train of SI flow may also result in the 10 CFR 50.46 requirements being exceeded for a small spectrum of small break LOCAs.

The medium break LOCA, as defined in the PSA, requires two HHSI trains for successful mitigation of the accident. A medium break LOCA results from a pipe break in the range of 2 to 6 inches in diameter. For a very narrow range of breaks on the smaller range of the spectrum, it is assumed one HHSI pump may not be enough to keep up with the break flow and the RCS may not depressurize enough to reach the LHSI injection pressure. Therefore, the core could uncover without two trains of HHSI available and core damage could result. However, in that case, emergency operating procedures require the operator to depressurize the RCS to the LHSI injection pressure. This action will provide the makeup capability necessary to prevent core damage. For breaks on the larger end of the spectrum, the accident behaves much like a large break LOCA.

The analyses of record demonstrating compliance with 10 CFR part 100 and GDC 19 requirements assumes two trains of containment sprays for the removal of Iodine after a large break LOCA. Review of this design basis calculation shows these limits may be exceeded if only one train of containment spray was available. Houston Lighting & Power has confidence that analyses performed with more realistic methods and assumptions would show a single train of containment spray is adequate.

The containment structural requirements analysis of record assumes two containment sprays and three RCFCs actuate for this event. With only one safety train, the number of containment sprays and RCFCs is reduced to one. A review of the analysis of record shows sufficient margin exists to ensure the containment structure does not exceed its design parameters with only one safety train.

The equipment qualification analysis of record assumes two safety trains function to reduce containment pressure and temperature and equipment dose during a large break LOCA. A review of the analysis shows sufficient margin exists such that one safety train will ensure the equipment pressure and temperature qualification limits are not exceeded. A review of the equipment qualification dose limits shows these limits may be exceeded.

The ATWS event is modeled in the PSA as requiring two trains of AFW for secondary heat removal. Three of the trains (A, B, and C) are motor operated pump trains and one is a turbine driven pump train (D). The three motor driven pump trains receive an ESF signal to start from their respective safety trains, while AFW train D receives a start signal from safety train A. STP has four trains of AFW, but loss of the A train ESF signal and either B or C train AFW pump could result in a failure to automatically start three trains of AFW. This loss of automatic start capability does not prevent the operator from starting the necessary AFW pumps.

Q7 . Proposed LCO 3.10.8.a would extend the time constraint associated with not meeting the requirements of TS 3.8.1.1.d from 2 hours to 24 hours. The bases section of TS 3.8.1.1 Action d states in part;

> "Provides assurance that a loss of offsite power, during the period that a diesel generator is inoperable, does not result in a complete loss of safety function of critical systems . . . the completion time takes into account the capacity and capability of the remaining AC sources, and the low probability of a DBA occurring during the period."

Provide an analysis of what safety functions could be lost during the 24 hours allowed for in this proposed TS, and a justification showing why 24 hours should be permitted instead of the 2 hours allowed for in TS 3.8.1.1.d if any safety functions could be lost. Since this special test exception is only intended for planned maintenance, explain what types of actions, if any, would be preplanned for an anticipated loss of a safety function prior to entering this proposed LCO.

A7. Technical Specification 3.8.1.1.d allows 2 hours of restoration time should a safety component/function become inoperable in a safety train other than the one with a diesel inoperable. This action is to provide assurance that a loss of offsite power, during the period that a diesel is inoperable, does not result in a complete loss of safety function of critical systems. The 2 hour restoration period takes into account the capacity and capability of the remaining AC sources, and the low probability of a DBA occurring during the period.

STP has a three train design for most safety functions, however, some safety components/functions have only a two train design and those that are important to prevent core damage are accounted for in the PSA. The following safety components/functions, which the PSA considers important to prevent core damage, have a two train design and might not be available if a total LOSP occurred in combination with a failure of one of the remaining standby diesel generators and the emergency transformer during the 24 hour period:

Charging Pumps -

There are two trains of charging pumps at STP powered by safety trains A and C. The charging pumps are high pressure pumps and are separate from the High Head Safety Injection (HHSI) pumps. The system is included in the PSA primarily because of its function to maintain the required water inventory in the RCS, RCP seal injection, and alternate pressurizer spray. However, the charging pumps are not an ECCS system.

The ability to maintain RCS inventory during an accident is primarily accomplished in the PSA through the isolation of letdown line valves. Isolation of these valves is required when normal charging is lost to prevent an uncontrolled loss of RCS inventory. The letdown line has an air operated isolation valve which will fail closed on a loss of instrument air following a LOSP. The seal return line is discussed under containment isolation.

The charging system provides RCP seal injection to prevent an RCP seal LOCA. The seal injection function is backed up by seal cooling provided by CCW through the RCP thermal barrier and an alternate seal injection path using the PDP. This alternate method of seal injection is included in the EOPs and will be available during the STE. This is discussed further in the CCW section below.

The charging system also provides a backup function to normal pressurizer spray. The PSA models this function for steam generator tube ruptures (SGTRs). A SGTR followed by a LOSP (or vice versa) is a low probability event as modeled in the PSA.

Although the HHSI pumps have a lower shutoff head, the makeup function of the charging pumps is backed up by the HHSI pumps.

Component Cooling Water -

The CCW system is a three train design; however, some CCW functions are provided by the common header while others are provide by the non-safety header. Both headers are fed by all three trains. The common header provides cooling flow to the spent fuel pool while the non-safety header provides cooling flow to the Boron Recycle Evaporator, the Letdown Heat Exchanger and other small non-essential loads. There are two isolation valves (MOVs) for each of these headers. One isolation valve on each header is powered by C train while the other is powered by A train on the non-safety header and by B train on the common header. These valves are normally open and close on an ESF signal so adequate flow for accident conditions is assured to the required accident loads. Unless the operable train is C train, only one of these headers will isolate during a total LOSP without manual action. The Emergency Operating Procedures (EOPs) give guidance on when the header isolation valves must be restored to keep the spent fuel pool from boiling. Should only one train of CCW be available, the PSA conservatively assumes the failure of these valves to close when required could divert enough flow so other CCW accident loads may not receive the required flow. The PSA conservatively assumes this will effectively cause a loss of all three trains of CCW. However, an operator can be dispatched to manually close these valves. The systems dependent on CCW for cooling, as modeled in the PSA, are seal cooling for the Reactor Coolant Pump (RCP) using the thermal barriers, the Residual Heat Removal (RHR) system heat exchangers and pump motors, Reactor Containment Fan Coolers (RCFCs), and Charging (room and lube oil cooling).

