ILLINOIS POWER
CLINTON POWER STATION, P.O. BOX 678, CLINTON, ILLINOIS 61727-0678, TELEPHONE (217) 935-8881

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July 2, 1990

10CFR50.73

Docket No. 50-461

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Subject: Clinton Power Station - Unit 1
Licensee Event Report No. 90-002-01

Dear Sir:

Please find enclosed Licensee Event Report No. 90-002-01: Inadequate Pre-Operational Test, Valve Positioning, Construction Cleanliness, and Corrosion/Silting Result in Less Than Design Flow Through Heat Exchangers. This Licensee Event Report has been revised to clarify previously supplied information, include additional discrepancies identified, add the results of the cause of event investigation, include additional corrective actions, include the results of the completed assessment of safety consequences and implications of the event, and include information of previous similar events. This report is being submitted in accordance with the requirements of 10CFR50.73.

Sincerely yours,

F. A. Spangenberg, III
Manager - Licensing and Safety

RSF/alh

Enclosure

cc: NRC Resident Office
NRC Region III, Regional Administrator
INPO Records Center
Illinois Department of Nuclear Safety
NRC Clinton Licensing Project Manager

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NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES 8/31/88

LICENSEE EVENT REPORT (LER)

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TITLE (4)
Inadequate Pre-Operational Test, Valve Positioning, Construction Cleanliness, and Corrosion/Silting Result in Less than Design Flow Through Heat Exchangers

EVENT DATE (5)			LER NUMBER (6)				REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR		SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
										None	0 5 0 0 0
0 1	2 4	9 0	9 0	–	0 0 2	– 0 1	0 7	0 2	9 0		0 5 0 0 0

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	1 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	X 50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
F. C. Edler, Project Manager - Heat Exchangers, extension 3094	AREA CODE 2 1 7 9 3 5 – 8 8 8 1

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	
X	B I	C C L	A 2 2 0	N		X	B M	C C L	A 2 2 0	N	
X	B O	C C L	A 2 2 0	N		X	B N	C C L	A 2 2 0	N	

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On March 6, 1990, the Shift Supervisor (SS) determined as-found flow rates through Shutdown Service Water (SX) pump room cooling coils 1VH07SA and 1VH07SB less than design were reportable conditions. Test engineers identified the flow rate problem of 1VH07SA on January 24, 1990, during heat exchanger performance testing. After the SS was notified of this problem, he directed that design flow be restored through the cooling coils. Investigation has identified flow problems in 27 components using Division I, II & III of SX for cooling water and in 2 components using chilled water for cooling. The causes of this event were: inaccurate pressure drop data and inadequate testing criteria/methodology in pre-operational testing; valves used for throttling purposes were not in position as specified by the SX system procedure; inadequate construction cleanliness; and corrosion/silting. Corrective actions include: achieving acceptable flow rates for components that use the SX system and chilled water for cooling water; reviewing other safety-related pre-operational tests to ensure that acceptance criteria is correct; establishing a standing order for positioning throttle valves; investigating marking throttle valves to ensure repeatability of positioning; and cleaning piping/components.

DESCRIPTION OF EVENT

On March 6, 1990, the Shift Supervisor determined that as-found flow rates through Division I Shutdown Service Water (SX) system [BI] pump [P] room cooling coil [CCL] 1VH07SA and Division II SX system pump room cooling coil 1VH07SB less than the design values were reportable conditions.

In response to Generic Letter 89-13 "Service Water System Problems Affecting Safety-Related Equipment," Illinois Power Company's (IP's) plan was to open, inspect, and obtain baseline data on safety-related heat exchangers [HX] and develop a program to monitor the performance of the heat exchangers for the life of the plant. In November 1989, IP experienced tube leaks on the Division I and II diesel generator [EK] [DG] heat exchangers. Investigation of this problem resulted in the conclusion that the tubes were experiencing Microbiologically Induced Corrosion (MIC) attack. IP accelerated the plan to open and inspect the safety-related heat exchangers and developed a plan to open Division I heat exchangers prior to and during PO-3 (a planned maintenance outage which began February 21, 1990, and was completed April 10, 1990.)

On January 24, 1990, with the plant in Mode 1 (POWER OPERATION) at 100 percent reactor [RCT] power, test engineers were performing heat exchanger performance testing in accordance with test procedure 2602.01, "Heat Exchanger Performance," to establish the as-found system flow conditions. This as-found data was needed in response to Generic Letter 89-13, to establish a baseline for determining the effectiveness of heat exchanger cleaning and inspection activities scheduled for PO-3.

