Duquesne Light Company
Beaver Valley Power Station
P.O. Box 4
Shippingport, PA 15077-0004

JOHN D. SIEBER
Vice President - Nuclear Group

(412) 643-5255

January 29, 1990

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

Reference: Beaver Valley Power Station, Unit No. 1 and No. 2
BV-1 Docket No. 50-334, License No. DPR-66
BV-2 Docket No. 50-412, License No. NPF-73
Response to Generic Letter 89-13, Service Water System Problems Affecting Safety-Related Equipment

Gentlemen:

Attached is our response to the Recommended Actions as requested by Generic Letter 89-13; Service Water System Problems Affecting Safety-Related Equipment.

Please note that this submittal provides information addressing both Beaver Valley Unit 1 and Unit 2.

If you have any questions regarding this response, please contact my office.

Very truly yours,

J. D. Sieber
Vice President
Nuclear Group

cc: Mr. J. Beall, Sr. Resident Inspector
Mr. W. T. Russell, NRC Region I Administrator
Mr. P. Tam, Sr. Project Manager
Mr. R. Saunders (VEPCO)

1/1

A065

ATTACHMENT

Response to Generic Letter 89-13
Service Water System Problems Affecting Safety-Related Equipment

Recommended Action To Be Taken by Addressees:

The NRC requests that licensees and applicants perform the following or equally effective actions to ensure that their service water systems are in compliance and will be maintained in compliance with 10 CFR Part 50, Appendix A, General Design Criteria 44, 45, and 46 and Appendix B, Section XI. If a licensee or applicant chooses a course of action different from the recommendations below, the licensee or applicant should document and retain in appropriate plant records a justification that the heat removal requirements of the service water system are satisfied by use of the alternative program.

Response:

The Beaver Valley Power Station Unit 1 and 2 service water systems are in compliance and will be maintained in compliance with 10 CFR 50, Appendix A, General Design Criteria 44, 45 and 46 and Appendix B, Section XI as discussed in the BVPS Unit 1 and 2 Final Safety Analysis Reports and associated Safety Evaluation Reports issued by the NRC. Assurance that the service water systems meet the minimum requirements of the above is provided in the responses to the following recommendations.

Action I.

For open-cycle service water systems, implement and maintain an ongoing program of surveillance and control techniques to significantly reduce the incidence of flow blockage problems as a result of biofouling. A program acceptable to the NRC is described in "Recommended Program to Resolve Generic Issue 51" (Enclosure 1). It should be noted that Enclosure 1 is provided as guidance for an acceptable program. An equally effective program to preclude biofouling would also be acceptable. Initial activities should be completed before plant startup following the first refueling outage beginning 9 months or more after the date of this letter. All activities should be documented and all relevant documentation should be retained in appropriate plant records.

ENCLOSURE 1

Recommended Program to Resolve Generic Issue 51

This enclosure describes a program acceptable to the NRC for meeting the objectives of the requested Action I in the proposed generic letter. Both Action I and this enclosure are based upon the recommendations described in "Technical Findings Document for Generic Issue 51: Improving the Reliability of Open-Cycle Service-Water Systems," NUREG/CR-5210, August 1988, and "Value/Impact Analysis for Generic Issue 51: Improving the Reliability of Open-Cycle Service-Water Systems," NUREG/CR-5234, February 1989. The NRC has concluded that Generic Issue 51 will be resolved when licensees and applicants implement either the recommended surveillance and control program addressed in this enclosure or an equally effective alternative course of action to satisfy the heat removal requirements of the service water system.

Water Source Type	Surveillance Techniques	Control Techniques
Marine or Estuarine (brackish) or Freshwater with clams	A	B and C
Freshwater without clams	A and D	B and C

Response

Beaver Valley Power Station has a freshwater (river) source and has identified clams as being in the water source. Therefore, Surveillance Technique A and Control Techniques B and C are addressed as follows:

Surveillance Technique A:

The intake structure should be visually inspected, once per refueling cycle, for macroscopic biological fouling organisms (for example, blue mussels at marine plants, American oysters at estuarine plants, and Asiatic clams at freshwater plants), sediment, and corrosion. Inspections should be performed either by scuba divers or by dewatering the intake structure or by other comparable methods. Any fouling accumulations should be removed.