The main short term effect of losing CCW and mitigating an accident based on the dependencies mentioned above is the loss of seal cooling and normal injection to the RCPs which could result in an RCP seal LOCA. In the case of a loss of all RCP seal cooling and normal injection, STP has an alternate means of seal injection during a loss of offsite power with the Positive Displacement Pump (PDP) powered by the Technical Support Center (TSC) diesel generator. The availability of this alternate method of seal injection is an LCO action in the STE.

Containment Isolation -

Containment isolation of various systems is accomplished by two of the three safety trains. A loss of power to two trains will result in a loss of power to several systems as modeled in the PSA. Most of the systems modeled in the PSA for containment isolation including Supplemental Purge, the main potential air pathway, has an air operated valve associated with it which will be closed by ESF actuation or fail closed on a loss of instrument air. Two systems modeled in the PSA associated with containment radiation monitoring (safety trains A and B) and RCP seal return line (safety trains B and C) have MOVs for both the inboard and outboard isolation function. The lines associated with these pathways out of containment are small and manual isolation of these lines is provided in the EOPs.

Containment Spray -

The Containment Spray system is a three train design which does not impact core damage in the PSA; however, the current design bases analysis assumes two pumps are providing flow during a LOCA. While one pump will provide approximately 70% of design flow and approximately 75% of design pressure, the current model assumes 100% design flow for the dose analysis.

The following safety components/functions, which the PSA does not consider important to prevent core damage and which will not be required if core damage is prevented, have a two train design and might not be available if a total LOSP occurred during the 24 hour period:

Hydrogen Recombiners -

STP has two trains of hydrogen recombiners that are diesel backed (safety trains B and C) . Therefore, if one diesel was out of service and the other recombiner or its support systems became inoperable, a subsequent LOSP will cause a loss of this function. The recombiners are not modeled in the STP PSA and have no impact on core damage frequency. The PSA has also shown the Large Early Release Frequency for STP is small without taking credit for the hydrogen recombiners.

Fuel Handling Building Filtration System -

STP has two trains of fuel handling building filtration that are diesel backed (safety trains A and B) . Therefore, if one diesel was out of service and the other filter train or its support systems became inoperable, a subsequent LOSP will cause a loss of this function. The fuel handling building filtration systems are not modeled in the STP PSA and have no impact on core damage frequency. Without core damage there will not be a significant source term requiring the operation of the filter trains. The PSA has also shown the Large Early Release Frequency for STP is small without taking credit for the fuel handling building filtration systems.

Technical Specification 3.8.1.1.d is also based in part on the low probability of an accident during the allowed restoration time. The total LOSP event for STP has a probability of 2.1E-6 per hour based on the updated electric power analysis used for this proposed Technical Specification. Therefore, the probability of a total LOSP during a 2 hour period is 4.2E-6 while the probability of a total LOSP during a 24 hour period is 5.0E-5. The increased probability to 5.0E-5 is low based on the small exposure period. Also, this value does not take into account the likelihood of recovering electric power or the additional subsequent failures on the remaining operable train that are necessary to have a core damage event.

Q8. The bases section of TS 3.10.8.a states in part that the purpose of this exception is to allow pre-planned testing and maintenance of the SDG and the essential cooling water, and to allow performance of surveillances prescribed in 4.8.1.1.2 in Modes 1, 2, 3 and 4. However, the staff does not allow certain SDG surveillances to be performed while in Modes 1, 2, 3 and 4. Please specify the surveillances you intend to perform during this special LCO.

A8. STP intends to take credit for the performance of the 18 month, 5 year, and 10 year diesel maintenance inspections required by surveillance 4.8.1.1.2.e.1 and the 24 hour diesel generator run required by surveillance 4.8.1.1.2.e.7. The justification for the 24 hour diesel generator run at power has already been submitted in letter ST-HL-AE-5089 dated May 22, 1995.

Q9. What is the accident mitigation capability if only one ECW train is operable?

A9. Please refer to Q6 for a bounding answer.

ATTACHMENT 4

DIESEL GENERATOR MAINTENANCE SCOPE
AND
VENDOR REQUIREMENTS

Table of Contents for the 18 Month Surveillance procedure.

1) Pre-outage checks include engine analysis (including compression checks), lube analysis and turbocharger spin down time.

2) Perform engine upper and lower end boroscopic inspection.

3) Inspect rocker arms and valve actuation train.

4) Visually inspect timing chains and sprockets and check chain tension.

5) Visually inspect auxiliary chain and sprockets and check chain tension.

6) Check engine cam/valve timing.

7) Inspect camshaft lobes and crossheads.

8) Inspect vibration damper.

9) Inspect turbocharger.

10) Inspect inlet butterfly valve.

11) Based on DP, replace main lube oil filters.

12) Based on DP replace Turbocharger lube oil filters.

13) Based on DP replace fuel oil filters.

14) Remove, inspect and clean fuel oil strainers.

15) Functionally test connecting rod bearing temperature detectors.

16) Remove and inspect all fuel injector nozzles. Pop and spray test as necessary.

17) Test engine overspeed trip.

18) Internal and external visual inspection of the generator.

19) Verify tightness of generator terminal connections.

20) Clean generator windings.

21) Verify generator air gaps.

22) Inspect collector ring (slip ring) and brushes.

Table of Contents for the 18 Month Surveillance procedure (continued).

23) Measure generator insulation resistance

24) Calibrate generator differential protective relay.

25) Inspect and test Jacket Water Pump Motor.

26) Inspect and test lube oil pump motor>

27) Test/calibrate lube oil pressure trip switches.

Typically, we also take this opportunity to inspect our coolers/heat exchangers, perform adjustments as identified by engine analysis and surveillance inspections (i.e. fuel racks, governor linkage, both fuel and valve timing, etc.) and perform ASME Section XI tests and/or inspections.

SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION D0527

[illegible] Effective Date: 02/27/95 Print Date: 1441 2/20/95	0PSP04-DG-0002		Rev. 2 General	Page 1 of 41
Standby Diesel Generator 5 Year Inspection				
Quality	Safety-Related	Usage: IN HAND	Effective Date: 02/27/95	

Lee Griffin	Gary Hunt	Harvey Wright	Maintenance
PREPARER	TECHNICAL	USER	COGNIZANT ORGANIZATION

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SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION D0527

[illegible] Effective Date: 02/27/95 Print Date: 1455 2/20/95	0PSP04-DG-0003	Rev. 2 General	Page 1 of 116
Standby Diesel Generator 10 Year Inspection			
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COOPER-BESSEMER KSV TECHNICAL MANUAL
FOR NUCLEAR STANDBY APPLICATIONS

SECTION 15
RELIABILITY CHECKING AND MAINTENANCE INSPECTION

APPENDIX A – EMERGENCY DIESEL GENERATOR PERFORMANCE MONITORING RECOMMENDATIONS

APPENDIX B – RECOMMENDED RUNNING TIMES AND LOADING RATES – BREAKIN AND TESTING

NOTE: This section contains recommendations for maintenance and inspection of KSV engines in Nuclear Standby applications when an adequate system for monitoring and trending the health of the engines has been implemented. Without such a system the recommendations in Section 15 of the original issue of the Operating and Maintenance manual should be followed.

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~~APPENDIX C - REPAIR INSTRUCTIONS FOR HEAT EXCHANGERS~~

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APPENDIX D - SPECIAL DATA ON SDG # 12

APPENDIX E - ~~SBG~~ SBDG CYLINDER COMPRESSION PRESSURE TESTING MLL 10/19/93

SECTION 15

RELIABILITY CHECKING AND MAINTENANCE INSPECTION

Introduction

The purpose for Reliability Checking and Maintenance is to assure that the diesel generator will always start and load upon demand, and in accordance with appropriate specifications. It is presumed that periodic test runs will be made consistent with applicable "Regulatory Agency" requirements.

Design of the diesel generator unit permits its operation regardless of the status of the nuclear power plant. It should not be run with jumpers or any other form of by-pass around any part of the control system.

Whenever an engine is running and loaded, a complete log of operating parameters should be made at least once every two hours, and trended or checked by personnel responsible for plant operation and maintenance. Any deviation from parameter limits listed in Section 2, General Data should be immediately reconciled. Regardless of other evaluations, a review of diesel generator logs or trending data should be made in order to recognize deteriorating trends.

A log taken with the diesel generator running partially loaded and not up to operating temperatures can provide a very misleading set of data. In order, therefore, for valid data to be acquired, the unit should be running at rated load and stabilized at normal operating temperatures before making a log of running conditions.

Accurate records should be kept of all items that have required attention so that historical evidence may be used to consolidate future preventive maintenance programs.

For the sake of alternating annual inspections of multiple unit installations, it is suggested that the "first year" range from twelve to eighteen months. Thereafter, inspections should be scheduled on an annual or refueling outage basis as required by the plant's Technical Specifications.

When carrying out the "Annual, Five Year and Ten Year Inspections," it is recommended that the services of qualified C-B representatives be used under contract. Such an arrangement provides access to the manufacturer's collective experience, ensures continuity for the purpose of updating procedures in conjunction with design philosophy, and will generally expedite the various inspections.

The commonly used action verbs in this section are defined as follows:

1. Check, Measure or Verify – read the parameter and compare the indicated value with an existing parameter limit.
2. Inspect – observe the condition and make an assessment of the acceptability of that condition.
3. Analyze – review data about a parameter or condition to determine the acceptability to a parameter limit or condition.
4. Log – record and/or use an electronic recording device to obtain operating parameter information for later trending or evaluation.
5. Trend – review logged operating parameters, normally plotted for ease of review.
6. Evaluate – make an assessment of engine performance based on a review of one or more operating parameters or conditions.

Pre–Periodic Tests or Engine Standby Checks

To assure start up when the diesel generator is in standby mode, the following checks should be performed:

1. Verify proper operation of the lube oil circulating pump. Lube oil circulating pump operation can reduce engine wear during start up by ensuring engine bearings are well lubricated.
2. Verify proper operation of the jacket water circulating pump. Jacket water circulation can help reduce engine wear during start up by maintaining an evenly heated engine while in standby condition.
3. Verify proper operation of the jacket water heater and the lube oil heater. These heaters maintain the engine at an elevated temperature to assist in ease of starting the diesel engine in the event of an emergency.
4. Check the jacket water stand pipe and lube oil sump for required levels, and record any abnormal conditions observed.
5. Check for signs of external water, fuel oil, lube oil, and air leaks. This inspection can provide an early indication of potential engine problems.
6. As applicable, check the oil level in the speed regulating governor sight glass and the overspeed governor to ensure it is at the required oil level. Check the oil level in the generator outboard bearing.

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7. Repair and/or correct any significant leaks or other anomalies at the first opportunity. For example, if a jacket water leak is noted between a cylinder head and the block, that head should be removed and the source of the leak identified and repaired. Always install new gaskets and water seals when reinstalling the head.

Periodic Test Runs–Once Per Month Minimum

1. Start and load the diesel generator in accordance with the station procedures. (Note the recommended start and load rates for monthly surveillance runs are contained in Appendix B.)
2. Log engine operating parameters in accordance with station operating procedures. Appendix A, Emergency Diesel Generator Performance Monitoring Recommendations contains a list of engine performance parameters and the recommended periodicity for monitoring.
3. Check for signs of external water, fuel oil, lube oil, and air leaks during engine operation. This inspection can provide an early indication of potential engine problems.
4. Check for excessive sparking of generator brushes, if applicable. Follow generator manufacturer's maintenance guidance if brush sparking is excessive.
5. Unload and stop the diesel generator in accordance with station procedures. (Note the recommended engine shutdown instructions for monthly surveillance runs are contained in Appendix B.)