At approximately 1500 hours, using Polysonics and Panametrics flow meters, test engineers identified an as-found flow of thirty-two gallons per minute (gpm) through the Division I Shutdown Service Water system pump room cooling coil 1VH07SA. This as-found flow was lower than the value of eighty-two gpm required by design documents. These test results were not immediately reported to the Shift Supervisor because test engineers recognized these results not as an operability concern but rather as an indication the cooling coil needed cleaning. This perception that no operability concern existed was supported by 1) the differential pressure indication recorded for the cooling coil during testing was consistent with the value provided by the cooling coil vendor, 2) the flow measuring equipment used during the testing had been showing spurious "alarms" that made measurements questionable, and 3) the reason for the testing was not to measure flow rates but to obtain a value of hydraulic resistance as a baseline for measuring heat exchanger cleaning effectiveness as requested in Generic Letter 89-13. The test engineers did verify that Division I SX pump room cooling coil inlet valve [V] 1SX009A was locked. Since cooling coil 1VH07SA was already scheduled for cleaning and inspection during PO-3, the test engineers took no further action.

The test engineers reported the flow-test results to engineering for trending purposes to indicate the condition of the cooling coil prior to the inspection and cleaning of Division I heat exchangers.

The engineering review of these test results compared the design flow to the measured flow but did not result in a prompt follow-on investigation because 1) the as-recorded differential pressure for the cooling coil was consistent with the value provided by the coil vendor, 2) the reason for testing was not to measure flow rates but to obtain a value of hydraulic resistance as a baseline for measuring heat exchanger cleaning effectiveness, 3) the affected coil was already scheduled for cleaning and inspection during PO-3.

On February 13, 1990, at approximately 2134 hours, the plant entered Mode 4 (COLD SHUTDOWN) because of a failure to meet Primary Containment Integrity (Reference LER 90-001-00).

On February 15, 1990, at approximately 1100 hours, the flow-test data for 1VH07SA was reviewed by the Supervisor-Plant Testing and he determined that the Shift Supervisor should be notified of the as-found flow rate. The Shift Supervisor was immediately notified of this condition and he directed test engineers to calibrate the test equipment and to measure the flow rate again. The test equipment was verified to be in calibration; then test engineers measured the flow rate at three different locations and found it to be fifty-five gpm. At 1343 hours, the Shift Supervisor directed the area operator to restore design flow through 1VH07SA by adjusting the flow through valve 1SX009A to approximately eighty-five gpm and relocking the valve. The Shift Supervisor further directed that engineering evaluate the operability of cooling coil 1VH07SA. Condition Report (CR) 1-90-02-046 was initiated to track the problem of low flow rate.

On February 24, 1990, at approximately 1200 hours, test engineers notified the Shift Supervisor (SS) that performance testing of Division I Emergency Core Cooling System (ECCS) Reactor Core Isolation Cooling (RCIC) system [BN] pump room cooling coil 1VY04S, following cleaning of the piping leading to the cooling coil, identified an as-found flow of twelve gpm through the cooling coil (condition documented in CR 1-90-02-065). Design documents require a flow of eighteen gpm through this cooling coil. The SS directed that engineering determine the heat removal capability of the cooling coil at the as-found flow rate and directed that this condition be resolved prior to increasing reactor pressure above 150 pounds per square inch gauge (psig). The SS further directed that engineering coordinate proper corrective actions with Plant Technical if failures of other heat exchanger performance tests were identified.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

On March 2, 1990, engineering held a meeting and discussed flow balancing of the SX system. At this meeting, Sargent & Lundy (S&L), the Clinton Power Station (CPS) architect/engineer, was assigned responsibility for developing appropriate acceptance criteria and technique for flow balancing the SX system.

On March 5, 1990, while developing the criteria and technique for flow balancing, Sargent & Lundy identified that the acceptance test criteria used in the pre-operational test of the SX system, PTP-SX-01, prior to initial plant operation were not consistent with specifications. The acceptance criterion used in PTP-SX-01 for cooling coil 1VH07SA was a differential pressure of 18.1 inches water gauge while the design/procurement specification indicated a differential pressure of 58.8 inches water gauge. The use of the 18.1 inches water gauge differential pressure value caused the flow rate to be set incorrectly for cooling coil 1VH07SA.

On March 6, 1990, while reviewing SX system cleanliness Condition Reports, specifically CR 1-90-02-046, a system engineer identified that Division II SX system pump room cooling coil 1VH07SB could have the same problem as 1VH07SA had with the differential pressure values used during pre-operational testing, and therefore could also have its flow rate incorrectly set.

