

UNION ELECTRIC COMPANY

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ST. LOUIS, MISSOURI

October 30, 1984

DONALD F. SCHNELL
VICE PRESIDENT

MAILING ADDRESS:
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Mr. Darrell G. Eisenhut
Director, Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Eisenhut:

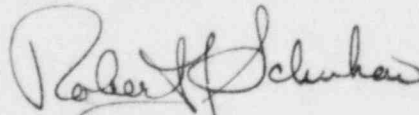
ULNRC- 962

RESPONSE TO GENERIC LETTER 84-15
DIESEL GENERATOR RELIABILITY

Reference: ULNRC-910 dated August 14, 1984

Union Electric Company received NRC Generic letter 84-15, Proposed Staff Actions to Improve and Maintain Diesel Generator Reliability, in July 1984. The Generic Letter requested that licensees furnish information pertaining to diesel generator reliability. Under the provisions of the Generic Letter, the referenced letter provided a commitment to respond by October 31, 1984. In accordance with that commitment the enclosure to this submittal provides the requested information concerning the Callaway program for diesel generator reliability.

Very truly yours,


for Donald F. Schnell

DJW/bjk

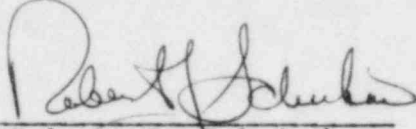
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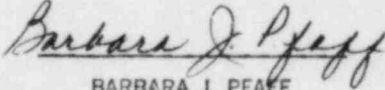
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STATE OF MISSOURI)
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CITY OF ST. LOUIS)

Robert J. Schukai, of lawful age, being first duly sworn upon oath says that he is General Manager-Engineering (Nuclear) for Union Electric Company; that he has read the foregoing document and knows the content thereof; that he has executed the same for and on behalf of said company with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By 
Robert J. Schukai
General Manager-Engineering
Nuclear

SUBSCRIBED and sworn to before me this *31st* day of *October*, 1984.


BARBARA J. PFAFF
NOTARY PUBLIC, STATE OF MISSOURI
MY COMMISSION EXPIRES APRIL 22, 1985
ST. LOUIS COUNTY.

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Response To Generic Letter 84-15

Following a brief overview of the Callaway Diesel Generators and auxiliary systems, specific information is provided to address the three areas of concern described in the Generic Letter.

Overview

The Callaway standby generation system consists of two separate diesel generator trains with each train containing a Colt Industries Colt-Pielstick diesel engine, a starting air system, an intake and exhaust air system, a fuel oil storage and transfer system, a lubricating oil system, a cooling water system, and a generator. The diesel engine is a four stroke, water cooled engine with fourteen cylinders in a "V" configuration. Each cylinder is surrounded by a water jacket to provide cooling during operation and heating during standby periods. During these standby periods, the jacket water cooling system provides electrically heated water that is maintained at a specified temperature. An air starting system is provided for each diesel engine to allow starting the engine without an external power source. This system has the capability of starting the engine ten times without being recharged and contains components to filter, cool, and dry the starting high pressure air. The air intake and exhaust system for each diesel consists of two air intake filters, two intake silencers, two turbochargers, two intercoolers, and one exhaust silencer. Air for combustion is drawn from the room through an automatically actuated damper which opens simultaneously with the diesel engine start. This air, drawn in by the turbocharger compressors and cooled by the intercoolers, is supplied to each cylinder bank under pressure. The exhaust silencer is a multicompartment type suitable for attenuating the diesel engine exhaust noise level to within acceptable limits. Engine exhaust is discharged to the atmosphere well away from the combustion air intake point. Two redundant fuel oil storage and transfer systems each consist of a storage tank, transfer pump, day tank, piping, valves, and controls. Delivery of fuel oil to the diesel engine cylinders is provided by the engine driven fuel oil booster pumps. Excessive fuel in the cylinder heads flows back to the day tank. Storage tank fuel oil supply is maintained to provide for seven days of diesel generator operation at its continuous rating. The day tank is sized to provide one and a half hours of operation at the continuous rating. Each diesel engine is provided with an independent lubrication system consisting of an engine driven gear type pump and an auxiliary ac powered oil circulating keepwarm pump. During engine operation the shaft driven lube oil pump supplies the oil to all surfaces requiring lubrication and to the pistons for cooling. When the engine is in standby, the electrically driven prelube keepwarm pump continuously circulates oil to major engine components. This lube oil is electrically heated and maintained at a specified temperature to keep the