Post-Periodic Tests – All Test Runs

1. Verify proper operation of the lube oil circulating pump following engine shutdown. Verify pressure is within normal limits.
2. For KSV-20T engines, verify that the turbo lube oil pressure is normal.
3. For KSV-16T engines, within 15 minutes after engine shutdown, verify turbo lube oil pressure is zero.
4. Check the jacket water stand pipe and lube oil sump for proper levels.
5. Check for signs of external water, fuel oil, lube oil, and air leaks. This inspection can provide an early indication of potential engine problems.
6. As applicable, check the oil level in the speed regulating governor sight glass and over speed governor to insure it is at the required level.

Lube Oil Sampling – Once Per Quarter Minimum

Obtain a representative engine lube oil sample from a flowing line between the discharge of lube oil pump and prior to the lube oil cooler and filter. Analyze the lube oil sample for:

- Viscosity
- Dirt
- Water
- Wear metals
- Acidity

A firm that analyzes oil will recommend when any of the above conditions are cause for draining and replacing the oil. General guidance for the above conditions are as follows:

Viscosity – Lube oil viscosity changes can result from extended operation and from fuel oil dilution (numerous starts, leaking injectors, etc.).

Dirt – Excessive dirt in the lube oil may result from inadequate filter maintenance and must be eliminated by changing oil and filters (oil and air) more frequently.

Water – Excessive water in the lube oil normally indicates a leak between the two systems in a cooler or in the engine. Another source of water may be condensation of combustion products when the engine is not allowed to fully warm up, i.e. run for short periods of time.

Wear metals – Changes in wear metal levels must be checked to determine where in the engine they originated and that area must be inspected for wear.

Acidity – Changes in lube oil acid level develop from long and severe service and/or operating with high sulphur oil. In addition, numerous engine starts and stops without sufficient warmup can introduce moisture and acids into the lube oil.

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RELIABILITY CHECKING AND MAINTENANCE INSPECTION

Poor lube oil quality can lead to serious problems with the engine performance and wear. Comparison with previous analyses should indicate changes in engine conditions that would lead to deterioration of the oil.

Annual or Refueling Outage Inspections
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An annual or refueling outage inspection will likely follow one of the "Periodic Test Runs" noted above. Therefore, complete all the required checks or inspections above, as well as the following inspections:

HC 7 Perform Step 1 within 90 days of starting an outage.

1. With engine running and up to operating temperatures and the generator at rated load, use an engine analyzer (such as the Cooper-Bessemer EN-SPEC 3000) to measure and record parameters, such as combustion pressure/time diagrams, horsepower, peak pressure angle, etc. for each power cylinder. Engine analysis should not be performed until at least one hour of rated load operation has been completed and engine operating parameters have stabilized. Analyze records for possible unusual engine running conditions and take appropriate remedial action.

2. Measure power cylinder compression pressures.

3. Unload the engine for a normal cool-down. Measure and record turbocharger spin down time following completion of the engine run.

4. Insure all foundation bolts in engine and generator are correctly tightened. If bolts are found loose or abnormal conditions identified, evaluate the need to perform a crankcase web deflection inspection.

5. Remove all fuel injection nozzles. If the engine analyzer results indicate out of balance combustion pressure or timing conditions (see Section 2, General Data for combustion pressure limits), or the nozzle tips appear unusual in any way, check opening pressure and spray pattern on a test stand. Proper injector nozzle operation is essential to good engine performance. The nozzle opening pressure should be 3400 psig, minimum. The spray pattern should be fully atomized into a uniform mist "plume" and all nine spray holes should be clear. The cone angle of all the plumes should appear uniform and be approximately 140 degrees. No secondary injections or nozzle pops in the plume should be observed.

   Note that combustion balance and timing can also be influenced by many other factors which may require investigation.

6. Use a modern, high resolution borescope inserted through the fuel injection nozzle opening to inspect the interior of all power cylinders (include liners, heads, piston crowns, valves and seats, etc.). With the pistons at BDC, inspect the liner for excessive wear (e.g. scuffing, scoring, cracking) or other signs of deterioration. The intake, exhaust and start air valves should be checked for signs of cracking or wear. If indications of a problem are observed, remove the power cylinder head and perform a detailed inspection of the head, piston and liner. The fast starts and rapid loading common with emergency diesel generators may cause more rapid cylinder wear than occurs in engines in other applications.

7. If the borescope inspections and engine analyzer results indicate the need, remove affected cylinder heads and check their condition. If required, reseat all valves. Excessive seat wear can cause poor engine performance. Refer to Section 2 for acceptance criteria. Replace head gaskets and "O"-ring seals for the jacket water connections on any cylinder heads removed for any reason.

8. Inspect the following inside the engine crankcase:

   a. Cylinder liners for scuffing, with the pistons near TDC.

   b. Expansion seal at bottom of liner for water leaks, dents or cracks.

   c. Visible portions of the piston skirt for abnormal wear of the tin surfaces, with the pistons near BDC.

   d. Bolts and locking devices for tightness.

   The inspections should check for excessive wear (e.g., scuffing, scoring, cracking) or other signs of deterioration.

9. Replace fuel oil filter elements if trending of filter differential pressure at rated engine load indicates this is necessary. The fuel oil filter traps particles that could clog the fuel pumps and fuel injectors.

10. Inspect lube oil strainers for dirt and metal particles. The lube oil stainers prevent foreign particles, such as pipe scale or a ruptured oil filter, from entering the engine. Foreign particles should be removed from the strainer and analyzed to determine their source.

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11. Replace elements in lube oil filter. The lube oil filter prevents contaminants from being distributed throughout the engine and causing wear to vital parts.

12. Inspect crankcase breather air filters and cylinder head breather filter (if used) and clean as necessary. Inspect and clean individual breathers in each cylinder head cover (if used).

13. Inspect rocker arm assemblies (without disassembly). Visually inspect for excessive wear or dusting of metal around the shaft bushings. Check clearances if wear is evident. Inspect lube oil crossover lines for signs of fretting or cracking and replace as necessary.

14. Check operation and/or calibration of all control and safety shutdown devices. Refer to Section 9 and Section 16 for guidance. Inspect control air tubing for indications of cracks or leaks. Replace gaskets and "O"-rings as necessary.