At 1500 hours, on March 6, engineering notified the SS that the acceptance criteria used in PTP-SX-01 for Divisions I and II SX system cooling coils 1VH07SA and 1VH07SB to set flow rates through these heat exchangers were not correct, and therefore the required design flow rates were not being met. Engineering further identified that the SX system had been outside the design basis since initial plant operation as a result of using inappropriate acceptance criteria.

At 1620 hours, on March 6, 1990, at the direction of the SS, the area operator adjusted flow through valve 1SX009B to provide a flow rate of approximately eighty-five gpm through cooling coil 1VH07SB. The SS also directed that flow through 1VH07SA be determined and corrected as necessary after the Division I SX system has been refilled with water. (At this point in time, Division I SX was out-of-service and inoperable for inspection and cleaning in accordance with IP's Generic Letter 89-13 plan.) In addition, the SS determined that the flow rate problem was reportable as an LER under the provisions of 10CFR50.73(A)(2)(ii)(B) because the flow rate problem resulted in the plant being in a condition outside it's design basis.

No automatic or manually initiated safety system responses were necessary to place the plant in a safe and stable condition. The CORRECTIVE ACTION section of this LER identifies additional components that contributed to this event because their flow rates did not meet design requirements.

CAUSE OF EVENT

The cause of this event is attributed to inaccurate pressure drop data supplied by the American Air Filter Company (AAF), inadequate testing criteria/methodology, lack of a method for determining proper flow-rate through affected components following positioning of throttle valves, inadequate construction cleanliness, and corrosion/silting in SX system piping/components.

AAF supplied inaccurate pressure drop data to Sargent and Lundy and/or Sargent and Lundy via Baldwin Associates, the CPS construction contractor. Specifically, AAF provided data that was not appropriate for the type of cooling coils specified for and delivered to CPS. The data did not include appropriate head losses for clean-out plugs in the cooling coils. For example, the difference between the AAF-supplied pressure drop and the calculated pressure drop across the 1VY03S cooling coil was as high as 202 inches of water (The AAF-supplied value was 72 inches of water while the IP-calculated value was 274 inches of water). Sargent and Lundy provided this inappropriate data to IP for incorporation into the CPS pre-operational test of the SX system (PTP-SX-01). This inappropriate data contributed to less-than-design-specified cooling water flow being supplied to cooling coils. The affected cooling coils are identified in Tables I, II, III, and IV with manufacturer code [d].

Illinois Power submitted information to the Nuclear Regulatory Commission (NRC) under the provisions of 10CFR21 in letter U-601636, dated April 3, 1990 regarding the inaccurate pressure drop data supplied by AAF.

Pre-operational test PTP-SX-01 was not consistent with the requirements of the design specifications. The acceptance criteria for flow balancing the loads served by the SX system were assigned a non-conservative plus-or-minus ten-percent allowable deviation from design flows. This non-conservative allowable deviation contributed to the acceptance of flow rates less than design specifications. IP was unable to determine the origin of the ten-percent allowable deviation value. Normal practice during the pre-operational test program required issuance of a Field Problem Report (FPR) to determine tolerances on design specifications when those tolerances were not provided in design documents. However, review of FPRs for the SX system did not identify any FPRs issued to obtain this allowable deviation value.

Pre-operational test PTP-SX-01 did not consider pressure drop for pipe head loss. Failure to account for pipe head loss resulted in errors when flow values were calculated.

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Adequate pre-operational retesting was not performed for all affected components following installation of flow restriction orifices. These orifices were installed to obtain required flow through certain heat exchangers so that excessive valve throttling would not be required.

As-found positions of some valves used to set SX system flow rates were not as specified in the valve lineup of system operating procedure 3211.01, "Shutdown Service Water (SX)". These valves are positioned by using the number of turns of the valve handwheel. The mis-positioning of the valves, sometime after pre-operational test PTP-SX-01, resulted in some changes in SX flow rate to the components. The cause of these mispositioned valves is attributed to the lack of a method for correctly determining flow-rate through the affected components following positioning of the valves.

A review of maintenance history determined that inadequate construction cleanliness resulted in duct tape and pieces of a plastic pipe cap remaining in the SX system components (see CORRECTIVE ACTION section of this LER for details). The tape and the cap were not removed by the SX system flush.

Prior to responding to Generic Letter 89-13, Illinois Power did not have a program to identify corrosion and silting of SX system piping and components. Several occurrences of corrosion and/or silting were identified in accordance with administrative procedure 101[illegible].02, "System Cleanliness," during rework of the SX system following Generic Letter 89-13 testing. This corrosion/silting caused some reduction in flow rates through certain SX system piping/components.