Response A:

The intake structure is inspected twice per year (spring and fall) for Asiatic clams and sediment. Inspections are performed either by divers, or by dewatering. Fouling accumulations (clams, sediment) are removed.

Control Technique B:

The service water system should be continuously (for example, during spawning) chlorinated (or equally effectively treated with another biocide) whenever the potential for a macroscopic biological fouling species exists (for example, blue mussels at marine plants, American oysters at estuarine plants, and Asiatic clams at freshwater plants). Chlorination or equally effective treatment is included for freshwater plants without clams because it can help prevent microbiologically influenced corrosion. However, the chlorination (or equally effective) treatment need not be as stringent for plants where the potential for macroscopic biological fouling species does not exist compared to those plants where it does. Precautions should be taken to obey Federal, State, and local environmental regulations regarding the use of biocides.

Response B:

The service water system is presently chlorinated 2 hours per day in compliance with the BVPS NPDES Permit. At the present time, this program is considered an equally effective treatment to continuous chlorination. However, the program is being monitored and, if required, appropriate changes will be made to assure that the performance of the service water system will not be reduced.

Control Technique C:

Redundant and infrequently used cooling loops should be flushed and flow tested periodically at the maximum design flow to ensure that they are not fouled or clogged. Other components in the service water system should be tested on a regular schedule to ensure that they are not fouled or clogged. Service water cooling loops should be filled with chlorinated or equivalently treated water before layup. Systems that use raw service water as a source, such as some fire protection systems, should also be chlorinated or equally effectively treated before layup to help prevent microbiologically influenced corrosion. Precautions should be taken to obey Federal, State, and local environmental regulations regarding the use of biocides.

Response C :

Redundant and infrequently used cooling loops are presently flushed and flow tested periodically at the design flow rate. Procedures will be revised and testing scheduled on a regular basis to ensure that the other components in the service water system are not fouled or clogged. Service water cooling loops will either be drained (dry-layup) or treated with chlorine or equivalently treated water before layup (wet-layup). The BVPS Fire Protection System (FPS) uses raw service water as a source. We are evaluating the addition of chlorine or equally effectively treated water before layup. This evaluation will consider the materials compatibility of the biocide, effects on equipment protected by water suppression systems and NPDES restrictions.

The above activities described in the responses to Action I will be completed before plant startup following the next refueling outage for each unit. All activities will be documented and all relevant documentation will be retained in appropriate plant records.

Action II

Conduct a test program to verify the heat transfer capability of all safety-related heat exchangers cooled by service water. The total test program should consist of an initial test program and a periodic retest program. Both the initial test program and the periodic retest program should include heat exchangers connected to or cooled by one or more open-cycle systems as defined above. Operating experience and studies indicate that closed-cycle service water systems, such as component cooling water systems, have the potential for significant fouling as a consequence of aging-related in-leakage and erosion or corrosion. The need for testing of closed-cycle system heat exchangers has not been considered necessary because of the assumed high quality of existing chemistry control programs. If the adequacy of these chemistry control programs cannot be confirmed over the total operating history of the plant or if during the conduct of the total testing program any unexplained downward trend in heat exchanger performance is identified that cannot be remedied by maintenance of an open-cycle system, it may be necessary to selectively extend the test program and the routine inspection and maintenance program addressed in Action III, below, to the attached closed-cycle systems.

A program acceptable to the NRC for heat exchanger testing is described in "Program for Testing Heat Transfer Capability" (Enclosure 2). It should be noted that Enclosure 2 is provided as guidance for an acceptable program. An equally effective program to ensure satisfaction of the heat removal requirements of the service water system would also be acceptable.

Testing should be done with necessary and sufficient instrumentation, though the instrumentation need not be permanently installed. The relevant temperatures should be verified to be within design limits. If similar or equivalent tests have not been performed during the past year, the initial tests should be completed before plant startup following the first refueling outage beginning 9 months or more after the date of this letter.

