U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-412/86-04

Docket No. 50-412

License No. CPPR-105

Licensee: Duquesne Light Company
Nuclear Construction Division
P. O. Box 328
Shippingport, PA 15077

Facility Name: Beaver Valley Power Station, Unit 2

Dates: February 1 - 28, 1986

Inspectors: W. M. Troskoski, Senior Resident Inspector
L. J. Prividy, Resident Inspector

Approved by: L. E. Tripp
L. E. Tripp, Chief, Reactor Projects Section 3A

3/7/86
Date

Inspection Summary: Inspection No. 50-412/86-04 on February 1 - 28, 1986.

Areas Inspected: Routine inspections by the resident inspectors (62 hours) of licensee actions on previous inspection findings, preoperational program implementation, emergency diesel generator qualification and proof testing, review of recirculation spray system and quench spray system preoperational tests, and turbine driven auxiliary feed pump test.

Results: No violations or significant safety concerns were identified.

DETAILS

1. Persons Contacted

R. Coupland, Director, Site Quality Control
C. E. Ewing, Manager, Quality Assurance
T. P. Noonan, Station Superintendent
R. J. Swiderski, Startup Manager
D. Williams, Chairman, Joint Test Group

The inspector also met with other licensee and contractor personnel during the course of the inspection.

2. Project Status Summary

Construction activities are currently estimated to be 92.7% complete, with 260 of 450 subsystems turned over for flushing and proof-testing. For software, 49 out of 123 preoperational (PO) and initial startup tests (IST) have been issued. The remainder are in various phases of development.

Approximate dates for the major project milestones, as currently estimated by the licensee are as follows:

--	Reactor Coolant System Cold Hydrostatic Test	March 17, 1986
--	Integrated Hot Functional Test	October 20, 1986
--	Fuel Receipt	September 1, 1986
--	Loss of Power Test	February 2, 1987
--	Integrated Leak Rate Test	February 23, 1987
--	Fuel Load	May 1, 1987
--	Initial Startup	May 16, 1987
--	Commercial Operation	August 30, 1987

Major activities planned for next month include finishing the CVCS and RCS flushes, RCS cold hydrostatic test, shoot peening steam generator tube sheets for stress relief, and initial turnover of the Low Head Safety Injection System. The remaining ESF systems are not scheduled until after the RCS hydro.

3. Licensee Action on Previous Inspection Findings

No open items were reviewed during the course of this inspection.

4. Emergency Diesel Generator Testing

a. Purpose

Vendor qualification test records and construction proof test procedures were reviewed to ensure technical adequacy and consistency with Regulatory requirements, guidance and station commitments. Portions of the proof tests were witnessed to verify that the test was conducted in ac-

cordance with approved procedures, that those procedures were available to personnel conducting the test, and test data was collected and recorded in an approved manner.

b. References

-- BVPS-2 FSAR, Section 8.3, Onsite Power Systems
-- BVPS-2 FSAR, Section 14.2.12.54, 4KV Station Service
- Regulatory Guide 1.9, Selection, Design and Qualification of Diesel Generator Units Used As Onsite Electrical Power Systems at Nuclear Power Plants
-- Regulatory Guide 1.108, Periodic Testing of Diesel Generator Units
-- IEEE Standard 387-1977, Criteria for Diesel Generator Units Applied as Standby Power Supplies
-- IEEE Standard 308-1974, Criteria for Class 1E Power Systems

c. Prototype Qualification Testing

Though the diesel generator units supplied for BVPS-2 were manufactured by Colt Industries, Fairbank-Morse Engine Division, and are similar to those previously qualified by Alabama Power Company, qualification by similarity was not pursued. Verification of suitability of the diesel generator units was made by testing to meet the requirements for engine qualification and load acceptance tests of IEEE Standard 387-1977 and Regulatory Guide 1.108. The inspector reviewed the engineering report dated July 26, 1978 by Colt Industries detailing the 300 start and load acceptance qualification tests on the second diesel generator (S/N 206147B) conducted during June, 1978. Of those, 270 starts were performed from warm standby temperature with one failure and 30 starts were from normal equilibrium temperatures with no failures. The failed component was a rocker arm mechanism of cylinder number 1 (during start number 147). After the immediate start, a single step load of greater than 50% of the generator nameplate (4662 kW) continuous kW rating was applied, with frequency recovery to 98% within four seconds with voltage remaining essentially the same for each test. The diesel accepted loads within 7 to 8 seconds. When loaded in accordance with the loading sequence, voltage was not less than 75% of nominal and frequency was not less than 95% nominal for motor loads up to 1670 HP. The largest motor currently on the diesel generator loading sequence at Beaver Valley, is 1250 HP.

To insure load carrying capability, tests verified that the temperature of jacket coolant out of the engine after obtaining equilibrium did not exceed 152.7 F, the temperature of the lube oil out of the engine did not exceed 160 F and the temperature rise of jacket water through the engine did not exceed 15 F.