CORRECTIVE ACTION

Appropriate test engineers were briefed on actions to be taken in response to test discrepancies.

Appropriate engineering personnel will be briefed on the failure to conduct a prompt follow-on investigation of the inconsistences between the design flow and the measured flow. This briefing is scheduled to be performed by September 1, 1990.

Pressure drop data for all AAF-supplied cooling coils using the SX system for cooling water was reevaluated and corrected by S&L. The corrected data was incorporated into test procedure 2800.10, "SX System Flow Balance Verification." Flow through the three divisions of the SX system was balanced using the corrected data.

The flow rates through components that use Division I of the SX system for cooling water were measured and the as-found flow rates for thirteen of twenty-one components were less than design values as indicated in Table I of this LER. As-left flow rates were subsequently achieved for the components as indicated in Table I of this LER. The design flow rate for the Residual Heat Removal (RHR) [BO] system HX Room cooling coil 1VY03S was achieved by modifying (relocating) the piping downstream of the coil in accordance with Field Alteration (FA) SXF012. FA SXF014 was implemented to increase flow through RHR HX 1E12B001A and other components on the same branch of the SX system by throttling Fuel Pool Cooling and Cleanup [DA] HX 1A outlet valve 1SX062A. Design flow rates were achieved for the remaining components by adjusting the throttle valves of the components. As-left flow rates less than original design values were reviewed by engineering and verified to be acceptable prior to startup from PO-3.

Additionally, FA SXF017 has been initiated to enlarge orifice [OR] 1SX12MA to RHR HX 1E12B001A in order to increase the margin of SX flow through that HX. FA SXF017 is scheduled to be implemented during the second refueling outage (RF-2).

The flow rates through components that use Division II of the SX system for cooling water were measured, and the as-found flow rates for eleven of twenty-one components were found to be less than design values as indicated in Table II of this LER. As-left flow rates were subsequently achieved for the components as indicated in Table II of this LER. The design flow rate for the RHR system HX Room Cooling Coil 1VY05S was achieved by modifying (relocating) the piping downstream of the coil in accordance with FA SXF013. FA SXF015 was implemented to enlarge orifice 1SX12MB to RHR HX 1E12B001B in order to increase SX flow through that HX. In addition, FA SXF016 was implemented to provide additional flow to RHR HX 1E12B001B and other components on the same branch of the SX system by throttling Fuel Pool Cooling and Cleanup HX 1B outlet valve 1SX062B. Design flow rates were achieved for the remaining components by adjusting the throttle valves of the components. As-left flow rates less than original design values were reviewed by engineering and verified to be acceptable prior to startup from PO-3.

Additionally, during corrective actions to correct flow conditions in Division II on March 29, 1990, at approximately 1845 hours, maintenance technicians discovered duct tape on the SX system outlet piping flange of Division II Switchgear Heat Removal Condensing Unit [CDU] 1VX06CB (condition documented in CR 1-90-03-157). The SS was notified of this condition at approximately 1900 hours. The SS directed that engineering determine the actions necessary to restore 1VX06CB to operability and that the operability be restored prior to entry of the plant into Modes 1, 2 (STARTUP) or 3 (HOT SHUTDOWN).

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At 0300 hours, on April 3, 1990, while flushing the return line on Division II ECCS RHR 1C Pump Room Cooling Coil 1VY07S in accordance with MWR D07080, pieces of a plastic pipe cap were flushed out of the coil. Condition Report 1-90-04-069 was initiated to investigate/resolve this condition.

The duct tape and plastic pipe cap pieces were removed from condensing unit 1VX06CB and cooling coil 1VY07S, respectively. Foreign material in piping systems should not recur because administrative procedure 1019.02, implemented after construction of CPS, provides adequate controls to ensure foreign material is prevented from entering systems opened for maintenance.

The flow rates through components that use Division III of the SX system for cooling water were measured and the as-found flow rates for three of six components were found to be less than design values as indicated in Table III of this LER. As-left flow rates were subsequently restored to design values by adjusting the throttle valves of the components. These as-left flow rates were reviewed by engineering and determined to be acceptable.

The non-conservative tolerance of plus-or-minus ten-percent applied to minimum flow specifications in PTP-SX-01 was corrected by implementing test procedure 2800.10 for all three divisions of the SX system. Test procedure 2800.10 supersedes PTP-SX-01 and does not provide such a tolerance. In addition, the minimum design flows used in performance of 2800.10 were increased by a minimum of five percent to allow for instrument error. Test procedure 2800.10 requires an engineering evaluation of flow values found to be less than the 105-percent minimum design flow values.

