MARCH 12, 1982

LRG-II POSITION PAPERS

VOLUME IV

TECHNICAL DISCUSSIONS AND RESOLUTION OF 11 LRG-II ISSUES. THE POSITIONS TAKEN IN THESE PAPERS WILL BE REFERENCED IN LRG-II PLANT OL APPLICATIONS.

NOTE: ADDITIONAL ISSUES WILL BE ADDRESSED IN SUBSEQUENT POSITION PAPER VOLUMES.

THIS VOLUME ALSO CONTAINS A REVISED LRG-II POSITION FOR ISSUE 4-CPB.

TABLE OF CONTENTS

LRG II POSITION PAPER - VOLUME 4

MJA:hmc/D031129*

LRG-II POSITION PAPER

March 12, 1982

3-CPB

CHANNEL BOX DEFLECTION

ISSUE

General Electric report NEDO-21354 describes a channel creep deflection phenomena that may interfere with control rod insertion. Long term channel deflection occurs when fuel channels are radiated to high exposures or are located in a region of the core which has a gradient in fast neutron flux. The resulting bulge (caused by long term creep) or bow (caused by differential deflection of the channels) reduces the size of the gap available for control rod insertion.

A program to detect the onset interference between the channel box and the control blade is required. NEDO-21354 describes a control rod drive setting friction test which can be used to measure the interference of the channel with the control blades. This testing should be included in the program or an alternative proposed.

LRG-II POSITION

The LRG-II position is to adopt the following guidelines:

Channel Box Deflection Guidelines

The following general guidelines minimize the potential for and detect the onset of channel bowing:

A. Records will be kept of channel location and exposure for each operating cycle.

B. Channels shall not reside in the outer row of the core for more than two operating cycles.

C. Channels that reside in the periphery (outer row) for more than one cycle shall be situated in a core location each successive peripheral cycle which rotates the channel so that a different side faces the core edge.

D. At the beginning of each fuel cycle, the combined outer row residence time for any two channels in any control rod cell shall not exceed four peripheral cycles.

Prior to beginning a new operating cycle, a control rod drive friction test shall be performed for those core cells exceeding the above general guidelines or containing fuel channels with exposures greater than 30,000 MWd/T (associated fuel bundle exposures). This test* will be part of the Reload Startup Test Program. Each control rod will be allowed to settle two notches from the fully inserted position. Total control rod drive friction is acceptable if the rod settles to the next notch before approximately ten seconds. If the rod settles too slowly, a rod block will actuate and further investigation will be required to determine the extent of and source of the friction.

In lieu of friction testing, fuel channel deflection measurements may be used to identify the amount of remaining channel lifetime for channels exceeding 30,000 MWd/T (associated fuel bundle exposures).

In the future, analytic channel lifetime prediction methods, benchmarked by periodic deflection measurements of a sample of the highest duty fuel channels, could be used to ensure clearance between control blades and fuel channels without additional testing.

* This control rod settling friction test, also recommended by GE, provides an equivalent level of the tests described in NEDO-21354. This test provides adequate assurance of the scram function. The amount of friction detectable by this test is ~250 lbs. Control Rod Drive tests indicate that the CRO will tolerate a relatively large increase in driveline friction (350 lb) while still remaining within technical specification limits. The control blade is in its most constrained, highest friction location when it is fully inserted. The ability of the blade to settle from this position demonstrates that the total drive line friction is less than the weight of the blade (~250 lbs.).

LRG-II POSITION PAPER
March 12, 1982

11-CPB

CORE THERMAL-HYDRAULIC STABILITY ANALYSIS

ISSUE:

General Electric has made changes to the BWR fuel design which affect core thermal-hydraulic stability. The maximum decay ratio for most BWRs has increased and is larger than .5, which is the original General Electric design criterion for BWR stability. GE now proposes a decay ratio of 1.0 for their criterion. The Staff has not agreed that the proposed decay ratio criteria of less than 1.0 as calculated by the FABLE Code is acceptable.

BWR/6 core thermal-hydraulic stability analyses indicate that the maximum decay ratios are approximately .98 for the equilibrium cycle. The Staff has approved for operation previous core designs having calculated maximum decay ratio values as high as 0.7 for the initial cycle. Later cycles have higher calculated decay ratios comparable to the 0.98 values of the BWR/6 design. The Staff will condition the BWR/6 operating licenses to prohibit operation at natural circulation and to require new stability analyses be submitted and approved prior to second cycle operation.