As a part of the initial test program, a licensee or applicant may decide to take corrective action before testing. Tests should be performed for the heat exchangers after the corrective actions are taken to establish baseline data for future monitoring of heat exchanger performance. In the periodic retest program, a licensee or applicant should determine after three tests the best frequency for testing to provide assurance that the equipment will perform the intended safety functions during the intervals between tests. Therefore, in the periodic retest program, to assist that determination, tests should be performed for the heat exchangers before any corrective actions are taken. As in the initial test program, tests should be repeated after any corrective actions are taken to establish baseline data for future monitoring of heat exchanger performance.

An example of an alternative action that would be acceptable to the NRC is frequent regular maintenance of a heat exchanger in lieu or testing for degraded performance of the heat exchanger. This alternative might apply to small heat exchangers, such as lube oil coolers or pump bearing coolers or readily serviceable heat exchangers located in low radiation areas of the facility.

In implementing the continuing program for periodic retesting of safety-related heat exchangers cooled by service water in open-cycle systems, the initial frequency of testing should be at least once each fuel cycle, but after three tests, licensees and applicants should determine the best frequency for testing to provide assurance that the equipment will perform the intended safety functions during the intervals between tests and meet the requirements of GDC 44, 45, and 46. The minimum final testing frequency should be once every 5 years. A summary of the program should be documented, including the schedule for tests, and all relevant documentation should be retained in appropriate plant records.

Response

A test program to verify the heat transfer capability of all safety-related heat exchangers cooled by service water or an equally effective program to ensure satisfaction of the heat removal requirements of the service water system will be performed as discussed in the responses to Enclosure 2. This program will include an initial test program and a periodic retest program for the heat exchangers cooled by the open-cycle service water system. The need for testing the closed-cycle system heat exchangers is not considered necessary at the present time because of the high quality of existing chemistry control programs. However, if during the conduct of the total testing program, a downward trend in heat exchanger performance is identified that cannot be remedied by maintenance of the open-cycle system, the test program and inspection and maintenance program will be selectively extended to the closed-cycle system as discussed in the Action III response.

Testing will be performed with both portable and permanently installed instrumentation. This instrumentation will be sufficient (within the limits of piping size, and equipment location) to ensure that test results are accurate and are capable of being repeated. The relevant temperatures will be verified to be within design limits. If similar or equivalent tests have not been performed within the past fuel cycle, the initial tests will be completed before plant startup following that unit's next outage.

If necessary, corrective action will be taken before testing in order that the tests will establish baseline data for future monitoring of heat exchanger performance. In the periodic retest program, three tests, at least one each fuel cycle, will be used to establish the best frequency for testing. This frequency will provide assurance that the equipment will perform its intended safety function during the interval between tests, and meet the requirements of GDC 44, 45 and 46. The minimum final testing frequency will be once every 5 years or on a comparable time period tied to refueling outage cycles. To assist in this determination, tests will be performed, where possible, before any corrective action is taken. Tests will then be repeated after corrective actions to reestablish baseline data for future monitoring of the heat exchanger performance. A summary of the program will be documented and will be retained in appropriate plant records.

Alternatively, to the above test program, regular maintenance of selected heat exchangers in lieu of testing for degraded performance is planned for selected heat exchangers. The attached Tables 1 and 2 delineate the BVPS Units 1 and 2 heat exchangers and the type of tests and/or maintenance that are scheduled to be performed.

The following response to Enclosure 2 provides additional information on the Heat Transfer Testing Program.

ENCLOSURE 2

PROGRAM FOR TESTING HEAT TRANSFER CAPABILITY

This enclosure describes a program acceptable to the NRC for meeting the objectives of the requested Action II in the proposed generic letter. Both Action II and this enclosure are based in part on "Operating Experience Feedback Report - Service Water System Failures and Degradations," NUREG-1275, Volume 3, November 1988 and "Technical Findings Document for Generic Issue 51: Improving the Reliability of Open Cycle Service Water Systems," NUREG/CR-5210, August 1988. This enclosure reflects continuing operational problems, inspection reports, and industry standards ("Operation and Maintenance of Nuclear Power Plants," ASME/ANSI OM-1987, Part 2.) The NRC requests licensees and applicants to implement either the steps addressed in this enclosure or an equally effective alternative course of action to satisfy the heat removal requirements of the service water system.