The failure of PTP-SX-01 to correctly consider pressure drop for pipe head loss has been corrected by implementing test procedure 2800.10 for all three divisions of the SX system. The SX system flow verification data sheets included in procedure 2800.10 incorporate pressure drop for pipe head loss. Test procedure 2800.10 identifies the location for installation of differential pressure flow measuring instrumentation.

The positions of incorrectly positioned valves used to set SX system flow rates were corrected during the flow balance of the three divisions of the SX system. The as-left valve positions have been incorporated into the SX system valve lineup checklist, 3211.01V001. To correct the lack of a method for determining proper flow-rate through affected components following valve positioning, IP has issued Operations Standing Order (OSO)-073, "Positioning of Throttle Valves". This standing order establishes guidelines to ensure proper flow through affected components. (This standing order was issued in response to a valve mis-positioning event described in LER 90-011-00.) In addition to issuing OSO-073, IP will investigate methods for marking all throttled SX system valves to provide a repeatable positioning thus ensuring acceptable flow rates. This investigation is scheduled to be completed by August 15, 1990.

SX piping and components identified as having corrosion/silting problems were cleaned during PO-3 in accordance with administrative procedure 1019.02. Following the cleaning, the SX component/division was flow tested in accordance with test procedure 2800.10. The results of these tests were reviewed by engineering and were determined acceptable. Based on comparison of flow test results for some portions of the SX system both before and after cleaning, IP has determined that silting in the SX system is not a significant problem. Illinois Power submitted information to the NRC regarding silting and corrosion in letters U-601626, dated March 20, 1990, and U-601644, dated April 6, 1990. Continued monitoring of SX system heat exchangers for silting/corrosion will be performed in accordance with IP's plan which responds to Generic Letter 89-13. This plan provides for development of acceptance criteria and cleaning methods for silt. The plan also provides for improving raw water treatment which will reduce corrosion.

IP and S&L reviewed selected safety-related pre-operational tests to determine if discrepancies similar to those found in the SX pre-operational test existed in pre-operational tests for other systems in which flow balancing of liquid or gas flows was required. Selection of these pre-operational tests was based on 1) Similar type safety-related systems that have flow rate requirements, 2) Tests that may have been authored by the same individual (review of other pre-operational tests identified that the only pre-operational test prepared by this individual was PTP-SX-01), 3) Tests that may have been written in the same time period as the SX test. The reviews included evaluation of the acceptance criteria, test methodology, flow calculations and other aspects of those tests. The reviews confirmed that the test program problems on safety-related systems were limited to the SX system and to American Air Filter heat exchangers in the Control Room Heating, Ventilating, and Air Conditioning (HVAC) system (VC) [VI].

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

At 1835 hours, on April 3, 1990, while reviewing selected safety-related pre-operational test reports in accordance with the corrective actions of this LER, S&L identified that flow of chilled water through Division I and II VC Cooling Coils 0VC06AA and 0VC06AB and Division I and II Control Room HVAC Equipment Room Cooling Coils 0VC18AA and 0VC18AB may not be in accordance with design requirements (condition documented in CR 1-90-04-014). The SS was immediately notified of this potential flow problem and he declared Division I and II of the VC system inoperable. Investigation of this potential flow problem determined that chilled water flow through 0VC06AA and 0VC06AB was within design requirements; however, chilled water flow through 0VC18AA and 0VC18AB was less than design requirements. Table IV of this LER provides further information regarding these cooling coils. As-left flow rates were subsequently restored to design values by adjusting the throttle valves of the components. These as-left flow rates were reviewed by engineering and determined acceptable.

The cause for the less-than-design flow through cooling coils 0VC18AA and 0VC18AB is attributed to inaccurate pressure drop data supplied by AAF.

ANALYSIS OF EVENT

This event is reportable under the provisions of 10CFR50.73(a)(2)(ii)(B) because the as-found flow conditions resulted in the plant being in a condition outside its design basis.

Assessment of the safety consequences and implications of this event has determined that this event is not nuclear safety significant.

IP's investigation of this event identified as-found flow rates less than original design for twenty-seven heat exchangers/cooling coils using the SX system for cooling water. In addition, IP identified as-found flow rates less than original design for two Control Room HVAC system cooling coils using a closed loop chilled water system for cooling water.

An evaluation was performed to determine if the twenty-seven heat exchangers/cooling coils using the SX system for cooling water could have performed their design safety function with their as-found flow rates. This evaluation included the effects of the as-found flow rates on: direct heat rejection; room temperature increases; and subsequent effects on environmental qualification, building steel/concrete, secondary containment drawdown time, and radiological release rates.

