

# CATEGORY 1

## REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:9802130023      DOC.DATE: 98/01/30      NOTARIZED: NO      DOCKET #  
FACIL:50-220 Nine Mile Point Nuclear Station, Unit 1, Niagara Powe      05000220  
AUTH.NAME      AUTHOR AFFILIATION  
MAZZAFERRO,P.      Niagara Mohawk Power Corp.  
ABBOTT,R.B.      Niagara Mohawk Power Corp.  
RECIP.NAME      RECIPIENT AFFILIATION

SUBJECT: LER 97-010-01:on 970911, personnel observed increased steaming from Emergency Cooling Loop 12 vent to atmosphere. Caused by original design deficiency. Emergency cooling condensers replaced.W/980130 ltr.

DISTRIBUTION CODE: IE22T      COPIES RECEIVED:LTR 1 ENCL 1      SIZE: 7  
TITLE: 50.73/50.9 Licensee Event Report (LER), Incident Rpt, etc.

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	NRR/DE/ECGB	1 1	NRR/DE/EELB	1 1
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NIAGARA MOHAWK

GENERATION  
BUSINESS GROUP

NINE MILE POINT NUCLEAR STATION/LAKE ROAD, P.O. BOX 63, LYCOMING, NEW YORK 13093

January 30, 1998  
NMP1L 1284

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

RE: LER 97-10, Supplement 1  
Docket No. 50-220

Gentlemen:

In accordance with 10CFR50.73(a)(2)(i)(A) and 10CFR50.73(a)(2)(v)(D), we are submitting LER 97-010, Supplement 1, "Technical Specification Required Shutdown Due to Emergency Cooling Condenser Tube Leak."

Very truly yours,

Richard B. Abbott  
Plant Manager - NMP1

RBA/GJG/cmk  
Enclosure

xc: Mr. H. J. Miller, Regional Administrator, Region I  
Mr. B. S. Norris, Senior Resident Inspector  
Records Management

9802130023 980130  
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IE22/1





LICENSEE EVENT REPORT (LER)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503

FACILITY NAME (1)

Nine Mile Point Unit 1

DOCKET NUMBER (2)

05000220

PAGE (3)

1 OF 6

TITLE (4)

Technical Specification Required Shutdown Due to Emergency Cooling Condenser Tube Leak

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)	
09	16	97	97	010	01	01	30	98	N/A	05000	
									N/A	05000	

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)

100

- |  |  |  |   |
|--|--|--|---|
| <input type="checkbox"/> 20.402(b)         | <input type="checkbox"/> 20.405(c)                 | <input type="checkbox"/> 50.73(a)(2)(iv)           | <input type="checkbox"/> 73.71(b)                             |
| <input type="checkbox"/> 20.405(a)(1)(i)   | <input type="checkbox"/> 50.36(c)(1)               | <input checked="" type="checkbox"/> 50.73(a)(2)(v) | <input type="checkbox"/> 73.71(c)                             |
| <input type="checkbox"/> 20.405(a)(1)(ii)  | <input type="checkbox"/> 50.36(c)(2)               | <input type="checkbox"/> 50.73(a)(2)(vii)          | <input type="checkbox"/> OTHER                                |
| <input type="checkbox"/> 20.405(a)(1)(iii) | <input checked="" type="checkbox"/> 50.73(a)(2)(i) | <input type="checkbox"/> 50.73(a)(2)(viii)(A)      | <i>(Specify in Abstract below and in Text, NRC Form 366A)</i> |
| <input type="checkbox"/> 20.405(a)(1)(iv)  | <input type="checkbox"/> 50.73(a)(2)(ii)           | <input type="checkbox"/> 50.73(a)(2)(viii)(B)      |   |
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LICENSEE CONTACT FOR THIS LER (12)

NAME

Peter A. Mazzaferro, Manager Technical Support

TELEPHONE NUMBER

(315) 349-1019

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRPDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRPDS
X	BL	HX							

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE)

NO

EXPECTED SUBMISSION DATE (15)

MONTH

DAY

YEAR

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

On September 11, 1997, Nine Mile Point Unit 1 (NMP1) personnel observed increased steaming from the Emergency Cooling (EC) Loop 12 vent to atmosphere. On September 12, 1997, operators at NMP1, based upon elevated EC loop temperatures and vent radiation monitor readings, isolated Loop 12 and entered Technical Specification (TS) 3.1.3.b. On September 15, 1997, NMP1 initiated a shutdown to inspect and test the EC condensers. Subsequently, it was determined that the EC repairs could not have been completed within the allowed TS Limiting Condition for Operation (LCO) time, and that the event was therefore reportable as a TS required shutdown. Inspection and testing revealed that tube cracking indications were present in all four EC condensers.

The root cause of the EC condenser tube failures has been determined to be an original design deficiency that failed to preclude exposing the upper tubes to a continuous steam environment. This condition subsequently resulted in tube leakage due to thermal fatigue and transgranular stress corrosion.