Both the initial test program and the periodic retest program should include all safety-related heat exchangers connected to or cooled by one or more open-cycle service water systems. A closed-cycle system is defined as a part of the service water system that is not subject to significant sources of contamination, one in which water chemistry is controlled, and one in which heat is not directly rejected to a heat sink. (The scope of closed cooling water systems is discussed in the industrial standard, "Operation and Maintenance of Nuclear Power Plants," ASME/ANSI OM-1987, Part 2.) If during the conduct of the total testing program any unexplained downward trend in heat exchanger performance is identified that cannot be remedied by maintenance of an open-cycle system, it may be necessary to selectively extend the test program to the attached closed-cycle system.

Testing should be done with necessary and sufficient instrumentation, though the instrumentation need not be permanently installed.

As a part of the initial tests program, a licensee or applicant may decide to take corrective action before testing. Tests should be performed for the heat exchangers after the corrective actions are taken to establish baseline data for future monitoring of heat exchanger performance. In the periodic retest program, a licensee or applicant should determine after three tests the best frequency for testing to provide assurance that the equipment will perform the intended safety functions during the intervals between tests. Therefore, in the periodic retest program, to assist that determination, tests should be repeated after any corrective actions are taken to establish baseline data for future monitoring of heat exchanger performance.

An example of an alternative action that would be acceptable to the NRC is frequent regular maintenance of a heat exchanger in lieu of testing for degraded performance of the heat exchanger. This alternative might apply to small heat exchangers, such as lube oil coolers or pump bearing coolers or readily serviceable heat exchangers located in low radiation areas of the facility.

In implementing the continuing program for periodic retesting of safety-related heat exchangers cooled by service water in open-cycle systems, the initial frequency of testing should be at least once each fuel cycle, but after three tests, licensees and applicants should determine the best frequency for testing to provide assurance that the equipment will perform the intended safety functions during the intervals between tests and meet the requirements of GDC 44, 45, and 46. The minimum final testing frequency should be once every 5 years.

I. For All Heat Exchangers

Monitor and record cooling water flow and inlet and outlet temperatures for all affected heat exchangers during the modes of operation in which cooling water is flowing through the heat exchanger. For each measurement, verify that the cooling water temperatures and flows are within design limits for the conditions of the measurement. The test results from periodic testing should be trended to ensure that flow blockage or excessive fouling accumulation does not exist.

Response:

Cooling water flow, inlet and outlet pressures and temperatures, where possible, will be monitored and recorded for all affected heat exchangers in the test program. These measurements will be made during modes of operation in which cooling water is flowing through the heat exchanger. The above cooling water flows, pressures and temperatures will be verified to be within the design limits for the conditions of the measurement. The test results will be trended to ensure that flow blockage or excessive fouling does not exist.

II. In addition to the considerations for all heat exchangers in Item I, for water-to-water heat exchangers

A. Perform functional testing with the heat exchanger operating, if practical, at its design heat removal rate to verify its capabilities. Temperature and flow compensation should be made in the calculations to adjust the results to the design conditions. Trend the results, as explained above, to monitor degradation. An example of this type of heat exchanger would be that used to cool a diesel generator. Engine jacket water flow and temperature and service water flow and temperature could be monitored and trended during the diesel generator surveillance testing.

Response:

Where practical, functional testing will be performed with the heat exchanger operating at its design heat removal rate to verify its capabilities. Compensation will be made, in the calculations (if practical), to adjust the results to the design conditions if not tested at design heat removal rate. These results will be trended to monitor degradation.

B. If it is not practical to test the heat exchanger at the design heat removal rate, then trend test results for the heat exchanger efficiency or the overall heat transfer coefficient. Verify that heat removal would be adequate for the system operating with the most limiting combination of flow and temperature.

Response:

If functional testing is not performed at the design heat removal rate, then test results will be trended to ensure that the heat exchanger (operation, efficiency or the overall heat transfer coefficient) will perform its safety function. The heat removal will be verified to be adequate with the most limiting combination of flow and temperature, if practical.

III. In addition to the considerations for all heat exchangers in Item I, for air-to-water heat exchangers

A. Perform efficiency testing (for example, in conjunction with surveillance testing) with the heat exchanger operating under the maximum heat load that can be obtained practically. Test results should be corrected for the off-design conditions. Design heat removal capacity should be verified. Results should be trended, as explained above, to identify any degraded equipment.