The evaluation concluded that temperatures would have increased in several areas of the plant, but these temperature increases would have had no detrimental effect on the operability or environmental qualification of the applicable safety-related components in these areas. The evaluation further concluded that the less-than-design flow rates did have an impact on secondary containment drawdown ability but would not result in release rates that would exceed off-site radiological dose limits or Main Control Room radiological dose limits. Based on this evaluation of as-found flow rates, the ability of the SX system heat exchangers/cooling coils to support safe shutdown of the plant and maintain the plant in a safe shutdown condition was not exceeded.

Based on an evaluation of the as-found flow rates for the two Control Room HVAC system cooling coils using a closed loop chilled water system for cooling water, it was concluded that these as-found flow rates would provide the cooling capability required for the normal and accident functions of the coils. Therefore the as-found flow rates were not safety significant.

The high as-found flow conditions identified in Diesel Generator heat exchangers 1DG11AA, 1DG11AB, 1DG12AA, and 1DG12AB were evaluated for effect on erosion in the tubes of the heat exchangers. It was determined that the high flow conditions did not present a threat of erosion.

As-found flow conditions less than design values, as indicated in Tables I, II, III, and IV of this LER, have existed since initial plant operation for twenty-seven components that use the three divisions of the SX system for cooling water and two components that use the Control Room Chilled Water System for cooling water. Acceptable SX system cooling water and Control Room chilled water flow rates were restored for the components prior to startup from PO-3.

ADDITIONAL INFORMATION

Tables I, II, III, and IV identify the manufacturer and model number of the equipment with as-found flow rates less than design values.

LER 90-011-00 discussed inadequate SX cooling water flow to the Division I and II Diesel Generator heat exchangers because of inadequate procedures for positioning SX system throttle valves.

For further information regarding this event, contact F. C. Edler, Project Manager-Heat Exchangers at (217)935-8881, extension 3094.

TABLE I

Division I SX System

	EQUIPMENT NUMBER	EQUIPMENT DESCRIPTION	DESIGN FLOW RATE (gpm)	AS-FOUND FLOW RATE (gpm)	AS-LEFT FLOW RATE (gpm)	EQUIPMENT MODEL NUMBER/ MANUFACTURER []
1)	1VH07S	SX Pump Room Cooling Coil	82	20.5[1]	102[1]	24-61-3CW5-8 [d]
2)	1VY03S	ECCS RHR Hx Room Cooling Coil	60	23[1]	70.9[b][1]	22-47-4CW5-8 [d]
3)	1VY02S	ECCS RHR Pump Room Cooling Coil	60	52[1]	88.1[1]	22-47-4CW5-8 [d]
4)	1VY01S	Low Pressure Core Spray [BM] Pump Room Cooling Coil	90	57.5[1]	106.8[1]	28-48-4CW5-8 [d]
5)	1VY04S	ECCS RCIC Pump Room Cooling Coil	18	10.1[1]	17.5[a][1]	18-35-4CW5-8 [d]
6)	0VG07SA	Hydrogen Recombiner [BB] [RCB] Room Cooling Coil	90	50.8[1]	92.6[1]	28-48-4CW5-8 [d]
7)	1VX13SA	Inverter [INVT] Room Cooling Coil	20	15.7[1]	23.7[1]	8-18-3CW5-8 [d]
8)	1VY09S	Main Steam Isolation Valve (MSIV) [ISV] Leakage Inboard [BD] Room Cooling Coil	60	43.3[1]	58 [a][1]	18-32-4CW5-8 [d]

TEXT (If more space is required, use additional NRC Form 366A's) (17)

	EQUIPMENT NUMBER	EQUIPMENT DESCRIPTION	DESIGN FLOW RATE (gpm)	AS-FOUND FLOW RATE (gpm)	AS LEFT FLOW RATE (gpm)	EQUIPMENT MODEL NUMBER/ MANUFACTURER []
9)	1VR09S	Combustible Gas Control System Room Cooling Coil	36	7.1[1]	27.4[a][1]	18-38-4CW5-8A[d]
10)	0VG05SA	Standby Gas Treatment System (SGTS) [BH] Room Cooling Coil	90	40.3[1]	98.6[1]	28-48-4CW5-8 [d]
11)	0PR13A	SGTS Exhaust Hi-Range Radiation Monitor [IL] Cooler [CLR]	20	13.8[1]	19.3 [a][1]	FNB6133 [f]
12)	1E12B001A	RHR Hx	5800	4532[k][1]	5605.1[m][a]	767E786 [e]
13)	1FC01AA	Fuel Pool Cooling and Cleanup Hx	4143	3376[k][1]	3681 [m][a]	76-N-014-1 -1AB[g]
14)	1DG11AA	Diesel Generator Hx	450	1139[1]	552.8[m]	[j]
15)	1DG12AA	Diesel Generator Hx	600	1092[1]	742.8[m]	[j]
16)	1E12C002A	RHR Pump Seal [SEAL] Cooler	20[o]	22[1]	22[1]	[j]
17)	1VP04CA	Drywell [VB] Chiller [CHU]	2000	2140[1]	2058.5[m]	[j]