15. Change the lube oil in the speed regulating governor and the over speed governor, if applicable. Insure that any air is bled from the governors and that the oil level is correct when the engine is first started. Refer to Governor manual.

16. Check valve timing and tappet clearance on at least one cylinder per bank to ensure proper engine combustion. Refer to Section 2, General Data for timing and clearance requirements. It may be necessary to check timing on additional cylinders if the combustion analysis indicates problems.

17. Inspect fuel pump and valve cam lobes for indications of wear, grooving, or looseness on the shaft. Inspect the fuel pump cam rollers for wear or degradation.

18. Remove the combustion air inlet pipe from the turbocharger. Inspect and record the turbocharger thrust bearing clearance (.005 to .022). Visually examine the compressor wheel for damage or excessive deposits. Examine the turbine wheel for damage, using a boroscope.

19. Check turbocharger rotor for freedom to turn. This inspection verifies that the turbocharger is free to spin with no excess bearing drag.

20. Disassemble the turbocharger if the turbocharger spin down time test results or the inspections listed above indicate there is a defect that could affect engine performance. (Refer to Turbocharger Manual).
    a. Check blower bearing, which includes the thrust bearing, for wear.
    b. Check turbine bearing for wear.
    c. Check all bearing clearances.
    d. Clean turbine rotor and diffuser.

21. Inspect air inlet system (filters, ducting, etc.) for evidence of dirt or debris and clean as necessary. Air filters ensure adequate supply of clean combustion air.

22. Inspect forward end auxiliary drive for:
    a. Condition of gears, drive chains and roller bearings for the jacket water pump and lube oil pump. Inspect for wear and proper adjustment. Check drive chain for proper tensioning. (Refer to C-B Engineering Standard SD-66-3 in Appendix 1.)
    b. Condition of vibration damper (if applicable). Check mounting bolts for adequate torque.

    The forward end auxiliary drive provides power for the jacket water and lube oil pumps. Inspect for visual evidence of wear or damage.

23. Inspect flywheel end main drive for:
    a. Condition of drive gears, chains and sprockets. Inspect for wear and proper adjustment. Check drive chain for proper tensioning. (Refer to C-B Engineering Standard SD-66-3 in Appendix 1.)
    b. Condition of idler gear bearing and end play. Inspect for wear and sufficient lubricant.
    c. Condition of camshaft gears. Inspect for indications of excessive wear, backlash, slippage, etc.
    d. Condition of turning gear. Inspect for cleanliness, lubrication, proper tooth engagement and/or chipped teeth.

    Repair or replace any defective parts as necessary.

DANGER! WHENEVER WORKING ON THE GENERATOR MAKE SURE THAT IT IS STATIONARY AND ALL WINDINGS ARE DEENERGIZED. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH.

24. Check the tightness of the terminal connections on generator.

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25. Measure and trend generator winding insulation resistance (IR) measurements to ground using a Meg ohmmeter. Follow generator manufacturer's guidance on measurement method and minimum acceptable IR values.

26. Clean insulated generator windings by blowing out with dry air, brushing (soft brush), wiping, vacuum cleaning or any method described in the generator manufacturer's manual. Observe all relevant safety precautions.

27. Measure and record generator rotor to stator air gap at four locations, 90 degrees apart, on both ends of the rotor (see generator instruction manual). Realign if necessary.

28. Inspect generator outboard bearing for signs of external oil leaks.

29. Clean air inlet casing to generator stator.

30. Inspect all electric motors in accordance with the vendor recommendations. Repair as necessary.

31. Prior to running engine and after its systems have been filled with oil and water, open indicator cocks on all power cylinder heads. Ensure the engine lube oil circulating pump is operating. Roll the engine through at least two complete turns. Check for moisture at indicator cocks. If moisture is found, investigate cause and remedy.

32. Ensure the lube oil circulating pump, the lube oil heater, the jacket water circulating pump and jacket water heater are in operation.

33. Start engine and apply load gradually until oil and water temperatures stabilize at their normal operating values. Run in accordance with Appendix B following inspection. (When major engine components have been replaced, note the recommended break-in run instructions contained in Appendix B.)

34. Use an engine analyzer to measure and record combustion parameters for each power cylinder, as in step 1. Analyze records for possible unusual engine running conditions and take appropriate remedial action.

Five Year or 3rd Refueling Outage Inspections

Every five years or during every 3rd refueling outage, the following inspections should be accomplished in addition to those recommended in "Annual or Refueling Outage Inspections" section above.

1. If logged data indicates excessively high pressure drop on air side or other performance deficiencies, remove air intercoolers and thoroughly clean. This ensures an adequate supply of combustion air. SEE PAGE 254 FOR REPAIR INSTRUCTIONS.

2. If the engine analyzer test results indicate the need, re-calibrate fuel injection pumps on a test stand.

3. When engine operation indicates a degradation in pump performance or there is other evidence of deterioration, disassemble engine driven water pumps, inspect mechanical seals and replace if necessary. Replace all "O"- rings and gaskets, and inspect impeller rings for wear.

4. When engine operation indicates a degradation in performance, or there is other evidence of deterioration of the engine driven lube oil pump, disassemble, clean, inspect and repair as needed.

5. Based on the results of engine monitoring data trending, inspect lubricating oil and jacket water coolers, check for leaks and repair as necessary. SEE PAGE 254 : FOR REPAIR INSTRUCTIONS

6. Replace non-metallic flexible hoses, especially the internal lube oil hoses and the start air valve hoses.

7. Based on trending of fuel oil booster pump performance results, or other indications of deterioration, disassemble, clean, inspect, and repair as necessary.

8. Replace main and connecting rod bearing temperature eutectic devices. Clean the trip valves and replace the "O"- rings.

   It is not necessary to change out the turbocharger thrust bearing eutectic unless it is defective.

9. Check vibration readings, motor current, and performance data on the motor driven pumps installed on the auxiliary skid, and analyze results to determine the need for repairs. Recondition the pumps or motors as necessary.

10. Inspect the generator. The following is intended as a guide and to highlight various areas. Refer to the generator manufacturer's instructions for specific details.

    a. Inspect collector ring and commutator surfaces and commutator. Brushes shall move freely in their brush boxes. Replace worn brushes. Clean collector rings, commutator, brushes and brush rigging by wiping with a clean, dry lint-free cloth.

    b. Check rotor pole bolts (or keys) for tightness.