Response:

Where practical, testing of air-to-water heat exchangers will be performed under the highest heat load that can be obtained. Test results will be corrected to the design conditions. Design heat removal capacity will be verified and the results trended to identify any degraded equipment.

B. If it is not possible to test the heat exchanger to provide statistically significant results (for example, if error in the measurement exceeds the value of the parameter being measured), then:

1. Trend test results for both the air and water flow rates in the heat exchanger.

2. Perform visual inspections, where possible, of both the air and water sides of the heat exchanger to ensure cleanliness of the heat exchanger.

Response:

If it is not possible to test the heat exchanger to provide statistically significant results then:

1. Test results for the flow rates (or other data) will be trended, or

2. Visual inspections, where possible, of both the air and water sides of the heat exchanger will be performed to ensure cleanliness.

IV. In addition to the considerations for all heat exchangers in Item I, for types of heat exchangers other than water-to-water or air-to-water heat exchangers (for example, penetration coolers, oil coolers, and motor coolers)

A. If plant conditions allow testing at design heat removal conditions, verify that the heat exchanger performs its intended functions. Trend the test results, as explained above, to monitor degradation.

Response:

Where practical, testing will be performed at design heat removal conditions, or at conditions that will verify that the heat exchanger will perform its intended safety function. The results will be trended to monitor degradation.

B. If testing at design conditions is not possible, then provide for extrapolation of test data to design conditions. The heat exchanger efficiency or the overall heat transfer coefficient of the heat exchanger should be determined whenever possible. Where possible, provide for periodic visual inspection of the heat exchanger. Visual inspection of a heat exchanger that is an integral part of a larger component can be performed during the regularly scheduled disassembly of the larger component. For example, a motor cooler can be visually inspected when the motor disassembly and inspection are scheduled.

Response:

If testing at design conditions is not possible, then extrapolation of test data to design (or safety function) conditions will be performed. Where practical, operation efficiency or heat transfer coefficients will be determined to ensure the heat exchanger will meet its safety function. Visual inspection of these (oil coolers, motor coolers, etc.) heat exchangers will be performed periodically if testing can not establish acceptable heat removal rates.

Action III.

Ensure by establishing a routine inspection and maintenance program for open-cycle service water system piping and components that corrosion, erosion, protective coating failure, silting, and biofouling cannot degrade the performance of the safety-related systems supplied by service water. The maintenance program should have at least the following purposes:

A. To remove excessive accumulations of biofouling agents, corrosion products, and silt;

B. To repair defective protective coatings and corroded service water system piping and components that could adversely affect performance of their intended safety functions.

This program should be established before plant startup following the first refueling outage beginning 9 months after the date of this letter. A description of the program and the results of these maintenance inspections should be documented. All relevant documentation should be retained in appropriate plant records.

Response

A routine inspection and maintenance program for open-cycle service water system piping and components is in effect at BVPS. This program is being reviewed to ensure that corrosion, erosion, protective coating failure, silting and biofouling will not degrade the performance of the safety-related systems supplied by service water. The maintenance program contains, at the least, the following:

A. Removal of excessive accumulations of biofouling agents, corrosion products and silt.

B. Repair of defective protective coatings (if any) and corroded piping and components that could adversely affect performance.

These programs for Action III will be reviewed and revised as required prior to plant startup following the next refueling outage. A description of the programs and results of inspections will be documented and will be retained in appropriate plant records.

Action IV.

Confirm that the service water system will perform its intended function in accordance with the licensing basis for the plant. Reconstitution of the design basis of the system is not intended. This confirmation should include a review of the ability to perform required safety functions in the event of failure of a single active component. To ensure that the as-built system is in accordance with the appropriate licensing basis documentation, this confirmation should include recent (within the past 2 years) system walkdown inspections. This confirmation should be completed before plant startup following the first refueling outage beginning 9 months or more after the date of this letter. Results should be documented and retained in appropriate plant records.