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engine warm during the standby periods and to aid starting. In addition, the lube oil system is augmented by the rocker lube oil system. In order to protect the crankcase oil from contamination from cooling water or fuel leaks, the valves and cylinder rockers are lubricated by this separate system. During engine operation an engine driven oil pump provides lube oil to the rockers and valve trains. The system also includes a motor driven prelube pump to ensure a supply of lube oil prior to planned starts. The rocker prelube pump is operated for at least five minutes prior to any planned starts of the diesel engine. Since the keepwarm lube oil pump runs continuously, a "cold start" is considered a start that omits the five minute rocker prelube pump operation. All surveillance or maintenance testing not requiring cold starts, are prefaced by the five minute operation of the rocker prelube pump. The lube oil systems are provided with filters and strainers to maintain oil purity. Radiant heat generated by the diesel generators is given up to the atmosphere in the diesel generator room and is removed by the ventilation system. Component friction heat is absorbed in the circulating lube oil and then given up to cooling water in lube oil coolers. Heat generated by combustion in the cylinders and miscellaneous components is removed through the cylinder water jackets and through the manifold intercoolers and is given up to cooling water in the intercooler and jacket water heat exchangers. The Essential Service Water System provides the heat sink, in series, for the intercooler heat exchanger, the jacket water heat exchanger, and the lube oil cooler. During normal operation the Service Water system provides the supply through the Essential Service Water piping.

Reduction in Number of Cold Fast Start Surveillance Tests for Diesel Generators

The Callaway diesel generators are not subjected to a significant amount of cold fast starts, nor the excessive amount of testing described in the example given in the generic letter. Procedures controlling the major diesel generator surveillances involve following manufacturer recommendations for maintaining prelube. When the engine is in standby the keepwarm lube oil system and the jacket water system continuously circulate heated oil to areas needing lubrication, and heated water to the cylinder water jackets. The oil temperature is maintained between 120-125 degrees F and the jacket water is maintained at approximately 150 degrees F. Procedurally the cylinder valves and rockers are subjected to a prelube by running the rocker prelube pump five minutes prior to any planned engine starts. "Cold starts" or ambient starts are defined to be those starts where the five minute prelube using the rocker prelube pump is omitted. Callaway Technical Specifications and surveillance procedures require that starts from ambient conditions be performed only once per 184 days in the surveillance tests and

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all other surveillance testing be preceded by an engine prelube period and/or other warmup procedures recommended by the manufacturer.

The diesel generators are also load/unload tested in a manner to minimize the mechanical stress and wear on the engine. Again procedures implementing manufacturer recommendations and the Callaway Technical Specifications provide for warmup prelubrications; limit the frequency of surveillance tests requiring starts from ambient conditions; and specify minimum diesel engine run times to demonstrate operability while loaded or unloaded. Administratively the unloaded engine is run for at least twenty minutes. As required by Technical Specifications, the engine is loaded to >6201 Kw within 60 seconds and must successfully run for sixty minutes. This surveillance test is performed once a month for each diesel while in Modes 1, 2, 3 and 4.

Diesel Generator Reliability Data

The Callaway Plant received its Operating License in June of 1984. Since that time the plant has achieved initial fuel loading, performed zero power testing, achieved initial criticality, essentially completed low power testing, and is starting power level ascension testing. Technical Specification surveillance requirements began at hot shutdown. From the time that Callaway entered hot shutdown in August, surveillance records indicate there have been fourteen valid tests performed. Only one recorded failure occurred in August when the generator breaker for one of the diesel generators failed to close. This failure was described in Special Report 84-02 and was transmitted to the NRC in Union Electric letter ULNRC-922 dated 9/11/84. Attachment 1 to this enclosure provides a copy of Special Report 84-02.

Diesel starts are recorded in the Reactor Operator Log maintained in the control room and in a diesel generator tracking log in the Compliance Department. An Out-of-Service Log is also maintained in the control room and would contain records of diesel generator out of service. All maintenance and repair activities to the diesel generators are recorded and are trackable through the plant Work Requests program. A review of plant Incident Reports and LERS provide the instances of actual demands on the diesel generators.

Diesel Generator Reliability

Compliance with the Callaway Plant Technical Specifications and implementation of the Callaway preventive maintenance program serves as a reliability program by surveillance and maintenance

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of the diesel generators. Through the various logbooks and reviews of surveillance results the data is provided for monitoring diesel generator reliability.

The diesel generator reliability program as described in the Typical Technical Specifications appears to be a step forward in improving diesel generator reliability. Callaway Plant is a Standard Technical Specification plant but has included the limited cold fast start provisions as shown in the Attachment to Enclosure 1 of Generic Letter (GL) 84-15.