The NRC is performing a generic study of the hydrodynamic stability characteristics of light water reactors. The results of this study will be applied to the Staff's review and acceptance of stability analyses, criteria and analytical methods now in use by the reactor vendors.

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LRG-II RESPONSE:

The LRG-II position is to accept the license condition that prohibits operation at natural circulation for cycle 1. A new stability analysis will be provided before cycle 2 for each plant. LRG-II plants will follow the progress of NRC generic study.

LRG-II Position Paper
March 12, 1982

1-CSB

CONTAINMENT DYNAMIC LOADS

ISSUE:

LRG-II plants must use NRC approved containment load definitions as the basis for containment dynamic load evaluations.

LRG-II plants must demonstrate that previous tests are applicable or must commit to perform in-situ safety/relief valve (SRV) tests.

LRG-II Position:

Containment Loads

LRG II participants use the GE generic containment dynamic load methodology as presented in the Final Containment Loads Report (FCLR). The FCLR is in the final phases of NRC review; an SER is expected in mid 1982. Any changes to the FCLR that result from this review will be evaluated for applicability to LRG-II plants. Where applicable, the containment loads analyses for the LRG-II plants shall incorporate these changes.

In-Situ SRV Testing

The LRG-II position is that previous in-situ tests at Caorso and Kuo Sheng generically show that pool dynamic loads are conservatively defined. Similarities in the relevant plant design features of these plants with LRG-II plants and results of the in-situ testing indicate that additional Mk III testing is not necessary.

Each LRG-II plant is initiating efforts to obtain, interpret and confirm the applicability of Kuo Sheng test data to its plant.

MJA:hjr:rf/113A1
3/12/82

LRG-II Position Paper
March 12, 1982

3-ASB

PROTECTION OF EQUIPMENT IN MAIN STEAM PIPE TUNNEL

ISSUE

It is required that the compartment in the auxiliary building between the containment and the turbine building which houses the main steam lines and feedwater lines and their isolation valves, be designed to consider the environmental effects (pressure, temperature, humidity) and potential flooding consequences from an assumed crack, equivalent to the flow area of a single-ended pipe rupture in these lines.

It is also required that if this assumed crack could cause the structural failure of this compartment, then the structural failure should not jeopardize the safe shutdown of the plant. Finally, it is required that essential equipment located within the compartment, including the main steam isolation and feedwater valves and their operators be capable of operating in the environment resulting from the above crack.

LRG-II Position

LRG-II participants performed subcompartment pressurization analysis to evaluate the effects of a high energy line break in the main steam tunnel. As a minimum, a break of one of the main steam lines anywhere in the steam tunnel was considered in this analysis to determine the resulting accident environmental conditions in the tunnel. Data on mass and energy release from a main steam line rupture downstream of the outer isolation valve was supplied by General Electric Company. The plant unique analysis performed

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3/12/82

and documented in each LRG-II member's FSAR indicates that the maximum pressure after the line break would be less than the steam tunnel design pressure. Thus, structural failure of the tunnel would not occur and safe shutdown of the plant is not jeopardized.

With regard to equipment environmental qualification, the first feedwater isolation valve outside the containment within the steam tunnel is designed as a Class 1 valve for severe duty application with environmental effects more severe than the accident conditions derived, as a minimum, from the break of one main steamline. The qualification of the remaining essential equipment in the steam tunnel will be demonstrated in the NUREG-0588 equipment qualification program.

MJA:hjr:rf/113A3
3/12/82

LRG-II Position Paper
March 12, 1982

4-ICSB

IE BULLETIN 80-06: ENGINEERED SAFETY FEATURE (ESF) RESET CONTROL

ISSUE:

Evaluate LRG-II plants for compliance with IE Bulletin 80-06 "Engineered Safety Feature Reset Control". In particular, identify those systems which do not remain in emergency mode upon reset of the actuation signal. Justify any deviations or propose design changes.

LRG-II POSITION:

All systems were examined for deviations from IE Bulletin 80-06. The findings of the NSSS evaluation is discussed below. The review of balance of plant systems for compliance with IE Bulletin 80-06 is being handled plant uniquely.

LRG-II Solid State Plants (Clinton):

Clinton will submit a plant unique response.

LRG-II Relay Plants (Perry and River Bend)

Four possible problem areas were identified and are discussed below. Two areas meet the intent of IE Bulletin 80-06. Two areas do not comply with IE Bulletin 80-06.