SECTION 15

RELIABILITY CHECKING AND MAINTENANCE INSPECTION

c. Measure and trend insulation resistance of windings to ground using a Meg ohmmeter. Repair in accordance with generator manufacturers specifications.

d. Inspect generator frame and all fasteners for unusual signs of distress.

e. When reassembling any part of the generator, ensure that any insulation provided to prevent stray shaft currents is correctly installed.

f. Inspect exciter in accordance with manufacturer's instructions.

11. Check mechanical condition of all switch gear and relays. Follow the respective manufacturer's instructions for cleaning relay contacts and other maintenance items.

12. Replace the thermostatic elements in the jacket water and lube oil temperature control valves on the auxiliary skid.

13. Replace 2301 Governor dropping resistor.

Ten Year or 6th Refueling Outage Inspections

Every ten years or during every 6th refueling outage, the following inspections should be accomplished in addition to those recommended in "Five Year or 3rd Refueling Outage Inspections" section above.

1. Remove four cylinder heads, inspect valves and seats, and recondition as necessary. Replace all gaskets and "O"-rings. Any head which was removed and reconditioned during the two year period immediately before this inspection should not be selected for removal unless there are indications of a problem with that cylinder. Evaluate the need to remove additional heads based on this examination.

2. Remove four pistons and inspect piston, piston rings, piston pin and bushing, articulated pin and bushing, and liner condition. Determine from such an inspection the extent to which other pistons should be removed and any necessary rework accomplished.

3. Remove connecting rod bearings from rods attached to pistons removed per paragraph 2 and inspect. Determine from the inspection the extent to which other rod bearings should be removed and any necessary rework accomplished. Do not reinstall any bearing shells removed from the rods for this inspection. Replace them with new shells.

4. Remove two main bearings at random and inspect. Determine from the inspection the extent to which other main bearings should be removed and any necessary rework accomplished. Replace any bearing shells which are removed with new shells.

5. Inspect generator outboard bearing and repair as necessary. Insure that the insulation resistance between the bearing and its support is maintained after reassembly.

HC 4 DCN # MM-1312

EMERGENCY DIESEL GENERATOR PERFORMANCE
MONITORING RECOMMENDATIONS

APPENDIX "A"

PARAMETER TO BE MONITORED	PERIODICITY
ENGINE:	
Cylinder Exhaust Gas Temperatures (°F.)	MONTHLY
Cylinder Peak Firing Pressures (psig) & Angles (°ATDC)	ANNUALLY/REFUELING
Start Time (Seconds)	MONTHLY
Crankcase Pressure (" H_2O)	MONTHLY
LUBE OIL SYSTEM:	
Main Lube Oil Pressure (psig)	MONTHLY
Turbo Lube Oil Pressure (psig)	MONTHLY
Main Full Flow Oil Filter Delta-P (psig)	MONTHLY
Turbo Oil Filter Delta-P (psig)	MONTHLY
Engine Oil Inlet temperature (°F.)	MONTHLY
Engine Oil Outlet Temperature (°F.)	MONTHLY
Lube Oil Analysis	QUARTERLY
FUEL OIL SYSTEM:	
Fuel Oil Pressure (psig)	MONTHLY
Fuel OIl Filter Delta-P (psig)	MONTHLY
Fuel Oil Strainer Delta-P (psig)	MONTHLY
Fuel oil Transfer Pump Flow (gpm)	QUARTERLY
Fuel Oil Analysis	QUARTERLY
JACKET WATER SYSTEM:	
Jacket Water Pump Discharge Pressure (psig)	MONTHLY
Jacket Water Engine Inlet Temperature (°F.)	MONTHLY
Jacket Water Engine Outlet Temperature (°F.)	MONTHLY
Jacket Water Analysis	QUARTERLY

APPENDIX "A"

EMERGENCY DIESEL GENERATOR PERFORMANCE MONITORING RECOMMENDATIONS

PARAMETER TO BE MONITORED	PERIODICITY
AIR INTAKE & EXHAUST SYSTEM:	
Turbocharger Exhaust Inlet Temperature (°F.)	MONTHLY
Turbocharger Exhaust Outlet Temperature (°F.)	MONTHLY
Turbocharger Air Discharge Temperature (°F.)	MONTHLY
Intake Manifold Temperature (°F.)	MONTHLY
Turbocharger Air Discharge Pressure (" Hg)	MONTHLY
Intake Manifold Pressure (R&L) (" Hg)	MONTHLY
Turbocharger Spin Down Time (seconds)	REFUELING
Outside Air Temperature (°F.)	MONTHLY
SERVICE WATER SYSTEM:	
Intercooler Water Inlet Temperature (°F.)	MONTHLY
Intercooler Water Outlet Temperature (°F.)	MONTHLY
Service Water Inlet Temperature (°F.)	MONTHLY
Service Water Outlet Temperature(s) (°F.)	MONTHLY
ELECTRICAL (GENERATOR, EXCITER, VOLTAGE REGULATOR):	
Kilowatts	MONTHLY
Kilovars	MONTHLY
Volts	MONTHLY
Generator Current (Amps)	MONTHLY
Generator Stator Temperature (°F.)	MONTHLY
VIBRATION MONITORING:	
Skid Mounted Pump/Motor Vibrations	3RD REFUELING
MISCELLANEOUS;	
Engine Run Hours	NOTE 1
Number of Engine Starts	NOTE 1

*; Parameter not measured as such; maintain as part of engine start/run records.

HC 4 DCN # MM-1312

START/STOP/LOAD APPLICATION PROCEDURE FOR
NUCLEAR POWER PLANT EMERGENCY POWER STAND-BY

APPENDIX B

In order to insure optimum engine life and reliability, it is important to operate an engine, whenever possible, in a manner to allow for gradual temperature increase and stabilization. This is especially of concern in nuclear stand-by service where the ratio of engine starts to total operating hours is very high.

The following recommendations are provided as guidlines for operating/loading KSV engines used in nuclear emergency power stand-by duty.