A comparison was made of the Callaway Plant Technical Specifications and the Typical Technical Specifications shown in Appendix A to GL 84-15. Comments are as follows:

- (1) Reduction in the number of starts as required by the Action Statements is seen as a positive step to reduce unnecessary wear and tear on the diesels. Current specifications require starting the diesel within 1 hr. and at least once per 8 hrs. thereafter upon the loss of normal A.C. electrical power sources.
- (2) Establishment of outage times based on manufacturer's recommendations as stated in Action b appears to be reasonable but would need further study to establish the time.
- (3) Since the requirements of Reg. Guide 1.108 are extremely prescriptive on what constitutes a valid test, the reduction shown on Table 4.8.1 of Number of Failures in Last 20 (vice 100) Valid Tests is seen as a major improvement in diesel generator preservation.
- (4) Callaway Plant currently meets the intent of the reporting requirements as shown in Attachment 1 to Table 4.8-2 via: a) diesel generator logs required by Reg. Guide 1.108; b) incident reporting system which identifies root cause, immediate corrective action, and action to prevent recurrence; and c) internal evaluation of the recommendations of NUREG/CR-0660 as shown in the following paragraphs.

A review of NUREG/CR-0660 "Enhancement of On-Site Emergency Diesel Generator Reliability" was made. Task IV - Comparative Study Existing Operating and Maintenance Practices versus "Good Practice" was reviewed in particular. Comments in regard to selected items of Task IV are listed below.

- (a) The report recommends that water content in the starting air should be reduced. Callaway starting air systems incorporate dessicant air dryers and equipment operators regularly blow down the air start tanks.

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- (b) The report indicates that the common practice of extended periods of light load and/or no load operation is very detrimental. The Callaway 1 hour full load test is performed once per month in Modes 1, 2, 3 and 4. In Modes 5 and 6, the diesel is run unloaded for at least 20 minutes. Any buildup of incomplete combustion products in the exhaust should be eliminated during this time. In addition, the manufacturer, Colt Industries, has not expressed a serious concern in this regard. Finally, the diesels are four stroke cycle engines which do not build up unburned fuel products in the exhaust system to the extent as other designs.
- (c) The report recommends that prelube of engine be followed in all cases, except emergency. The Callaway diesel generators have built-in keepwarm lube oil systems which maintain the sump oil between 120-125 degrees F. This system maintains a constant flow of heated oil through the main bearings of the engine when it is shutdown. The rocker arm lube oil system is, per procedure, manually started prior to surveillance runs. It then runs for five minutes and shuts off automatically. (Exception to this is one cold start per 184 days required by Technical Specifications.)
- (d) The report recommends a very careful yearly adjustment to factory standards. Callaway diesels are scheduled to receive a thorough inspection and adjustment, as required, at each refueling outage.
- (e) The report recommends avoidance of trying to live with dirt in the contactors and relays. The Callaway Repeating Work Request program addresses cleaning the control panels.

SPECIAL REPORT 84-02
DIESEL GENERATOR VALID FAILURE

On 8/12/84 at 1120 CDT while in mode 4, a valid failure of diesel generator (D/G) A, NE01, occurred while performing surveillance procedure OSP-NE-00002, Standby D/G Periodic Tests. The surveillance was being performed to show the operability of D/G A since it had been out-of-service due to a maintenance outage for NE01, the corresponding 4160 volt Class IE bus. The main feeder breaker, NB-01-11, from D/G A to NB01 failed to close thus constituting a valid failure of D/G A. Valid starts of the diesel generators have been tracked since the completion of Preoperational Testing on 5/11/84. There were three valid tests of D/G A between 5/11/84 and 8/12/84 and this is the first valid failure of either D/G.

Failure of the breaker to close appears to be due to mechanical binding of the manual closing switch. This kept the latch monitoring switch open and prevented charging of the closing spring. The manual closing switch was apparently mechanically bound during an operational relay check completed at 1125 on 8/11/84. During this check the breaker was manually opened. The closing spring was supposed to charge when the breaker was racked-in but because the manual closing switch was bound it failed to do so. Once the closing switch was released and the latch monitoring circuit closed, the closing spring charged automatically and operated normally. The surveillance procedure was then completed satisfactorily at 1417 on 8/12/84. Therefore, the D/G had been inoperable for approximately 27 hours due to the breaker. Because the D/G had been declared inoperable for the NE01 maintenance outage, failure of the breaker did not in and of itself require entry into a Technical Specification Action Statement.

After the closing switch was reset, the breaker functioned automatically with no problem. Therefore, this particular failure is considered an isolated case.

Currently, surveillance tests are performed at least once per 31 days. This is in conformance with the schedule of Regulatory Position C.2.d which requires the test interval to be not more than 31 days if the number of failures in the last 100 valid tests is one or zero.