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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

OCT 19 1979

Docket Nos: 50-329
and 50-330

Mr. S. H. Howell
Vice President
Consumers Power Company
212 West Michigan Avenue
Jackson, Michigan 49201

Dear Mr. Howell:

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION REGARDING DIESEL GENERATOR STARTING RELIABILITY

Although our present safety review for Midland Plants Units 1 & 2 is limited or suspended in certain areas due to our manpower resource difficulties since the TMI-2 accident, we are continuing our review in those areas where resources allow. In continuing our FSAR review of areas assigned to our Power Systems Branch, we find that additional information is needed regarding reliability and availability of diesel generators. These questions are enclosed and relate to generic studies performed by the University of Dayton Research Institute identifying factor contributing to unreliability of diesel generators as reported in NUREG/CR-0660, "Enhancement of Onsite Emergency Diesel Generator Reliability."

We would appreciate your reply at your earliest opportunity. Please contact us if you desire clarification or other discussions of the information requested.

Sincerely,

L S Rubenstein

Lester S. Rubenstein, Acting Chief
Light Water Reactors Branch No. 4
Division of Project Management

Enclosure:
As Stated

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cc:
See next page

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Consumers Power Company

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040.0 POWER SYSTEMS BRANCH

040.114 (9.5.8) Experience at some operating plants has shown that diesel engines have failed to start due to accumulation of dust and other deliterious material on electrical equipment associated with starting of the diesel generators (e.g., auxiliary relay contacts, control switches - etc.). Describe the provisions that have been made in your diesel generator building design, electrical starting system, and combustion air and ventilation air intake design(s) to preclude this condition to assure availability of the diesel generator upon demand.

Also describe what procedure will be used under normal plant operation to minimize accumulation of dust in the diesel generator room. Your response should also identify and address any special conditions, construction or maintenance activities during operation of either unit which may result in abnormal generation of dust.

040.115 (9.5.6) RSP 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 on demand. Condensation of entrained moisture in compressed air lines leading to control and starting air valves, air start motors, and condensation of moisture on the working surfaces of these components has caused rust, scale and water itself to build up and score and jam the internal working parts of these vital components, thereby preventing starting of the diesel generators.

As reported in NUREG/CR-0660, failure of diesel engines to start from the effects of moisture condensation in air starting systems and from other causes have lowered their operational reliability to less than the desired reliability goal of 0.99 specified in Branch Technical Position ICSB (PSB) 2 "Diesel Generator Reliability Testing" and Regulatory Guide 1.108 "Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants."

To improve diesel engine starting reliability, we require that compressed air starting system designs include air dryers for the removal of entrained moisture. The two air dryers most commonly used are the dessicant and refrigerant types. NUREG/CR-0060 finds that of these two types, the refrigerant type is better suited for nuclear power plant application and its selection is highly advisable. Midland FSAR Figure 9.5-27, "Emergency Diesel Generator Starting System," shows an air dryer and FSAR Section 9.5.6 states that an air dryer is used in the starting system. However, the type is not specified and there is no further description of the air dryer. Starting air should be dried to a dew point of not more than 50°F when installed in a normally controlled 70°F environment, otherwise the starting air dew point should be controlled to at least 10°F less than the lowest expected ambient temperature.

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Describe the type of air dryer used in the diesel engine air starting system and revise your design if needed based on the information above.

040.116 (8.3) Provide a detailed discussion or plan of the level of training proposed for your operators, maintenance crew, quality assurance, and supervisory personnel responsible for the operation and maintenance of the emergency diesel generators. Identify the number and type of personnel that will be dedicated to the operations and maintenance of the emergency diesel generators and the number and type that will be assigned from your general plant operations and maintenance groups to assist when needed.

In your discussion identify the amount and kind of training that will be received by each of the above categories and the type of ongoing training program planned to assure a high level of availability of the emergency generators.

Also discuss the level of education and minimum experience requirements for the various categories of operations and maintenance personnel associated with the emergency diesel generators.

040.117 (9.5.7) RSP Several fires have occurred at some operating plants in the area of the diesel engine exhaust manifold and inside the turbocharger housing. The fires started from lube oil leaking and accumulating on the engine exhaust manifold and accumulating and igniting inside the turbocharger housing. Accumulation of lube oil in these areas, on some engines, is apparently caused from an excessively long prelube period, generally longer than five minutes, prior to manual starting of a diesel generator. This condition does not occur on an emergency start since the prelube period is minimal.

When manually starting the diesel generators for any reason, to minimize the potential fire hazard and to improve equipment availability, the prelube period should be limited to a maximum of three to five minutes unless otherwise recommended by the diesel generators. Specify the maximum prelube time interval to which your diesel engine will be exposed prior to manual start.