Overspeed tests are required to verify that the protective trip function prevents an engine speed from exceeding 576 rpm. The 115% load test requires the diesel generator to carry 6784 bhp without exceeding equilibrium temperature of 160 F lube oil and 152.7 F jacket water. These tests will be rerun on site as part of the preoperational test program.

Motor starting tests were conducted to verify the diesel generator is capable of accepting the resistive and motor loads without experiencing instability resulting from generator voltage collapse or significant evidence of a failure of the voltage to recover and to demonstrate that there is sufficient torque available to prevent engine stall and to permit engine speed to recover. By using the 1670 HP motor which is greater than the largest single step load of 1250 HP, the margin test represents a 35% margin above the most severe single step load within the design sequence. This meets the requirements of IEEE Standard 387-1977, (6.3.3) which requires only a 10% load test margin.

Based on the above, the inspector concluded that the BV-2 diesel generators meet the qualification requirements.

d. Test Conduct - Construction Proof Testing

During February 19 - 21, and 24 - 28, 1986, the inspector observed the No. 1 diesel generator test run under Construction Proof Test 2T-NNS-36B-2.23, Initial Loading of Emergency Diesel Generator. This test starts the EDG and brings it up to rated speed on mechanical governor, verifies generator parameters after the generator field is flashed, places the electrical governor in service, synchronizes the EDG to the bus with the output breaker closed, performs a cut-in verification of the protective relays with power at a minimum, and loads the generator in stages monitoring various parameters. Throughout the test, administrative controls for test conduct to assure personnel and equipment safety were implemented.

The proof test identified several instances where instrument wires were crossed. Examples include the governor, control room meters and breaker CTs. Discussions with test engineers indicated that in each case, the wires were installed per the installation drawing, which was in error. Engineering and Design Coordination Reports were issued to correct the field wiring and drawing, and QC was present to verify the work. Test program procedures for correcting installation errors appear to be effectively implemented.

During a load test on February 28, 1986, the diesel momentarily oversped to 110%. After dropping back, test personnel noted an imbalance as the Number 5 cylinder fuel injector pump failed full open. The test was terminated and the pump was replaced with a spare. Discussions with the vendor's representative indicated that this type of failure was not expected to result in exceeding the 1200 F rated cylinder temperature as the excess fuel is not burnt. Determination of the fuel injector pump's failure cause is IFI (85-04-01).

e. Preventive Maintenance, Surveillance and Test Programs for the EDG

The inspector discussed preventive maintenance plans for the EDG with the Maintenance Supervisor. The 18-month frequency electrical and mechanical procedures have already been developed in the Maintenance Surveillance Procedure (MSP) format that is successfully used at Unit 1. The inspector noted that these 18-month MSPs did not appear to be sufficient to support all vendor recommended inspection and testing at extended frequencies (usually 3, 6, and 9 year intervals, plus specific items dependent on the amount of hours on the engine). This concern is similar to Unresolved Item 334/85-22-06, that BV-1 is working on so that the EDG procedures comply with vendor recommendations to ensure a high degree of reliability. The Maintenance Supervisor stated that the BV-2 EDG procedures would also receive such a review. This will be tracked as Unresolved Item (86-04-02).

Discussions with the Operations Supervisor indicated that temporary logs were being developed as turnover progressed on plant systems. The draft logs for the final as-built EDG have been developed, but are still unapproved.

Operational surveillance tests are under development. However, the BV-2 Technical Specification review by NRR has just begun, and final approval is not expected for some time. As the Technical Specifications contain the approved surveillance test acceptance criteria, the final OST issue cannot yet be made.

f. Potentially Generic Problems Experienced at other Facilities.

(1) Colt submitted a 10 CFR Part 21 Report dated February 4, 1986, concerning the EDG model used at BV-2. The vendor determined that the diesel generator air start system which actuates the governor rack boost is not vented from the rack boost promptly after the start signal termination, causing it to fight the governor and create a potential overspeed condition. The inspector discussed this with the vendor's representative and the Senior Test Engineer. Though they were aware of the problem, the station has not yet made its engineering evaluation. This is Unresolved Item (86-04-03).

(2) A generator was severely damaged at another facility when its outboard metal screen inspection plate was sucked into it during a monthly surveillance test. Discussions with the vendor's representative at BV-2 and communications with the vendor's representative at that facility indicated that the generator screen design was different between the two units, and the metal screen had not been properly reinstalled at that facility. However, the inspector noted that many of the bolts that hold sections of the Unit 2 generator screen in place had been stripped and were missing, resulting in vibration when the diesel is running. Followup to insure that these bolts are replaced in a timely manner and are of a correct size, is IFI (86-04-04).

(3) Some nuts which are used to hold the diesel generator engine connecting rod and rod bearing caps in place were reported to be manufactured incorrectly at another facility. These nuts have faces which are not perpendicular to the thread pitch line. The result is that the fitup to the mating surface (the connecting rod cap), is not parallel, and could result in stress in excess of design. Though these specific nuts were received after April 9, 1984, and were not part of the initial engine installation, a review to determine whether or not they are site spare parts is Inspector Follow Item (86-04-05).

