

U.S. NUCLEAR REGULATORY COMMISSION  
REGION I

Report Nos. 50-334/89-20  
50-412/89-19

Docket Nos. 50-334  
50-412

License Nos. DPR-66  
NPF-73

Licensee: Duquesne Light Company  
P.O. Box 4  
Shippingport, Pennsylvania 15077

Facility Name: Beaver Valley Power Station, Units 1&2

Inspection At: Shippingport, Pennsylvania

Inspection Conducted: September 25-29, 1989

Inspectors: Jm Trapp 10/31/89  
J. M. Trapp, Sr. Reactor Engineer, Special  
Test Programs Section, EB, DRS Date

Art E Lopez 10/30/89  
A. E. Lopez, Reactor Engineer, Special Test  
Programs Section, EB, DRS Date

Approved by: P.K. Eapen 11/1/89  
Dr. P.K. Eapen, Chief, Special Test  
Programs Section, EB, DRS Date

Inspection Summary: Routine Unannounced Inspection on September 25-29, 1989  
(Combined Inspection Report Nos. 50-334/89-20, and 50-412/89-19)

Areas Inspected: Licensee actions in response to the "Expeditious Enhancements" described in Generic Letter No. 88-17, "Loss of Decay Heat Removal," including supporting instrumentation, training, procedures and staff awareness as related to mid-loop operation.

Results: The licensee is prepared to implement all "Expeditious Enhancements" described in Generic Letter No. 88-17, except Unit 1 RCS water level instrumentation, if the RCS is drained to a mid-loop condition. Procedures for installation and calibration of RCS level instrumentation were not in place for use during Unit 1 mid-loop operation. This item remains unresolved (Unresolved item 50-334/89-20-01) pending licensee's establishment of installation and calibration procedures.

## DETAILS

### 1.0 Persons Contacted

#### 1.1 Duquesne Light Company

- \* T. Burns, Operations Training Director
- \* J. Crockett, General Manager Corporate Nuclear Services
- \* R. Hecht, Site I&C Director
- \* J. Keegan, Engineer
- \* W. Lacey, General Manager Nuclear Operations Services
- \* S. Leung, Engineer II
- \* S. Nass, Supervising Engineer
- F. Shafner, Acting Engineering Supervisor
- \* J. Vasselo, Licensing Director

#### 1.2 U.S. Nuclear Regulatory Commission

- \* J. Beall, Sr. Resident Inspector
- \* J. Durr, Chief, EB, DRS
- \* P. Wilson, Resident Inspector

\* Denotes presence at exit meeting held on September 29, 1989.

### 2.0 Review of Licensee Actions in Response to Generic Letter (GL) No. 88-17, Loss of Decay Heat Removal (TI 2515/101)

Loss of decay heat removal (DHR) during non-power operation and the consequences of such a loss have been of increasing concern to the NRC. Many events of loss of DHR have occurred while the reactor coolant system has been drained down for mid-loop activities such as steam generator inspection or repair of reactor coolant pumps. The possibility exists that two fission product barriers could be breached while these activities are in progress, since the reactor coolant system and containment may both be open.

GL 87-12, "Loss of Residual Heat Removal (RHR) while the Reactor Coolant System (RCS) is partially filled" was issued to all licensees of operating PWR's and holders of construction permits on July 9, 1987. Responses indicated that the licensee did not fully understand the identified problems, and problems continued as evidenced by events at Waterford on May 12, 1988 and Sequoyah on May 23, 1988.

The seriousness and continuation of this problem has resulted in the issuance of GL 88-17. In addition, the Director of NRR has written to the CEO of each licensee operating a PWR, in which he states, "We consider this issue to be of high priority and request that you assure that your organization addresses it accordingly." He also wrote to each licensed operator at all PWR plants on "Operator Diligence while in Shutdown Conditions," and enclosed a copy of Generic Letter 88-17.

GL88-17 requested the recipients to respond with two plans of actions:

- a. A short-term program entitled "Expeditious Actions," and
- b. A long-term program entitled "Program Enhancements."

This inspection addressed the short-term licensee actions as outlined under "Expeditious Actions," of GL 88-17.

The inspectors reviewed the licensee response to Generic Letter No. 88-17, dated January 13, 1989 in conjunction with comments made by the NRR staff, dated April 11, 1989, "Response To Generic Letter 88-17 On Loss Of Decay Heat Removal With Respect To Expeditious Actions." The licensee's response provided a description of actions taken to address the eight recommended expeditious actions identified in the Generic Letter.