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3/12/82

The two areas of non-compliance are containment isolation valve designs. NUREG Item II.E.4.2 also requires these valves remain closed on reset of the isolation signal. The LRG-II position is to modify these valves to comply with IE Bulletin 80-06 and Item II.E.4.2

Finding #1 - HPCS Diesel Generator

A system level reset of the ESF actuation signal will not shut down the diesel generator. However, a system level reset does restore all of the protective trips provided for diesel generator protection (i.e., high jacket water temperature, low lubrication oil pressure, anti-motoring (reverse power), loss of excitation, overcurrent) which are blocked during an abnormal condition. If any of these protective trips are present at the time of system level reset, the diesel generator will trip and a lockout will occur.

In the emergency mode, the HPCS diesel generator is a source of on-site power. During emergencies, which includes a LOCA, most of the protective trip functions are blocked so that the diesel will operate as long as possible, regardless of the damage that it may incur. Upon conclusion of the emergency, all protective functions are restored as soon as the LOCA signal is manually reset. This restoration of protective functions is provided so that the diesel will not suffer any more damage than necessary. The trips are not reinstated until the LOCA signal is reset. Since this signal must be manually reset, the trips are, in effect, manually reinstated. Thus, after the LOCA, the diesel will continue to run with all trips functioning normally.

It is the LRG-II position that this method of operation meets the intent of IE Bulletin 80-06 and no modifications are planned.

MJA:hjr:rf/113A5
3/12/82

Finding #2 - Automatic Depressurization System

A reset de-energizes the ADS solenoids, thus returning the air operated ADS valves to normal closed condition.

The design of the ADS includes a dedicated reset button in each of the two divisions. Pushing both buttons causes all ADS valves to close interrupting ADS action for 120 seconds. The reset push buttons are provided as the means of manually preventing or limiting inadvertent actuation of the ADS. These are the only ADS shutoff switches available to the operator.

It is the LRG-II position that this design is consistent with IEEE Standards and no change is considered appropriate in response to IE Bulletin 80-06.

Finding #3 - RCIC System

RCIC/RHR steam supply valves E51-F063 and F064 change state with reset as follows: Valve E51-F063 will automatically re-open when the Division II RCIC steam isolation signal is reset, if the valve's control switch is left in the open position. Valve E51-F064 will automatically reopen when Division I isolation signal is reset if the valve control switch is left in the open position.

It is the LRG-II position to modify subject valve control circuits to require operator action to reopen the valve after the appropriate reset button is pushed.

Finding #4 - Nuclear Steam Supply Shutoff System/Nuclear Boiler System

Valves E12-F060A, B and E12-F075A, B (RHR Sample Line Valves) and B33-F019 and B33-F020 (Reactor Water Sample Valves) will reopen upon resetting from an isolation signal if they were open originally.

MJA:hjr:rf/113A6
3/12/82

It is the LRG-II position to modify the subject valve control circuits to require operator action to reopen the valve after the appropriate reset button is pushed.

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3/12/82

LRG-II Position Paper
March 12, 1982

1-PSB
DIESEL GENERATOR RELIABILITY

ISSUE

The NRC issued specific recommendations on increasing the reliability of nuclear power plant emergency diesel generators via the document NUREG/CR-0660, "Enhancement of Onsite Emergency Diesel Generator Reliability". Information requests concerning these recommendations are routinely transmitted to the applicants during the review process. While a generic issue has not been identified, LRG-II has chosen to address the NUREG/CR-0660 recommendations generically.

LRG-II POSITION

The LRG-II position is to implement the appropriate recommendations of NUREG/CR-0660 as they apply to the onsite emergency diesel generators.

A summary of each recommendation is given below followed by a discussion on how the recommendation will be implemented.

Recommendation 1 - Moisture in Air-Starting System

The air starting system for the diesel generators relied on periodic blowdown of the air receivers for removal of entrained oil and excess water from the starting air. Operating experience has shown that accumulation of water in the starting air system has been one of the most frequent causes of diesel engine failure to start. It is recommended that air dryers be installed upstream of the air receivers.

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3/12/82

LRG-II Compliance

Dessicant or refrigerant type air dryers will be used upstream of the air receivers to ensure a continual supply of dry starting air. Since the dryers are not required during the starting cycle of the diesel generator, they will be designed to ASME Section VIII requirements or 1.5 times system design pressure.

