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ACCESSION NBR:8804280346 DOC.DATE: 87/12/15 NOTARIZED: NO DOCKET #
 FACIL:50-397 WPPSS Nuclear Project, Unit 2, Washington Public Powe 05000397
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SUBJECT: Application for amend to License NPF-21,allowing slow starts.

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December 15, 1987
G02-87-285

Docket No. 50-397

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Gentlemen:

Subject: NUCLEAR PLANT NO. 2
OPERATING LICENSE NPF-21, DIESEL GENERATOR
LOCA RESPONSE MODIFICATION, REQUEST FOR NRC
REVIEW PRIOR TO IMPLEMENTATION

References: 1) Generic Letter 84-15
2) NUREG/CR-4557, "Improving DG Reliability"

The Supply System is modifying controls to Diesel Generators 1 and 2 to allow "slow" starts as contemplated in Generic Letter 84-15 and authorized in Amendment 19 to the WNP-2 Technical Specifications (Surveillance Requirement 4.8.1.1.2). The Supply System has evaluated the modification per 10CFR 50.59 and identified one feature of the modification as an unreviewed safety question, not previously reviewed by the staff. This feature is the ability to manually return to idle speed, given offsite power available, after fast starting in response to a LOCA start signal. In this condition the LOCA signal would still be present, offsite power would be utilized, and the diesel(s) would be at idle. On a loss of offsite power the idle signal would be automatically bypassed making diesel generator power available in less than 10 seconds. This design feature has not previously been reviewed by the staff and it is this feature for which staff prior review is being requested. The following is provided as background to assist the staff's review of this new LOCA response design feature.

The modification implements proposals in NUREG/CR-4557 which encourage design improvements of Emergency Diesel Generator systems consistent with long-term industry diesel generator reliability goals. The new governor control system design will add the capability to operate each diesel engine set at idle speed. This will be used primarily to provide the warmup and cooldown intervals recommended by the engine manufacturer to reduce mechanical stress and wear due to routine monthly, manually initiated, surveillance testing required by Technical Specifications.

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**DIESEL GENERATOR LOCA RESPONSE MODIFICATION, REQUEST
FOR NRC REVIEW PRIOR TO IMPLEMENTATION**

Current design dictates that the diesel generators are always "fast" started, where the engines accelerate from rest to rated RPM and the generator attains rated frequency and voltage all within 10 seconds.

The "fast" start sequence now consists of the following:

- o Upon receipt of a signal to start, a separate control voltage is directly applied to the electrohydraulic governor actuators to adjust fuel rack position to full throttle. The same start signal also engages air-start motors and enables the generator excitation ("field flash") circuits.
- o As the unit accelerates to rated RPM, the bias control voltage to the fuel actuators is removed and is replaced by the output of the electronic governor.
- o Speed signals that disengage the air start motors and provide other engine speed logic permissives during an engine start are derived from a single tach generator mounted on the engine skid. A separate frequency sensor on the generator output produces the (feedback) speed signal to the electronic governor.

The new design provides the capability to "fast" start in either auto or standby mode and "slow" start when under manual control. A slow start is where the diesel accelerates from rest to idle speed within a prescribed interval. When running at idle speed, the DG remains separated from its load bus with the generator excitation circuits blocked. Attachment 1 is provided to indicate the Final Safety Analysis Report sections to be changed due to this modification.

In both the existing and new designs, loss of coolant accident (LOCA) signal will automatically fast start, or accelerate the engine, to 900 RPM. The new design will allow the engine to be slowed to idle speed by use of a local switch during conditions when offsite power is provided to the bus. This will allow the engine to be operated for extended periods unloaded. The engine manufacturer does not recommend operating the engine at full speed-low load conditions for longer than 4 hours. Continued operation at high speed unloaded can result in fuel carry over, high exhaust temperatures, mechanical damage and/or fire. If the respective 4.16 KV Class 1E bus (SM-7, SM-8) primary undervoltage relay signal is received when an operating engine is at idle speed, manual control is automatically bypassed. The engines are accelerated to rated speed and generator excitation (field flash) is initiated. The diesel generator is automatically brought to rated frequency and voltage attaining a ready-to-load condition within the prescribed 10 seconds.

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In the new design, the "fast" start sequence includes the following:

- o With a signal to start, the electronic governor controller adjusts the fuel rack to the start position, air start motors are engaged and the generator excitation circuits are enabled. The engines accelerate from rest to rated speed as the controller continues to monitor and adjust fuel rack position. The acceleration time interval (ramp time) is preset and is entirely controlled by the electronic governor.
- o Speed signals for control logic permissives to various auxiliaries (including air start motors), as well as the electronic governor, are now derived from magnetic pickup transducers (two per DG) mounted radially from each engine flywheel.