The inspectors were advised that the licensee has not entered a mid-loop condition since the issuance of GL 88-17 and will not enter a mid-loop condition during it's present Unit No.1 Refueling Outage.

#### 2.1 Temperature Indication

The inspectors verified that for mid-loop conditions, the licensee has taken adequate administrative and procedural steps to provide two independent, periodically recorded core exit temperature indicators that are representative of the core exit temperature conditions. The licensee monitors the core exit temperature using fifty thermocouples for Unit 1 and fifty-one for Unit 2. Procedure 1.6.4, initial condition, step 15, for Unit 1 and Procedure 2.6.4, initial condition, step 14, for Unit 2 respectively, require trending a minimum of two thermocouples at a 10 minute interval on the trend recorder. OST 1.6.11, step 11, for Unit 1 and OST 2.6.11, step 10, for unit 2 respectively, require two core exit thermocouple indications be available prior to entering mid-loop condition. The core exit thermocouples are not presently alarmed and indication is not available when the reactor head is removed from the reactor vessel. Control room operators record the core exit thermocouple readings twice per shift on operator log sheets 1.54.3 and 2.54.3 for unit No. 1 and 2, respectively. The inspectors found the temperature indication available for Mid-Loop operation to be consistent with the expeditious actions of Generic Letter 88-17.

#### 2.2 RCS Water Level

Unit 1: The licensee stated in their response to Generic Letter No. 88-17 that they had two independent continuous RCS water level indications in the control room. However at the time of this inspection, procedures for the installation and calibration of level instruments were not in place. The licensee stated that the procedures for installation and calibration of the level instruments will be established prior to conducting mid-loop operations. This item remains unresolved pending licensee establishment of the above installation and calibration procedures (Unresolved item 50-334/89-20-01).

Unit 2: The inspectors verified that the licensee has two continuous RCS water level indications. They consist of one sight glass (LG-101) and one wide range level transmitter (LT-102) which provides continuous recorded level indication in the control room.

The level transmitter which provides indication in the control room is checked by an operator twice a shift and has a range of 0 to 180 inches ( Note: Bottom of hot leg pipe is zero inches and hot leg diameter is 29 inches). The licensee recognizes that the range of this instrument and the use of a common tap for both level indication instruments is less than ideal. Therefore, the licensee monitors and logs the site glass indicated RCS level every 15 minutes during mid-loop conditions.

The sight glass is permanently installed and monitored in containment. Operating Log L5-47, "Operating With The RCS At Reduced Inventory - Operating Mode - 5 & 6," step 105++ states, "If level is less than 57", then establish a temporary log and record local level every 15 minutes. Immediately report to the control room if significant level changes occur (0.5 to 1 inch)." (Note: 57 inches is 28 inches above the top of the hot leg pipe)

Both level indicators share a common penetration which is located at the bottom of a hot leg pipe. As such, these level instruments are not independent. Also, procedures requiring periodic draining or flushing to detect blockage of the common penetration, as recommended in the GL, were not available. However, the generic letter states that when two independent level indications are not practical in the short term, a single indication will be acceptable. Therefore, the licensee's Unit 2 instrumentation is consistent with the short term actions of Generic Letter No. 88-17. The licensee has committed in a letter, dated February 23, 1989, to provide two independent RCS level indications in response to the actions required under GL 88-17 programmed enhancements.

The inspectors found that Procedure OM 2.10.4D (Unit 2), step 5 allows the RCS to drain to a level of 13 inches, which is the RHR pump cavitation limit according to Procedure OM 2.10.5, Figure No. 10-10, "Hot Leg Water Level-Vs.-RHS Flow Rate" curve. The inspectors identified this problem and brought it to the attention of the licensee. The licensee took action by writing a "Operating Manual Deficiency Report" to revise this procedure prior to mid-loop operation.

### 2.3 RCS Inventory Addition

The inspectors verified that the licensee has procedures and administrative controls to provide at least two available or operable means of adding inventory to the RCS, in addition to pumps that are a part of the normal DHR system. One Charging/High Head Safety Injection (HHSI) pump and one Low Head Safety Injection (LHSI) pump are the two available sources of RCS inventory addition, during the mid-loop operation.