Monthly verification and/or maintenance of air dryer performance will be provided.

Recommendation 2 - Air Quality in Diesel Generator Room

Malfunction or failure of the contacts and relays to function properly is another major cause of diesel engine failure to start. The root cause is usually dust, dirt and grit between the electrical contact surfaces. It is recommended that all contacts and relays be inside dust-tight enclosures and that dust control measures be implemented in the diesel generator rooms.

LRG-II Compliance

In order to protect electrical contact surfaces, diesel generator control panels will be dust-tight and water resistant in accordance with the design requirements for NEMA type 4 cabinets.

In order to control dust in the area of the diesel generators, each unit is placed in its own room. During normal plant operation, the ventilation systems provide filtered air, as a minimum, to areas containing diesel generator electrical controls. Ventilation system filters will be cleaned or replaced periodically.

Recommendation 3 - Turbocharger Heavy Duty Gear Drive

The scheduling and frequency of surveillance testing can result in excessively long periods of no load and light load running of a diesel generator at full rated speed.

This light loading results in insufficient exhaust gas energy to drive the turbocharger on the General Motors - Electro-Motive Division (GM-EMD) diesel engines. This results in the need to mechanically drive the turbocharger. Mechanically driving the turbocharger will result in a short life expectancy for the standard design turbocharger gear drive. It is recommended that a heavy duty gear drive be installed on the turbocharger.

LRG-II Compliance

A heavy duty turbocharger gear drive will be installed to improve the reliability and availability of the GM-EMD diesel generators.

Recommendation 4 - Personnel Training

There is a particularly difficult problem in developing knowledge and maintaining skills of the operators and maintenance personnel of the diesel generator units. These units normally operate only during surveillance and trouble shooting tests to give assurance of readiness, should an emergency arise. The relatively short exposure to an operating unit makes "on the job" training especially difficult. When a nuclear power plant is put into operation, the operators having the diesel generator responsibilities may have little or no related skills on such units. It is recommended that the training of the operators and maintenance personnel, and especially their immediate supervisors, be an intensive and continuing education program. This would serve to develop knowledge and skills among those less experienced and act as "refresher training" to maintain the familiarity and skills of the qualified personnel.

LRG-II Compliance

Operators and selected supervisory personnel will receive training on the diesel generators as a part of the cold-license training program. In addition, these personnel will receive training and experience by assisting vendor representatives and/or startup engineers during preoperational testing of the diesel generators. Selected maintenance personnel will receive vendor training that will be incorporated into maintenance department training. Maintenance on diesel generators will be performed or directly supervised by personnel who have received this training. Ongoing training will include the requalification training program required by 10CFR55 for operations personnel and maintenance departmental training for maintenance personnel.

Recommendation 5 - Automatic Pre-Lube

Long periods on standby have a tendency to drain or nearly drain the engine lube oil piping systems. On an emergency start of the engine as much as 5 to 14 or more seconds may elapse from the start of cranking until full lube oil pressure is attained even though full engine speed is generally reached in about five seconds. With an essentially dry engine, the momentary lack of lubrication at the various moving parts may damage bearing surfaces with resultant equipment unavailability.

It is recommended that the engine's electrically driven pre-lube pump be started by the same signal which initiates the cranking of the engine and be stopped when the engine stops cranking. An alternative approach would be to start the pre-lube pumps by the same signal but stop the pump when the pressure in the engine lube oil header has achieved a predetermined level. An electrically driven pre-lube pump accelerates to full speed quite rapidly with full delivery while the engine driven pump accelerates more slowly with the engine. In either case, such modifications should be carried out in close consultation with the engine manufacturer.

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3/12/82

LRG-II Compliance

In order to prevent "dry starting of the diesel engine under emergency conditions", one of the two following actions will be implemented:

A. Modify the diesel lube oil system in accordance with GM-EMD Maintenance Improvement - 9644 and anticipated manufacturer clarification.

B. Manually pre-lube the diesel engine in accordance with the manufacturer's recommendations at least once per week and before each manual diesel engine start.

Recommendation 6 - Testing Loading and Preventative Maintenance

Testing and test loading are the essence of the surveillance test as practiced in the nuclear power plant. The basic function and value of a surveillance test on a diesel generator unit is to demonstrate operability. The following recommendations are provided to guide and standardize the general approach in surveillance testing:

A. No-load and light-load operation causing incomplete combustion should be minimized to reduce the formation of gum and varnish deposits on engine parts and to reduce the likelihood of mechanical failures. Minimum load should be at least 25% of rated load.