MONTHLY SURVEILLANCE RUNS

It is assumed that the numerous surveillance tests that have been run at the various utilities over the past years have demonstrated the capability of a diesel engine (in particular the KSV/generator) system to respond to an emergency. Therefore it should not be necessary to conduct fast start-fast load tests at each monthly surveillance. Whenever possible, a gradual load application as prescribed by the following schedule is recommended:

RPM	% LOAD	DURATION
600	0	15 MINUTES
600	25	30 MINUTES
600	50	30 MINUTES
600	75	30 MINUTES
600	100	120 MINUTES
600	unloaded	15 MINUTES

In order to enhance the long term life/reliability of the engine, it is advisable to operate long enough to acheive thermal stability within the engine. For this reason, Cooper-Bessemer recommends that a loaded engine run should not be less than four hours in duration.

HC 4 DCN # MM - 1312

APPENDIX "B"

START/STOP/LOAD APPLICATION PROCEDURE FOR
NUCLEAR POWER PLANT EMERGENCY POWER STAND-BY

BREAK-IN RUNS

Whenever major engine components (pistons, piston rings, liners, bearings & bushings) are replaced, it is recommended that a slightly different procedure be followed to verify that the engine is operating properly. The following loading schedule should be utilized at these times:

- Start engine.
- Run 15 minutes at 600 RPM, no load.
- Stop engine, remove crankcase doors and visually inspect. Look for any signs of abnormalities. Bearing caps should be "felt" to identify any bearings that are significantly hotter than the rest.
- Restart engine and load according to the following schedule:

RPM	% LOAD	DURATION **
600	0	1 HOUR *
600	25	2 HOURS
600	50	2 HOURS
600	75	2 HOURS
600	100	2 HOURS

* During this period of operation, fuel injection pump temperatures should be checked periodically by "feel". If any pumps get too hot to comfortably hold your hand on, proceed to 25% load point for 15 minutes. The engine should then be returned to the no load setting to complete the recommended one hour segment. If many new components are installed in the engine, consideration should be given to a longer run at zero load.

** If piston pin bolts or articulating pin bolts are disturbed during maintenance, the torque on these bolts should be rechecked after 1 to 4 hours operation.

ENGINE SHUTDOWN

Just as it is important to bring the engine up to speed gradually, it is also beneficial to avoid thermal shock during shutdown. For this reason, it is recommended to run at no load for 15 minutes prior to shutdown.

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COOPER-BESSEMER RECIPROCATING

APPENDIX D

February 27, 1991

Houston Lighting & Power
South Texas Project
Wadsworth, TX 77483

Via Fax (512) 972-8041

Attention: Mr. Ted Fryar

Reference: Inspection waiver request
Annual and five year inspection of SDG #12

Gentlemen:

Per your memo of February 22, 1991, it is now understood that contrary to initial interpretations, you are requesting a waiver of only a few items from the C-B recommendations and not a postponement of the entire five year inspection. As you explained, the annual and five year inspections of SDG #12 are to be completed with the following proposed exceptions.

1. Removal of Fuel Injection Nozzles/Borescope: Contrary to the annual inspection requirements, only those cylinders identified by engine analyzer data (i.e. indicator cards) as being out of specification will have injection nozzles removed and cylinders borescoped. The reason for this is to avoid additional high pressure fuel line connection leaks by not tampering with the connection any more than is absolutely necessary until Cooper design improvements are available.

   In order to minimize any concerns associated with the waiver of this inspection, it is recommended that additional "engine analysis" checks be made after six (September, 1991) and twelve (March, 1992) months. Any abnormalities found at these times should, of course, be immediately addressed.

2. Main Bearing Hose Replacement: The current hoses were installed in August, 1987. The recommended five year hose replacement will be deferred one month until the September, 1992 scheduled refueling outage. A deviation of this magnitude is felt to be insignificant and as a result is acceptable.

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Lincoln Avenue
Grove City, Pennsylvania 16127
(412) 458-8000

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Mr. Ted Fryar
Page Two
February 27, 1991

3. Air Intake Manifold: The intake air manifolds will be inspected on the engine when the intercoolers are removed for cleaning (to be completed during the current outage) and will not be removed from the engine. This is judged to be sufficient to comply with Cooper-Bessemer's five year requirement to inspect the air intake system.

4. Maintenance Procedure Inspection Interval Revision: A procedural revision to go from inspections at 4-½/9 years to 5/10 years in the future is in ageement with current Cooper-Bessemer recommendations.

5. 25% Tolerance on Recommended Inspeciton Intervals: The reasons for needing flexibility in maintenance interval requirements to aid in scheduling is certainly understood. As you are aware from previous waiver approvals, we will attempt to provide this flexibility whenever it can be justified. However, we cannot agree to a standard 25% time tolerance for all inspection intervals. Any deviation from published Cooper-Bessemer inspection period recommendations should be reviewed with us.

In summary, concurrence with the proposed waivers is granted, with the exception of the previously noted requirements.

Sincerely,

R. G. Billig

R. G. Billig, Sr. Design Engineer
Nuclear & Analytical Engineering Department

CC: J. M. Horne
R. A. Miklos
E. E. Roper

RGB/jld

DCN # MM-1312

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HC 6 DCN#MM-1382

APPENDIX E

SBDG CYLINDER COMPRESSION PRESSURE TESTING

1. Have Operations operate engine at full load and speed to obtain normal operating parameters.

2. Decrease load to approximately 2900 KW (app. 41" Hg. absolute air manifold pressure).

3. Install analytical equipment on cylinder to be tested. Remove fuel oil line shields if required (items 1, 2 & 3 Drawing KSV-50-9 - HL&P Drawings 4041-00242-CE and 8041-00253-CE).

4. Disconnect the fuel pump control rack on cylinder to be tested (items 35 & 37 Drawings KSV-32-15 - HL&P Drawings 4041-00280-CE, 4041-00211-CE, 8041-00291-CE and 8041-00222-CE). Pull the fuel pump control rack to the "no fuel" location.