EQUIPMENT NUMBER	EQUIPMENT DESCRIPTION (gpm)	DESIGN FLOW RATE (gpm)	AS-FOUND FLOW RATE (gpm)	AS-LEFT FLOW RATE	EQUIPMENT MODEL NUMBER/ MANUFACTURER [i]
18) 0VC13CA	Control Room Heating, Ventilating and Air Conditioning System Water Chiller	800	874[l]	849.38[m]	[j]
19) 1VX06CA	Switchgear [SWGR] Heat Removal Condensing Unit	160	230.6[l]	207.5[l]	[j]
20) 1SX01PA	SX Pump Motor [MO] Bearing Cooler	7	21.9[l]	25.1[l]	[j]
21) 1FC02PA	Fuel Pool Cooling and Cleanup Pump	25	26.5[l]	21.2 [a][l]	[j]

TABLE I, II & III NOTES:

[a] As-left flow rates are less than original design values. These as-left flow rates will be reviewed by engineering and verified to be acceptable prior to startup from PO-3.
[b] Existing piping was modified (Plant Modification SXF012) to achieve acceptable flow through 1VY03S.
[c] Existing piping will be modified (Plant Modification SXF013) to achieve acceptable flow through 1VY05S.
[d] Equipment manufactured by American Air Filter Company.
[e] Equipment manufactured by General Electric Company.
[f] Equipment manufactured by Sentry Equipment Corporation.
[g] Equipment manufactured by Yuba Heat Exchanger.

[i] Equipment manufactured by Carrier Corporation.
[j] Equipment Model Number/Manufacturer [] identification not required because the as-found flow rate met the design value.
[k] These are values initially determined using Polysonics. Use of Polysonics was later determined to be inaccurate for measuring flow through piping of the size installed to these heat exchangers. Polysonics proved to read low on piping of this size (12 inches in diameter and greater).
[l] Flow measured using Polysonics instruments.
[m] Flow measured using Caldon instruments.
[n] Flow measured using a combination of permanent flow elements and Polysonics instruments.
[o] Cooling required for shutdown cooling mode only; not required for accident conditions (suppression pool cooling mode).

TABLE II

DIVISION II SX SYSTEM

	EQUIPMENT NUMBER	EQUIPMENT DESCRIPTION	DESIGN FLOW RATE (gpm)	AS-FOUND FLOW RATE (gpm)	AS-LEFT FLOW RATE (gpm)	EQUIPMENT MODEL NUMBER/ MANUFACTURER [1]
1)	1VH07SB	SX Pump Room Cooling Coil	82	38[1]	99.5[1]	24-61-3CW5-8 [d]
2)	0VG05SB	SGTS Room Cooling Coil	90	40.3[1]	114.3[1]	28-48-4CW5-8 [d]
3)	0VG07SB	Hydrogen Recombiner Room Cooling Coil	90	20.9[1]	72[1]	28-48-4CW5-8 [d]
4)	1VY05S	ECCS RHR HX Room Cooling Coil	60	26[c][1]	76.5[1]	22-47-4CW5-8 [d]
5)	1VX13SB	Division II Inverter Room Cooling Coil	20	15.4[1]	20.9[1]	8-18-3CW5-8 [d]
6)	1VY10A	MSIV Leakage Outboard Room Cooling Coil	10	12[1]	11.0[1]	[j]
7)	1VX14S	Division IV Inverter Room Cooling Coil	60	28.4[1]	66.5[1]	28-24-4CW5-8 [d]
8)	1VY07S	ECCS RHR 1C Pump Room Cooling Coil	60	35.8[1]	64.2[1]	22-47-4CW5-8 [d]
9)	1VY06S	ECCS RHR 1B Pump Room Cooling Coil	60	34.7[1]	75.4[1]	22-47-4CW5-8 [d]