B. The surveillance test should be within the NRC guidelines and the frequency of testing, size of test load, and duration should generally follow the recommendations of the engine manufacturer.

MJA:hjr:rf/113A20
3/12/82

C. Investigative testing, replacement and adjustment should be part of the preventative maintenance program. Testing, per se, is not a corrective measure and serves only as confirmation of readiness and operability, or as an indication of the need for corrective action.

D. A "check off test" should be the final step after any corrective action. An actual start, run, and load test would help to determine if mistakes were made during a corrective action.

LRG-II Compliance

The LRG-II position on the above recommendations are as follows:

A. For no-load and light-load operation, the following conditions will be satisfied.

   (1) Implement the manufacturer's recommendations for no-load and light-load operations.

   (2) During periodic testing, the diesel will be loaded to a minimum of 25 percent of full load or as recommended by the manufacturer.

   (3) During troubleshooting, no-load operation will be minimized. If the troubleshooting operation is over an extended period (that is, 3 to 4 hr or more), the engine shall be cleared in accordance with item 1 above.

B. Surveillance testing of diesel generators will comply with requirements provided in each plant's Technical Specifications. These Technical Specifications will reflect the NRC guidance provided in the BWR/6 Standard Technical Specificatons.

MJA:hjr:rf/113A20
3/12/82

C. Preventive maintenance will go beyond the normal routine adjustments, servicing, and repair of components when a malfunction occurs. The preventive maintenance program will encompass investigative testing of components that have a history of repeated malfunctioning and require constant attention and repair. Furthermore, industry operating experience from sources such as the nuclear plant reliability data system will be utilized as an aid in evaluating industry history for diesel-generator component failure.

D. Upon the completion of repairs or maintenance and before an actual start, run, and load test, a final equipment check will be made to ensure that all electrical circuits are functional; that is, fuses are in place, switches and circuit breakers are in their proper position, no wires are loose, all test leads have been removed, and all valves are in the proper position to permit a manual start of the equipment. After the unit has been satisfactorily started and load tested, it will be returned to automatic standby service.

Recommendation 7 - Identification of Root Causes of Failures

Improvement in reliability hinges on identification of the basic problem or "root cause" and the proper choice of corrective action. The effectiveness of all efforts to improve reliability depends on the proper execution in finding the true root cause of problems. This is especially difficult because of the usual chain of related cause and effect relationships.

In order to detect "root causes" of problems, the following guidance should be observed:

A. The obvious cause should always be suspect as the "root cause". To be sure, the obvious is usually the direct cause of failure or malfunction. The possible chain of cause-and-effect may fail to be investigated.

B. Closely spaced component failures should not be accepted unless accompanied by specific assurance of the absence of contributing causes and that alternate improved components are unavailable.

C. The LER system and the records so produced have proven to be the best single source of information on the reliability status of the emergency diesel generators. Continued reliance on this source of information for reliability data should be encouraged.

LRG-II Compliance

In general, the above recommendation are inherent in the philosophy of good engineering and operating judgment. Such a philosophy is difficult to incorporate directly into a maintenance procedure and therefore is best accomplished as a function of an onsite review group. The purpose of such a group is to independently review atypical events, repetitive events and operating data from other stations in order to improve plant safety. LRG-II participants will establish such review groups in compliance with TMI Action Plan Item I.B.1.2 as contained in NUREG-0737.

Recommendation 8 - Diesel Generator Room Ventilation and Combustion Air Inlet

Some installed diesel generator units take their combustion air from the engine room regardless of the extent of airborne dirt and the arrangement of the fire suppression system. Some units have inherent recirculation of hot cooling system air, hot room ventilation air, and even hot exhaust gas. It is recommended that the following design guidance be observed for ventilation and combustion air inlet systems:

A. Engine combustion air should be through piping directly from outside the building and at least 20 feet from ground level through proper filters.

B. Room ventilation air should be filtered and taken from a level at least 20 feet above ground level. The piping for the room ventilation air should be separate from that used for the engine combustion air.

C. Room ventilation air, hot cooling system air and/or engine exhaust gas should not be permitted to circulate back into the diesel generator room, fuel storage area, or into any other part of the power plant.