The initial conditions of Procedures 1.6.4 and 2.6.4 for units No. 1 and 2 respectively, "Draining The RCS To Reduced Inventory of mid-loop Condition", require satisfactory completion of Operation Surveillance Test (OST) 1.6.11 (Unit 1), and 2.6.11 (Unit 2). OSTs 1.6.11 (Unit 1), and 2.6.11 (Unit 2),

Step 3 verifies one Charging/HHSI pump is operable. OSTs 1.6.11 (Unit 1), and 2.6.11 (Unit 2), Steps 5 thru 7 verifies a flow path from the RWST via the charging pump to both the hot and cold legs has been established. Nuclear Shift Supervisor Operational Clearance Tags (NSS OCT) are placed on the required valves and charging pump controls to provide administrative control to assure an established flow path remains available.

OSTs 1.6.11 (Unit 1), and 2.6.11 (Unit 2), Step 4 verifies that an LHSI pump is available to add inventory to the RCS. Methods for controlling flow paths to the hot and cold legs are similar to that described above for the Charging/HHSI pump.

Abnormal Operating Procedures (AOP) 1.10.2 (Unit 1, currently in draft form) and 2.10.2 (Unit 2), "Loss of RHR While At mid-loop Conditions," provides guidance on re-establishing DHR following the loss or cavitation of the RHR pumps while at mid-loop conditions. The AOP uses the equipment and flow paths established in OSTs 1.6.11 (Unit 1), and 2.6.11 (Unit 2) to increase RCS inventory.

The inspectors independently verified the makeup capability of the HHSI and the LHSI pumps was adequate to re-establish RCS level following the loss of DHR. Calculations indicate the boil off rate 20 HRS after Reactor Shutdown is approximately 130 gal/min. The nominal flow rate, of the Charging/HHSI and LHSI pumps are 550 GPM and 3000 GPM, respectively. These flow rates exceed the boil off rate at mid-loop RCS pressures. Therefore, the licensee has sufficient make-up capability to increase RCS level during a boil off condition. The Engineering Analysis and Assurance Group provided technically sound and thorough analysis to the Procedures Group on mid-loop operating concerns. However it appears that the engineers did not conduct follow-up reviews to assure the analysis was correctly interpreted and incorporated into the mid-loop operating procedures.

#### 2.4 RCS Perturbations

The inspectors verified that the licensee has implemented procedures and administrative controls to preclude operations that would lead to perturbations in the RCS. Procedures OM 1.6.4AP (Unit 1), 2.6.4V (Unit 2), "Reduced RCS Inventory Operation Checklist" establish administrative controls for all personnel involved in requesting, implementing, reviewing, working or authorizing activities that may affect or perturb the RCS water level while the RCS is operating at reduced inventory/mid-loop condition. These procedures provide a list of boundary valves between the RCS, RHR, and CVCS that, if opened, may cause a perturbation of RCS level. This procedure also provides a list of procedures from various station groups, whose operation may perturb the RCS level. The Nuclear Control Operator and the Senior Reactor Operator are responsible for completing this procedure prior to entering reduced inventory or mid-loop condition and when reviewing and preparing Valve/Switching Procedure forms. The procedures and administrative controls established were found to be consistent with the expeditious actions described in Generic Letter No. 88-17.

## 2.5 Nozzle Dams

Nozzle Dams are not part of the Beaver Valley Unit No. 1 or 2 system design.

## 2.6 Loop Stop Valves

The inspectors verified that the licensee has implemented procedures and administrative controls that assure all hot legs are not blocked simultaneously by the loop stop valves. The licensee requires in procedure OST 1.6.11, step 9 m and n for Unit 1, and OST 2.6.11, step 9d for Unit 2, to verify that all hot leg and cold leg loop stop valves are open. The cold leg loop stop valves have an interlock preventing them from opening until the hot leg stop valve in the loop is open. The licensee has also tagged all of the loop stop valves with Nuclear Shift Supervisor Operational Clearance tags to assure that these valves remain open during mid-loop level conditions. The inspectors concluded that the licensee's controls of the loop stop valves during mid-loop operation are consistent with the expeditious actions guidelines of generic letter 88-17.