Response:

Confirmation that the service water system will perform its intended function in accordance with the licensing basis (FSAR, Tech Specs, etc.) will be performed by single failure analyses, system walkdowns or design basis reviews. To ensure that the as-built system is in accordance with appropriate documentation, system walkdowns were performed for BVPS-1 in 1989 and for BVPS-2 during construction turnover to operations in 1987. These walkdowns satisfactorily address the 2-year system walkdown inspections. Confirmation of the design basis reviews will be completed before startup following each unit's next refueling outage. Results will be documented and will be retained in appropriate plant records.

Action V

Confirm that maintenance practices, operating and emergency procedures, and training that involve the service water system are adequate to ensure that safety-related equipment cooled by the service water system will function as intended and that operators of this equipment will perform effectively. This confirmation should include recent (within the past 2 years) reviews of practices, procedures, and training modules. The intent of this action is to reduce human errors in the operation, repair, and maintenance of the service water system. This confirmation should be completed before plant startup following the first refueling outage beginning 9 months or more after the date of this letter. Results should be documented and retained in appropriate plant records.

Response

Maintenance practices, operating and emergency procedures and training modules that involve the service water system are periodically reviewed and updated as required to ensure that safety-related equipment cooled by the service water system will function as intended and that operators of this equipment will perform effectively. Since reviews of practices, procedures and training modules are already in effect, additional confirmation is not required. These reviews already take into consideration the reduction of human error (training module revisions) and its effect on the operation, repair and maintenance of the service water system. In addition, Safety System Functional Evaluations and Probabilistic Risk Assessments are being performed to further ensure that equipment will function as intended. These reviews are retained in appropriate plant records.

TABLE 1

BVPS - Unit 1 River Water System Components

DESCRIPTION	MARK NO.	PRIMARY TEST METHOD(S)	MAINTENANCE FREQUENCY
Charging Pump Lube Oil Cooler	CH-E-7A, B and C	Temperature Monitoring (Bearing)	1/yr
Diesel Heat Exchanger	EE-E-1A and B	Temperature Monitoring (Jacket water)	As req'd
Primary Component Cooling	CC-E-1A, B and C	Overall Heat Transfer Coefficient (U)	As req'd
Recirculation Spray Coolers	RS-E-1A, B, C and D	Periodic Maintenance	Outage (18 mos)
Control Room Air Conditioner Condensers	VS-E-4A and B	Temperature Monitoring (Control Room air)	As req'd
River Water Pumps Motor & Brg CLRS	WR-P-1A, B, C		As req'd
Aux. River Water Pumps Motor & Brg CLRS	WR-P-9A, B		As req'd

TABLE 2

BVPS - Unit 2 Service Water System Components

DESCRIPTION	MARK NO.	PRIMARY TEST METHOD(S)	MAINTENANCE FREQUENCY
Charging Pump Lube Oil Cooler	2CHS*E25A, B and C	Temperature Monitoring (Bearing)	1/yr.
Diesel Inter/Jacket Cooler	2EGS*E21A and B 2EGS*E22A and B	Temperature Monitoring (Jacket water and lube oil)	As req'd
Component Cooling	2CCP*E21A, B and C	Overall Heat Transfer Coefficent (U)	As req'd
Recirculation Spray Coolers	2RSS*E21A, B, C & D	Periodic Maintenance	Outage (18 mos)
Control Room A/C Unit Condenser	2HVC*REF24A and B	Temperature Monitoring (air temperature)	As req'd
Main Steam Valve House Cooler	2HVR*CLC206A and B	Temperature Monitoring (Room Temperature)	As req'd
Rod Control Area SWS Coil	2HVR*ACU208A and B	Temperature Monitoring (heat duty)	As Req'd
MCC Cubical Cooling Coil	2HVP*CLC265A and B	Delta Pressure w/Flow	As Req'd
Safeguards Area Cooling Coil	2HVR*ACU207A and B	Delta Pressure w/Flow	As req'd

TABLE 2

BVPS - Unit 2 Service Water System Components

DESCRIPTION	MARK NO.	PRIMARY TEST METHOD(S)	MAINTENANCE FREQUENCY
Alternate Shutdown Panel A/C Unit	2HVP*ACUS301	Delta Pressure w/Flow or Temperature Monitoring w/Flow	As req'd
Service Water Pumps Motor & Brg CLRS	2SWS*P21A,B,C		As req'd
Aux Service Water Pumps Motor & Brg CLRS	2SWE-P21A,B		As req'd