LRG-II Compliance

The LRG-II position on the above recommendations are as follows:

A. A separate source of combustion air for each diesel engine is taken from the diesel generator building outside air intakes which are located at least 20 feet above ground level. This air is filtered prior to combustion.

B. The diesel generator building ventilation system air is drawn from intakes which are at least 20 feet above ground level. As a minimum, ventilation for areas which house control equipment with electrical contacts is filtered. The piping for the diesel generator building ventilation system is separate from that used for the engine combustion air.

C. Hot cooling systems air and engine exhaust gases are discharged directly from the building. Since engine combustion air is taken from outside air intakes, any recirculation of room ventilation air for temperature control will not degrade intake air quality.

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3/12/82

Recommendation 9 - Fuel Oil Storage and Transfer

In order to assure proper fuel oil storage and handling, the following recommendations are made:

A. Bulk fuel storage tanks should have provisions for water removal. In addition, the fuel outlet pipe should be several inches above the tank bottom to allow some tank volume for settling of any water.

B. Fuel supply pumps for the engine fuel system should be engine driven. The fuel supply to the engine driven fuel pump should either be an assured gravity fed supply or else by a booster pump powered from a Class 1E station battery.

LRG-II Compliance

The LRG-II position on the above recommendations are as follows:

A. Bulk fuel oil storage tanks have provisions for water removal. Typically water removal is via a drain located at the bottom of the tank.

The suction point in each storage tank is located approximately six inches from the tank bottom to prevent any accumulated water from being transferred to the day tank.

B. Fuel supply pumps for the engine fuel system are engine driven. The fuel supply to these pumps will either be an assured gravity fed supply or else by a booster pump powered from a Class 1E d-c power source.

Recommendation 10 - High Temperature Insulation for Overload Conditions

The nature of the emergency diesel generator duty includes a possibility of large overloads which could extend longer than the time required to start large water pumps, etc. There is a possibility of engine overheating from such extreme emergency overloads causing a generator fire. It is recommended that high temperature rated generator insulation be utilized for the diesel generator units to reduce the generator fire hazard.

LRG-II Compliance

LRG-II participants concur with the NRC staff position that explicit conformance with the consultants recommendation is considered unnecessary in view of the equivalent reliability provided by the design, margin, and qualification testing requirements that are normally applied to emergency standby diesel generators for nuclear power plant application.

Recomendation 11 - Engine Cooling Water Temperature Control

A water thermostat of the "3-way" or bypass-type splits the water flow so that only as much water passes through the coolers or radiator as needed to maintain the proper water outlet temperature. This type of cooling water temperature control is used in most nuclear power plant diesel engine cooling systems and was the only design reviewed which gave no indication of trouble. It is recommended that all engine cooling water temperature control arrangements be by means of the 3-way thermostat design.

LRG-II Compliance

Temperature regulation of the diesel engine coolant will be accomplished through the use of a "3-way" thermostatic valve.

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3/12/82

Recommendation 12 - Concrete Dust Control

Concrete floors tend to shed abrasive dust of sufficient particulate size to not only become airborne, but also to enter electrical cabinets and prevent contacts from completely closing. It is recommended that the floors be painted in all rooms which house equipment with electrical contacts.

LRG-II Compliance

The accumulation of dust, including dust generated from concrete floors and walls, on the electrical equipment associated with the starting of the diesel generators is limited by:

A. Concrete floors will be painted in all diesel generator rooms which house equipment with electrical contacts.

B. The diesel generator building ventilation system design and operation which provides filtered air to all diesel generator rooms which house equipment with electrical contacts.

C. Plant design which separates each diesel generator from other plant equipment and areas.

D. Administrative procedures for cleanliness and ventilation system maintenance.

Recommendation 13 - Mounting and Support of Instrumentation to Protect It From Vibration Damage

It is recommended that instruments, controls, monitors, and indicating elements be supported in or on a freestanding, directly floor mounted panel to the extent functionally practical to reduce vibration induced wear.

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3/12/82

LRG-II Compliance

Except for sensors and other equipment that must be directly mounted on the engine and associated piping, the controls and monitoring instrumentation for diesel generators used at LRG-II plants are installed on freestanding, floor-mounted panels separate from the engine skids and located in a floor area free of engine-induced vibration.