	EQUIPMENT NUMBER	EQUIPMENT DESCRIPTION	DESIGN FLOW RATE (gpm)	AS-FOUND FLOW RATE (gpm)	AS-LEFT FLOW RATE (gpm)	EQUIPMENT MODEL NUMBER/ MANUFACTURER [1]
10)	1VP12S	Combustible Gas Control System Room Cooling Coil	36	9.2[1]	20.3[1]	18-38-4CW5-8A[d]
11)	1DG11AB	Diesel Generator HX	450	1326[m]	625.6[m]	[j]
12)	1DG12AB	Diesel Generator HX	600	1362[m]	751[m]	[j]
13)	1E12C002B	RHR Pump Seal Cooler 1B	20[o]	12.95[o][1]	21.1[o][1]	[j]
14)	1E12B001B	RHR HX	5800	5643[m]	6342[m]	767E786 [e]
15)	1VP04CB	Drywell Chiller	2000	2301[m]	2230[m]	[j]
16)	0VC13CB	Control Room HVAC System Chiller	800	905.6[m]	872[m]	[j]
17)	1FC01AB	Fuel Pool Cooling and Cleanup HX	4143	4847.1[m]	3609[m]	[j]
18)	1VX06CB	Switchgear Heat Removal Condensing Unit	160	129.0[1]	178.8[1]	5H60 [i]
19)	1SX01PB	SX Pump Motor Bearing Cooler	7	18.6[1]	18.2[1]	[j]

	EQUIPMENT NUMBER	EQUIPMENT DESCRIPTION	DESIGN FLOW RATE (gpm)	AS-FOUND FLOW RATE (gpm)	AS-LEFT FLOW RATE (gpm)	EQUIPMENT MODEL NUMBER MANUFACTURER []
20)	1FC02PB-M	Fuel Pool Cooling and Cleanup Pump	25	28.5[1]	21[1]	[j]
21)	1E12C002C	RHR Pump Seal Cooler 1C	20[o]	11.6[o][1]	18.2[o][1]	[j]

NOTE: See TABLE I for notes.

TABLE III

DIVISION III SX SYSTEM

EQUIPMENT NUMBER	EQUIPMENT DESCRIPTION	DESIGN FLOW RATE (gpm)	AS-FOUND FLOW RATE (gpm)	AS-LEFT FLOW RATE (gpm)	EQUIPMENT MODEL NUMBER / MANUFACTURER [i]
1) 1VH07SC	SX Pump Room Cooling Coil	16	9.4[1]	20.9[1]	32-36-4CW5-8 [d]
2) 1VY08SA	High Pressure Core Spray (HPCS) [BG] Pump Room Cooling Coil 1A	60	54[1]	70.2[1]	22-47-4CW5-8 [d]
3) 1VY08SB	HPCS Pump Room Cooling Coil 1B	60	52[1]	73.2[1]	22-47-4CW5-8 [d]
4) 1DG13A	Diesel Generator Hx	650	811[1]	671[1]	[j]
5) 1SX01PC	SX Pump Seal Cooler	3	3.9[1]	3.4[1]	[j]
6) 1VX06CC	Switchgear Heat Removal Condensing Unit	50	71[1]	78.4[1]	[j]

NOTE: See TABLE I for notes.

TABLE IV

DIVISION I AND II VC SYSTEM

	EQUIPMENT NUMBER	EQUIPMENT DESCRIPTION	DESIGN FLOW RATE (gpm)	AS-FOUND FLOW RATE (gpm)	AS-LEFT FLOW RATE (gpm)	EQUIPMENT MODEL NUMBER/ MANUFACTURER []
1)	0VC06AA	Division I Control Room HVAC Cooling Coil	435	461.5[n]	444.5[n]	[j]
2)	0VC06AB	Division II Control Room HVAC Cooling Coil	435	451[n]	442.7[n]	[j]
3)	0VC18AA	Division I Control Room HVAC Equipment Room Cooling Coil	35	18.5[1]	35.5[1]	16-45-6CW5-8[d]
4)	0VC18AB	Division II Control Room HVAC Equipment Room Cooling Coil	35	24[1]	37.3[1]	16-45-6CW5-8[d]

NOTE: See TABLE I for notes.

NRC Form 366B (9-83)

LICENSEE EVENT REPORT (LER) FAILURE CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Clinton Power Station	0 5 0 0 0 4 6 1	9 0	0 0 2	0 1	2 1 OF 2 1

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	
X	B H	C C L	A 2 2 0	N							
X	B B	C C L	A 2 2 0	N							
X	B D	C C L	A 2 2 0	N							
X	I L	C L R	S 1 3 5	N							
X	D A	H X	Y 0 3 0	N							
X	B O	H X	G 0 8 0	Y							
X		C D U	C 1 5 0	N							
X	B J	C C L	A 2 2 0	N							
X	V I	C C L	A 2 2 0	N							