5. Record cylinder compression pressure using the analytical equipment.

6. Reconnect fuel pump control rack which will allow cylinder to return to its normal firing condition.

7. Repeat items 3 through 6 on all twenty cylinders.

8. Advise Operations when testing is complete.

ATTACHMENT 5

LARGE EARLY RELEASE INFORMATION

The risk significance of the special test exception has been evaluated for its impact to prevention and mitigation. The key figure of merit to evaluate the risk impact relative to prevention has been evaluated in terms of core damage frequency and the key figure of merit to evaluate the risk impact relative to mitigation has been evaluated in terms of large, early release probability (LERP). In combination, these figures of merit provide assurance that the impact of the special test exception appropriately consider both early and long-term health effects.

Large, early release probability (LERP) is defined in the STP PSA as a radioactive release which is both large and early. Large is defined as greater than three inches with a rapid, unscrubbed release of airborne aerosol fission products from the containment. Included in the "large" category are bypasses such as multiple steam generator tube ruptures and interfacing systems LOCAs. A release is considered "small" if it is a controlled leak failure mode (i.e., a slow continuous release to the environment with considerable atmospheric dilution). Small leaks are only considered for pre-existing failures or certain bypass scenarios. All other containment failures are considered to be large. "Early" is associated with the timing of containment failure relative to the release of fission products which is usually associated with vessel breach. An early release is defined as containment failure which may be the result of a pre-existing failure (before vessel breach), a containment failure that occurs at the time of vessel breach, or one occurring within four hours after vessel breach. Late release categories are those that occur on the order of 4 - 24 hours after vessel breach as well as those that result in long term overpressurization or basemat melt-through.

The risk profile shown in Figure A.5 estimates the impact of the proposed STE for the DG/EW on LERP. The risk significance threshold used is from the Nuclear Energy Institute PSA Application Guide. As seen the incremental risk is below the risk significance threshold value. Since the STE is associated with on-site electric power sources and other safety-related support systems, the risk impact relative to initiating events is an important consideration for both core damage assessment and containment performance. There is no indication of a direct correlation between initiating events and the above risk significance measures outside the scope of the PSA due to the implementation of the extended AOTs. STP design features and operational features included within the scope of the PSA include: fail-safe air operated valves which preclude guaranteed containment failure for loss of offsite power scenarios leading to station blackout, and emergency operating procedures which direct operators to verify containment closure or implement corrective actions if necessary.

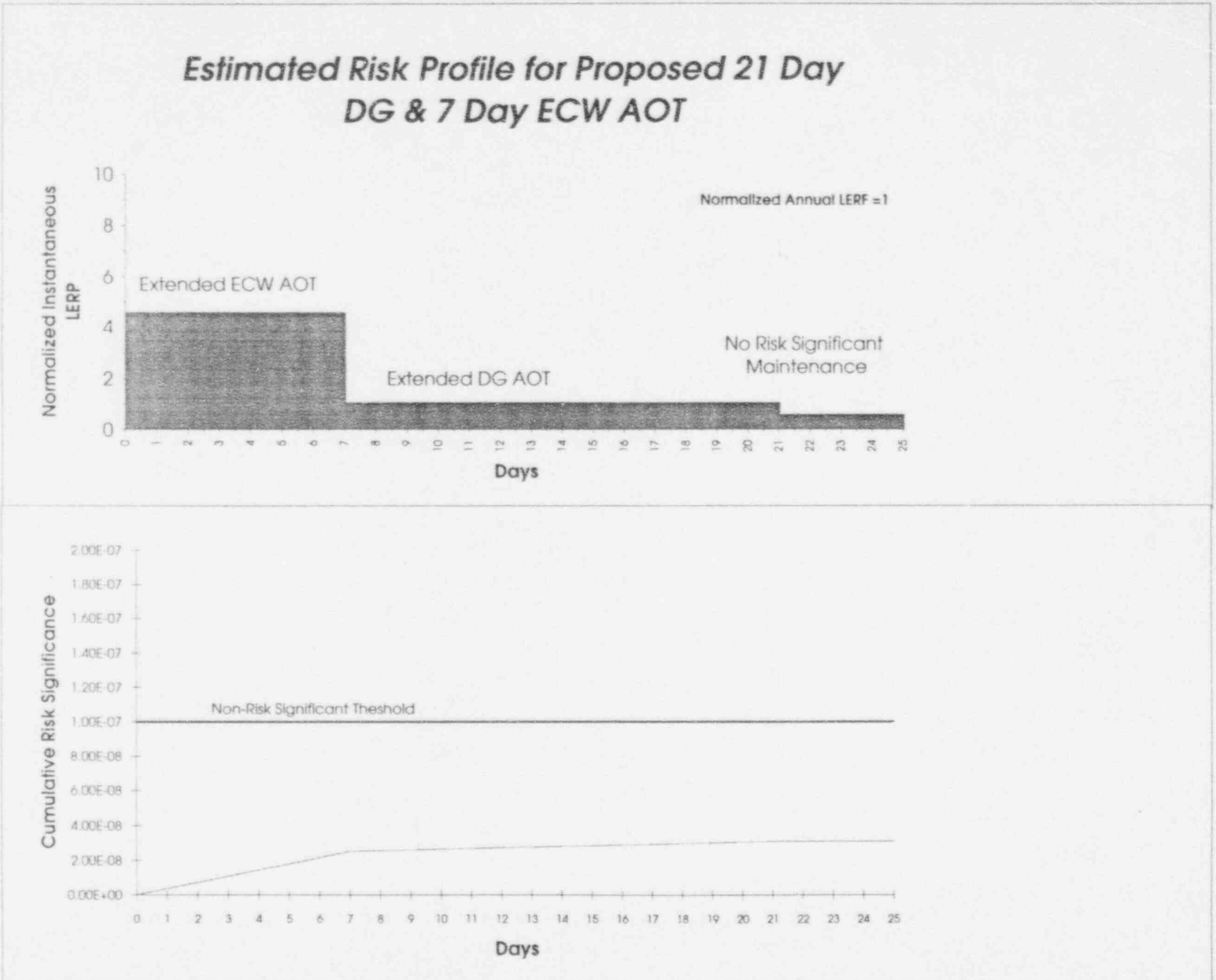

Figure A.5 Proposed STE Impact on LERP and Risk Threshold