MJA:hjr:rf/113A28
3/12/82

LRG-II Position Paper
March 12, 1982

1-CHEB
REACTOR COOLANT SAMPLING

ISSUE

In response to the requirements of NUREG-0737, Item II.B.3, "Post Accident Sampling Capability", LRG-II plants are required to demonstrate that the reactor coolant system sampling locations will provide coolant samples that are representative of core conditions. Of specific concern is the potential for significant dilution of the sample by makeup water which can result in the samples being analyzed at lower concentrations of soluble species (chlorine, boron, iodine, etc) than are actually present in the core.

LRG-II RESPONSE

The LRG-II position is that reactor coolant samples obtained from a tap off the jet pump pressure instrument system will provide representative core coolant samples for accident conditions and that samples be taken from this location.

In order to assure that this sample location provides a representative sample, sufficient core flow is needed to circulate water from the core to the jet pump intake. After a small break or non-break accident, the reactor water level is maintained at or near normal water level by the operator using emergency procedures. For decay power above 1% of rated power the core flow is estimated to be greater than 10% rated flow due to natural circulation. The entire reactor water inventory would be circulated through the jet pumps in about 3 to 4 minutes, thus assuring that representative samples of core coolant will be available at the jet pumps.

MJA:hjr:rf/113A29
3/12/82

At power levels of less than 1% rated, a sample that is representative of core conditions would be obtained by increasing the reactor water level by 18 in. This will fully flood the moisture separators and will provide a thermally induced recirculation flow path for mixing.

Makeup water does not significantly dilute the sample. Makeup water flow amounts to approximately 2% of the core flow for small steam line breaks or non-break accidents. For small liquid line breaks, the makeup water flow rate is estimated to be less than 18% of the core flow. Thus, no significant dilution occurs and the water circulating through the jet pump is representative of reactor coolant inventory for small break or non-break accidents.

Further, sample lines in the RHR system provide for a reactor coolant sample when the reactor is depressurized and at least one of the RHR loops is operating in the shutdown cooling mode.

Finally, for larger line breaks where reactor water level cannot be maintained, reverse flow through the core to the suppression pool is provided. Suppression pool samples are obtained from the RHR pump discharge as discussed in the LRG-II position paper 2-CHEB "Suppression Pool Sampling".

MJA:hjr:rf/113A30
3/12/82

LRG-II Position Paper
March 12, 1982

2-CHEB
SUPPRESSION POOL SAMPLING

ISSUE

In response to the requirements of NUREG-0737, Item II.B.3, "Post Accident Sampling Capability," LRG-II plants are required to demonstrate that the suppression pool sample locations will provide samples that are representative of pool inventory.

LRG-II RESPONSE

The LRG-II position is that suppression pool samples, obtained from the Residual Heat Removal pump discharge with the RHR loop lined up in the suppression pool cooling mode, will be representative of the pool inventory and that samples will be taken from this location.

The sample lines will be installed on the discharge side of the RHR pumps downstream of the pump check valve. Representative samples will be assured by operating the selected RHR loop for approximately 30 minutes prior to taking a sample. Since no SRV's discharge directly into the RHR suction and the SRV discharge locations in the pool facilitate mixing, the suppression pool sample location will provide adequately mixed samples that will be representative of pool inventory.

MJA:hjr:rf/113A31
3/12/82

LRG-II Position Paper
March 12, 1982

1-MEB
INPUT CRITERIA FOR USE OF SRSS FOR MECHANICAL EQUIPMENT
(NUREG-0484, Rev. 1)

ISSUE

The LRG-II participants must justify the use of SRSS methodology for mechanical equipment in LRG-II plants.

LRG-II POSITION

The LRG-II participants together with the owner of Grand Gulf and Allens Creek formed an Owners Group to show that these plants (and Mark III plants generically) satisfy the criteria contained in NUREG-0484 Rev. 1 "Methodology for Combining Dynamic Response". General Electric Company and Structural Mechanics Associates (SMA) were retained to assist in this effort. Dr. R. Kennedy of SMA, representing the Mark III Owners, discussed the final report, Reference 1, with the NRC Staff and their consultant, Brookhaven National Laboratory (BNL) on December 16, 1981. The Owners Group concluded, and the LRG-II position is, that SRSS is applicable to Mark III plants. The NRC committed to provide, upon conclusion of the BNL review, a letter or other documentation to provide acceptance of the SRSS methodology for combination of dynamic responses. No problems have been identified and final acceptance is anticipated in March, 1982.