This modification will provide diesel engine control design improvements that are consistent with long-term diesel generator reliability goals. Some of these improvements include:

- 1) The new governor system will allow slow starts for routine surveillance testing, thereby achieving a reduction in the number of fast start surveillance tests. This is in accordance with manufacturer's recommendations and NRC staff guidance as outlined in Generic Letter 84-15, "Proposed Staff Actions to Improve and Maintain Diesel Generator Reliability".
- 2) The new updated electronic governor was designed with a high degree of immunity to environment and operational influences and increased tolerance of human error. The manufacturer states that this new governor is much more reliable than the system presently used at WNP-2 based upon customer returns and field service.
- 3) The engine actuators which control fuel rack position will be changed from forward to reverse acting. Reverse acting actuators give full fuel rack position at minimum governor signal. Therefore, if the electronic governor fails due to loss of power or low output, the actuator will still control at a slightly higher speed using the mechanical backup flyball governors built into the actuators. The engine will continue to function for most electronic governor failures.

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- 4) The present design requires speed signal inputs from two sources: a tach generator connected to the auxiliary gearbox of the engine and a frequency transducer connected to the generator output. The tach generator provides a signal to a speed switch used to control startup of the engine. The frequency transducer provides a speed input to the old governor. Failure of either of these devices will disable the diesel. The new design derives both signals from a common source. The engine speed signal will be derived from a magnetic pickup located near the engine flywheel. For redundancy, and since these are tandem units, a magnetic pickup will be installed on each engine's flywheel. The signals from these magnetic pickups will be routed to a magnetic pickup selector module. This module automatically selects the pickup with the higher output and monitors for pickup failure. The output of the selector module then drives the speed switch and electronic governor. All components are made by the same manufacturer to ensure compatibility. This system will reduce the probability of failure of the engine.
- 5) The present design requires the engine to run at full speed unloaded when started by a LOCA, even with offsite power available. The engine manufacturer recommends operating for less than 4 hours in this condition. This is because unburned fuel will accumulate in the exhaust system and possibly cause a fire. The only way to stop the engine with a LOCA signal present is to manually utilize the emergency stop feature. This disables the engine from being restarted until the emergency stop is locally reset. The new design will allow the engine to be brought to idle speed during a LOCA condition when offsite power is available to the associated bus. This feature of the new design will allow the diesel to be idled for extended periods.

The Supply System has reviewed this design modification per 10CFR50.92 and provides the following in support of a finding for no significant hazards. No significant hazards will result relative to this modification because it does not:

- 1) Involve a significant increase in the probability or consequences of an accident previously evaluated since the new diesel engine governor control system is primarily a hardware upgrade. The LOCA response feature will allow the engine to be run at reduced speed for extended periods, unloaded during conditions with offsite power available and a LOCA signal present. When power is lost to the bus, the engine will automatically start if not already running or ramp to full speed if idling and automatically provide power to the bus within the required 10 second time frame. All other boundaries and functions of the diesel engine governor control system remain the same. Hence, no increase in the probability or consequences of an accident previously evaluated is possible. The diesel(s) will still respond within the required time frame.



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- 2) Create the possibility for an accident or malfunction of a different type than any previously evaluated because the automatic response of the diesel engine controls to accident signals "to start" is similar to the previous design. The new governor control system design retains the same fast-start ability from ambient conditions as the previous design. The LOCA response feature has been added to allow the engine to be run at reduced speed during a LOCA and offsite power feeding the buses. This new design still ensures that the diesel will be capable of automatically providing power in 10 seconds or less if offsite power is lost during these conditions. That is, if an automatic fast start demand signal (i.e. primary undervoltage on 4.16KV Critical Bus SM-7 or SM-8) is received when operating the diesel engines at reduced RPM (idle speed), manual control of engine speed is automatically bypassed. The governor control system automatically brings the diesel generator to rated frequency and voltage attaining a ready-to-load condition. Since the diesel(s) in all cases will respond as originally intended, i.e. within 10 seconds, no new accidents or malfunctions are credible. This design is similar to those previously approved on Clinton and San Onofre #2.

The idle speed feature of the new controller will be used for manually initiated surveillance testing or other maintenance startups that do not require proving the "10 second ready to load" response criteria of the Technical Specifications.

- 3) Involve a significant reduction in a margin of safety because the engine governor speed control system replacement and upgrade will not affect the Technical Specification bases or ability of the Diesel Engine System to meet Technical Specification requirements.

This review request has been reviewed and approved by the WNP-2 Plant Operations Committee (POC) and the Supply System Corporate Nuclear Safety Review Board (CNSRB).

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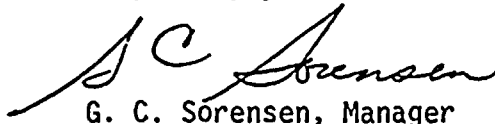
DIESEL GENERATOR LOCA RESPONSE MODIFICATION, REQUEST
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In accordance with 10CFR170.21, an application fee of One hundred fifty dollars (\$150.00) accompanies this request.

The Supply System desires to install the new LOCA response design feature during the spring 1988 refueling outage. Accordingly, it is requested that the Staff's review be completed no later than March 1, 1988 to support this schedule. The remainder of the design modification will be implemented during the spring 1988 refueling outage.

Should you have any questions, please contact Mr. P. L. Powell, Manager, WNP-2 Licensing.

Very truly yours,



G. C. Sorensen, Manager
Regulatory Programs

PLP/bk
Attachments

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