040.118 (9.5.7) RSP An emergency diesel generator unit in a nuclear power plant is normally in the ready standby mode unless there is a loss of offsite power, an accident, or the diesel generator is under test. Long periods on standby have a tendency to drain or nearly empty the engine lube oil piping system. On an emergency start of the engine, as much as 5 seconds 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 after start of cranking. With an essentially dry engine, the momentary lack of lubrication at the various moving parts may damage bearing surfaces, producing incipient or actual component failure with resultant equipment unavailability.

The emergency condition of readiness requires this equipment to attain full rated speed and enable automatic sequencing of electric load within ten seconds. For this reason, and to improve upon the availability of this equipment upon demand, it is necessary to establish as quickly as possible an oil film in the wearing parts of the diesel engine. Lubricating oil is normally delivered to the engine wearing parts by one or more engine-driven pumps. During the starting cycle the pumps accelerate slowly with the engine and may not supply the required quantity of lubricating oil where needed fast enough. To remedy this condition we require that, as a minimum, an electrically driven lubricating oil pump, powered from a reliable DC power supply, be installed in the lube oil system to operate in parallel with the engine-driven main lube pump. The electric-driven prelube pump should operate only during the engine cranking cycle or until satisfactory lube oil pressure is established in the engine main lube distribution header. The installation of this prelube pump should be coordinated with the respective engine manufacturer. Some diesel engines include a lube oil circulating pump as an intregal part of the lube oil preheating system which is in use while the diesel engine is in the standby mode. In this case, an additional prelube oil pump may not be needed.

Confirm your compliance with our above requirement or provide your justification for not installing an electric prelube oil pump.

040.119
(8.3)
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Preiodic testing and test loading of an emergency diesel generator in a nuclear power plant is a necessary function to demonstrate the operability, capability and availability of the unit upon demand. Periodic testing coupled with good preventive maintenance practices will assure a high level of equipment readiness and availability upon demand.

To achieve an acceptable level of equipment readiness status, the following requirements shall be met:

1. The equipment shall be tested with a minimum loading of 25 percent of rated load. No-load or light-load operation tends to cause incomplete combustion of fuel, resulting in the formation of gum and varnish deposits on the cylinder walls, intake and exhause valves, pistons and piston rings, etc., and accumulation of unburned fuel in the turbocharger and exhaust system. The consequences of no-load or light-load operation are potential equipment failure due to the gum and varnish deposits and fire in the engine exhaust system.

2. Periodic surveillance testing shall be performed in accordance with the Regulatory Guide 1.108 or an acceptable alternative,and with the recommendations of the engine manufacturer. Conflicts between any such recommendations and NRC guidelines, particularly with respect to test frequency, loading and duration, should be identified and justified.

3. Preventive maintenance should go beyond the normal routine adjustments, servicing and repair of components when a malfunction occurs. Preventative maintenance shall encompass investigative testing of components which have a history of repeated manfunctioning and require constant attention and repair. In such cases consideration should be given to replacement of those components with other products which have a record of demonstrated reliability, rather than repetitive repair and maintenance of the existing components. Testing of the unit after adjustments or repairs have been made only confirms that the equipment is operable and does not necessarily mean that the root cause of the problem has been eliminated or alleviated.

4. Upon completion of repairs or maintenance and prior to an actual start, run, and load test, a final equipment check shall be made to assure that all electrical circuits are functional, i.e., fuses are in place, switches and circuit breakers are in their proper position, no loose wires exist, all test leads have been removed, and all valves are in the proper position to permit a manual start of the equipment. The unit shall be satisfactorily started and load tested before being returned to automatic standby service and shall be confirmed to be under the control of the control room operator.

Discuss how the above requirements have been implemented in your emergency diesel generator system design, and how their implementation will be assured when the plant is in commercial operation.

040.120
(8.3)
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The availability of an emergency diesel generator upon demand is dependent upon, among other things, the proper functioning of its controls and monitoring instrumentation. This instrumentation is generally panel mounted and in some instances the panels are mounted directly on the diesel generator skid. Major diesel engine damage has occurred at some operating plants from vibration-induced wear on skid-mounted control and monitoring instrumentation. This sensitive instrumentation is not made to withstand and function accurately for prolonged periods under continuous vibrational stresses normally encountered with internal combustion engines. Operation of sensitive instrumentation under this environment rapidly deteriorates calibration, accuracy and control signal output.

Therefore, except for sensors and other equipment that must be directly mounted on the engine or associated piping, the controls and monitoring instrumentation shall be installed on a free-standing, floor-mounted panel which is separate from the engine skids. This panel shall be located on a vibration-free floor area unless equipped with vibration mounts.

Confirm and describe your compliance with our above requirement, or provide justification for noncompliance in view of these expressed concerns and experiences.