## 2.7 Containment Closure

The inspectors verified that the licensee has prepared procedures and administrative controls to assure containment closure prior to core uncover during a loss of DHR event. Initial Conditions of procedures 1.6.4 and 2.6.4 for unit 1 and 2, respectively, "Reduced Inventory/Mid-loop Operation Checklist," require Operation Surveillance Test (OST) 1.6.11 and 2.6.11 unit 1 and 2, respectively, be performed prior to reducing RCS level to the mid-loop condition. OSTs 1.6.11 (Unit 1), and 2.6.11 (Unit 2), Step 1, require OSTs 1.47.3 (Unit 1) and 2.47.3 (Unit 2), to be completed. OST 1.47.3 (Unit 1) and 2.47.3 (Unit 2) "Containment Integrity Checklist for Refueling - Acceptance Criteria," establishes refueling integrity prior to reducing RCS inventory. Refueling integrity requires, in part, that the equipment door be closed and held in place by a minimum of four bolts, one airlock door be closed, and each penetration providing direct access from containment atmosphere to the outside atmosphere be isolated and the containment purge valves be capable of isolating. OSTs 1.47.3 (Unit 1) and 2.47.3 (Unit 2) require a visual inspection be performed to verify that gaps between the sealing surface of the equipment access hatch do not exist, to assure adequate sealing of the equipment hatch. Nuclear Shift Supervisor (NSS) tags are used for administrative control to prevent inadvertent opening of penetrations closed to establish refueling integrity.

The licensee stated in their response to the "Expeditious Actions" of generic letter 88-17, that additional procedure development will be pursued, when necessary, if the containment needs to be open while in a reduced inventory condition. The inspectors found the licensee's action taken to assure containment closure during mid-loop operation to be consistent with the expeditious actions of generic letter 88-17.

## 2.8 Training

The inspectors verified that training conducted by the licensee made the station personnel aware of the risks associated with operation in a reduced inventory/mid-loop condition. The training material and lesson plans reviewed by the inspectors contained all the material committed to be part of training in the licensee response to Generic Letter No. 88-17. The personnel to be included in the formal training courses are: Licensed Operators, Non-Licensed personnel, I&C and Mechanical Maintenance personnel, and Chemistry and Radiation Control personnel. Outage schedules will include a daily meeting review of the concerns of Generic Letter No. 88-17. For short notice draindowns of the RCS, a self study guide will be available to all concerned personnel. The inspectors found that the personnel, and the non-licensed personnel in particular, involved in mid-loop operation were well trained and knowledgeable. The inspectors concluded that the training program and its implementation were consistent with the expeditious actions of Generic Letter 88-17.

## 2.9 QA Involvement

The QA organization did not participate in the licensee's actions taken in response to Generic Letter No. 88-17. This can be attributed to the licensee not having entered a mid-loop level operation since Generic Letter 88-17 was issued.

## 3.0 Summary/Conclusions

The inspectors found that the licensee has satisfactorily implemented the commitments made in it's response to Generic Letter 88-17.

The inspectors observed the following strengths as related to the licensee response to the expeditious actions for mid-loop operations:

- The formal training of non-licensed station personnel on the hazards associated with mid-loop operation were comprehensive.
- The licensee's procedures which maintain refueling integrity during mid-loop conditions are conservative and provide an intact second barrier during mid-loop operation.
- Procedures and practices to prevent RCS level perturbations during mid-loop conditions were detailed and they provided adequate control to prevent RCS perturbations.

The inspectors observed the weaknesses in the following areas:

- Operating procedures for Unit 2 required maintaining RCS levels during mid-loop operation which were at the cavitation limit for the RHR pumps, and did not include margin for level instrumentation inaccuracy. This issue was corrected by the licensee when identified by the inspectors.

- The present level instrumentation for unit 2 meets the intent of the Generic Letter for the short term only. An upgrade of the present equipment is required for accurate control room level indication for mid-loop RCS level conditions.
- Procedures for installation and calibration of unit 1 level instrumentation were not in place. This item remains unresolved pending establishment of installation and calibration procedures.

#### 4.0 Exit Meeting

At the conclusion of the site inspection, on September 29, 1989, an exit interview was conducted with the licensee's senior site representatives (denoted in Section 1) to discuss the results and conclusions of this inspection.

At no time during this inspection was written material provided to the licensee by the inspector. The licensee representatives did not indicate that this inspection involved information subject to 10 CFR 2.790 restrictions.