Reference 1: SMA 12109.01-R001, "Study to Demonstrate the Generic Applicability of SRSS Combination of Dynamic Responses for Mark III Nuclear Steam Supply and BOP Piping and Equipment Components"

MJA:hjr:rf/113A14
3/12/82

LRG-II Position Paper
March 12, 1982

1-SEB

COMBINATION OF LOADS

Issue:

For combining various dynamic loads, it is the NRC staff's position that the absolute sum method should be used unless actual time histories of the dynamic load occurrences are combined. If actual time histories are combin , details of the method used should be provided.

The Staff has given to each Mark III applicant its position concerning the combination of loads. The position is specific with respect to the consideration of pool swell and SRV loading but is not as clear as a load combination table listing all the permissible combinations of loads with their respective specified load factors. LRG-II plants should provide one such table for concrete containment, steel containment, concrete internal structures, and steel internal structures respectively.

In addition to the load combination requirement for the containment design, there is a fatigue analysis requirement for the liner of a concrete containment. For steel containment, the consideration of fatigue is specified in ASME Boiler and Pressure Vessel Code Section III, Division 1, Subsection NE. However, the liner on the concrete foundation mat of the steel containment should be treated as the liner of a concrete containment. Since the staff's position requires the pool liner to be designed in accordance with the ASME B&PV Code Section III, Division 1, Subsection NE, it is suggested that a generic method to consider fatigue of both the steel containment and the steel liner in the concrete containment should be adopted.

LRG-II Position:

The staff's position on load combination is understood. LRG-II plants use the absolute sum method of combining loads for the design of structures. LRG-II plants do not use SRSS for this purpose.

The development of a generic table of permissible load combinations is unnecessary for LRG-II Plants. Details of load combinations used in LRG-II plants are already provided in LRG-II plant FSAR's (Chapter 3).

Fatigue analysis for steel containments in LRG-II plants (Perry and River Bend) is performed according to ASME B&PV Code Section III, Division 1, Subsection NE. When liners are backed by concrete so that the concrete supports the loads, the liner fatigue analysis is determined according to ASME B&PV Code Section III, Division 2, Subsection CC. Because this design work is complete, development of a new generic approach applicable to different containment configurations at this time would serve LRG-II plants no useful purpose. It is the LRG-II position, not to pursue development of such a generic approach.

MJA:lm/13S-2
3/12/82

LRG-II Position Paper
March 12, 1982

2-SEB

FLUID/STRUCTURE INTERACTION

Issue:

The dynamic forcing functions for various loads have been established mostly through testing on models which are generally more stiff than the actual structures to which the loads will be applied. By applying directly such forcing functions to actual structures in the analysis, the interactive effect between the fluid mass and the structure is neglected. Under certain conditions, this effect may be significant. It is proposed that a generic approach to study such effects should be established.

LRG-II Position:

LRG-II containments are stiff in the suppression pool region and the dynamic forcing functions are conservatively defined. Therefore, any interactive effect between the fluid mass and the structure is inherently included. In-plant test data, recorded to date, confirms the conservatism of the load definition used. Studies to quantify the contribution of the effects of fluid structure interaction in LRG-II plants are not necessary and no such research program is contemplated.

MJA:lm/13S-3
3/12/82

LRG-II Position Paper
March 12, 1982
Revision 1

4-CPB
HIGH BURN-UP FISSION GAS RELEASE

Issue:

General Electric's model for predicting fission gas release from the fuel pellets to the gap (GEGAP III) may underpredict the amcunt of fission gas released for fuel with burn-up greater than 20,000 MWd/t. If the release of low thermal conductivity fission gas is underestimated, the calculated gap conductance will be overestimated and the peak clad temperature calculation will be nonconservative. A fission gas release enhancement factor will be required for fuel with burn-up greater than 20,000 MWd/t.

LRG-II Position:

Application of the correction factor is not necessary for LRG-II plants. In Reference 1, General Electric Company requested that credit for calculated peak cladding temperature margin, as well as credit for recently approved, but unapplied, ECCS evaluation model changes be used to offset any operating penalties due to high burn-up fission gas release. The methodology presented in Reference 1 was approved by the NRC staff (Reference 2) and applies to all LRG-II plants.

References:

1. Letter, R. M. Pifferetti (GE) to R. L. Tedesco (NRC), "Fission Gas Release from Fuel at High Burn-up", August 21, 1981

Letter, L. F. Rubenstein (NRC) to T. M. Novak (NRC), "General Electric ECCS Analysis at High Burn-up", October 22, 1981

rf/113A32