(4) PNO-I-86-19 provided information on a Fairbanks Morse EDG aluminum scavenging air blower failure that occurred after 51 hours of continuous operation at low-load. Though the BV-2 EDGs are 12 cylinder, 45 degree V engines, that do not use a scavenging air blower, discussions with the vendor's representative indicated that there are definite limits for running at no-load or low-load conditions; the EDG should be run at one-half load for one hour of every 24 hours at low-load. Through discussions with test personnel and observation of ongoing proof tests, the inspector verified that this practice was being implemented. Most of the testing to date has consisted of loading the EDG to specified load plateaus while measuring various parameters. The inspector had no further concerns.

g. EDG Preoperational (PO) Test Development

Of the four POs referenced in Section 14.2 of the FSAR, one was scheduled for review by the JTG on February 25, 1986. The other three are undergoing the second draft review by the A-E. The first of these POs is not scheduled until about one month after the RCS cold hydrostatic test.

5. Preoperational Test Procedure Review - Recirculation Spray System and Quench Spray System

Purpose

The Containment Depressurization System is an engineered safety feature (ESF) consisting of the Quench Spray System, Chemical Addition Subsystem and Recirculation Spray System. BV-2 has developed five preoperational tests (PO) that have been reviewed and approved by the JTG. The inspector reviewed PO-2.13.01, Recirculation Spray System Pumps, and PO-213-02, Quench Spray System Pumps, to verify technical adequacy and ensure consistency with Regulatory requirements, guidance and licensee commitments.

References

FSAR Section 14.12.15.1, RSS Pumps and Control Tests
FSAR Section 14.12.15.2, Quench Spray Pumps and Control Tests
FSAR Section 6, ESF

Findings

The inspector determined that PO-2.13.01 provided an adequate test of the alarm and annunciation system, measured pump operating parameters (discharge pressure flow rate), verified auto-start and control logic (CIB) and measured valve stroke times. The acceptance criteria were as specified in Test Specification 2-TSP-CSS-13A.A. The inspector noted that the RSS startup delay time was specified as 628 seconds as opposed to the 215 second value recorded in the Unit 2 Operating Manual Chapter and used by Unit 1. In discussing this with the cognizant test engineer, the inspector was informed that this item was recalculated to provide the RSS pump performance curve with an improved net positive suction head. Additionally, the information was updated in Amendment No. 5 dated February, 1985.

As part of the containment sump hydraulic study, the A-E noted that during the main steam line break, adequate water level could not be assured and operator action would be required to stop the RSS pump before damage occurs. These actions would have to include a reset of the CIB and manual stopping of the pumps. Consequently, the emergency operating procedures would have to contain the necessary steps. The inspector discussed this item with the EOP Procedure writer and verified that this information had been channeled to him. The inspector was informed that the BV Unit 2 EOPs were developed from the Westinghouse Owner's Group and modified for the plant specific items. The first issue is due during the week of March 3, 1986, with the first tabletop validation scheduled for April, 1986.

RSS test specifications were consistent with the assumptions in the various FSAR sections. The inspector determined that this preoperational test would adequately demonstrate the recirculation spray system pump operability and control logic assumed in the safety analysis.

Review of PO-2.13.02 likewise verified that the various operating characteristics and control logic were tested as specified in the FSAR. However, the inspector noted that the specific test specifications for this system had not yet been specified in the reference section (IX) of the test. Additionally, some parameters such as the pump low flow alarm setpoint and low flow alarm delay have not yet been provided. Therefore, further review of the test specifications and the test procedure acceptance criteria is Inspector Follow Item (86-04-06).

6. Turbine Driven Auxiliary Feed Pump Test

The possibility of a water hammer developing in the steam piping to the auxiliary feed pump turbine due primarily to the long run of the 3" piping from the Main Steam and Cable Vault Areas to the basement of the Safeguards Building was initially identified in Inspection Report 412/85-26. The inspector subsequently learned that the water hammer should not be a problem since drip pots were included in the 3" main steam piping to collect and discharge condensate that may form. The inspector was advised that detailed operating procedures had not yet been developed concerning the operation and alignment of these drip pots.

Discussions with Testing personnel responsible for preparing test procedure PO-2.24B.02, Turbine Driven Auxiliary Feed Pump, indicated that the test currently had no provisions for monitoring the piping for water hammer during the test. The inspector noted that such monitoring should be provided to enable proper evaluation of the performance of the drip pots in the 3" main steam line. Test personnel acknowledged that concern and committed to carry it as an open item on the SUG Software Deficiency Tracking Report, to be reviewed by the JTG prior to test issuance. This is Inspector Follow Item (86-04-07).

7. Exit Interview

A meeting was held with senior DLC startup testing personnel on March 3, 1986, to discuss the inspection scope and findings.