EC Loop 12 was manually isolated to secure the steaming from the loop vent to atmosphere and NMP1 was subsequently shutdown to determine the cause of the steaming and to affect repairs. The tube bundles for each of the EC condensers were replaced prior to returning NMP1 to service. In addition, a modification was made to the system to maintain water level above the tube bundles.



LICENSEE EVENT REPORT (LER)  
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
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Nine Mile Point Unit 1	05000220	97	10	01	02 OF 06

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

**I. DESCRIPTION OF EVENT**

On the morning of September 11, 1997, while operating at approximately 100 percent thermal power, Nine Mile Point Unit 1 (NMP1) personnel observed increased steaming from the Emergency Cooling (EC) Loop 12 vent to atmosphere. Monitoring of system parameters was immediately begun and a chemistry sample of the EC cooling water was taken. Based upon elevated EC loop temperatures and vent radiation monitor readings, EC Loop 12 was isolated on September 12, 1997 at 0130 hours and Technical Specification (TS) 3.1.3.b was entered. This Limiting Condition for Operation (LCO) allows seven days to repair the isolated train or proceed to cold shutdown. Chemistry analysis showed the presence of short-lived fission products and confirmed the indication of leaking tubes. After initial investigation to determine the cause of the increased steaming, it was decided on September 15, 1997, to shutdown NMP1 to clearly determine the cause and to make repairs. Subsequently, it was determined that repairs could not have been accomplished within the allowed TS LCO time and that the event was therefore reportable.

After NMP1 reached cold shutdown (September 16, 1997), a pressure test and visual examination of EC condenser #122 (one of the two Loop 12 condensers) tube bundles revealed one ruptured tube (out of 36). The inlet and outlet piping was subsequently removed to perform a thorough examination of all the tubes and tube sheet on EC condenser #122. Based upon indications discovered in the tubes and tube sheet, a pressure test was performed on the Loop 11 condensers (#111 and 112). The results of that testing indicated leakage in both Loop 11 EC condensers. Therefore, a decision was made to remove the inlet piping from the remaining three condensers (i.e., #111, 112, and 121) and perform Non-Destructive Examinations (NDE). Results identified cracks in tubes and tube sheets in each condenser. NRC notification of these leaks was made on September 22, 1997 and October 3, 1997. The tube bundles in each EC condenser were replaced prior to returning NMP1 to service.

After completion of the hydrostatic testing and review of all the tube failures, it became evident that the standard chemistry analysis showed the presence of typical short-lived fission products, indicative of a reactor coolant leak, that were apparent only after the tube leakage increased substantially above 10 gallons per minute (gpm). After the event, the chemistry department personnel reviewed isotopic analyses from regularly scheduled emergency condenser sampling activities which had been performed prior to the rupture. It was evident from this review that fluctuations in the net area counts in the 511 keV peak trended upwards with the increase in leakage from 10 gpm to 122 gpm. The changes in 511 keV net area counts had not been trended or recognized as significant since the 511 keV peak is common when Co 60 is present in samples. Co 60 was present in the EC condenser make-up water supply condensate storage tanks. After reevaluation of the 511 keV peak trends, it was evident that the 511 keV peak was indicative of Fluorine 18 which is a reactor coolant short lived isotope. Review of the 511 keV data indicates that the small leaks existed since March 1996.



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## II. CAUSE OF EVENT

The cause of the EC condenser tube failures has been determined to be a combination of thermal fatigue and transgranular stress corrosion cracking. The cause of both of these mechanisms has been traced to operation with the upper tubes of the EC tube bundle in a continuous steam condensing mode. The EC tube bundles have operated in this mode since initial startup. The root cause evaluation has concluded that to eliminate steam condensation in the EC tube bundles, without an active keep full system, the EC condensate return valve leakage must be less than 0.2 gpm, depending upon steam inlet piping insulation efficiency. Testing has verified that the EC return valve leakage was maintained well within the specified leakage required to meet the requirements of 10CFR50 Appendix J. However, the valve leakage still exceeds steam inlet piping condensation makeup capability; the estimated leakage through the isolation valves is 0.2 gpm under normal operating conditions. Testing has verified that to maintain the steam liquid interface continuously above the condenser tubes at this leakage rate, an active keep full system is required. Therefore, the root cause of the failed tubes has been determined to be an original design deficiency, since no leakage limitations were specified nor an adequate means to control the condensate level within the condenser tubes such that the tube bundles would remain constantly covered with water.

NMPC missed an opportunity to identify this condition when a modification was made in 1977. NMPC did not understand the design basis of the originally installed temperature alarm system which had been installed to annunciate on high temperature in the steam inlet piping. High temperature would indicate tube uncover. Since the alarm annunciator had been routinely in alarm, NMPC modified it to alarm on low temperature rather than high temperature. In effect, this modification masked the true operating condition of the condensers until this event occurred.

## III. ANALYSIS OF EVENT

This event is reportable in accordance with 10CFR50.73(a)(2)(i)(A), "the completion of any nuclear plant shutdown required by the plant's Technical Specifications," and 10CFR50.73(a)(2)(v)(D) "any event or condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to: D) Mitigate the consequences of an accident."

Section V-E of the NMP1 Updated Final Safety Analysis Report (UFSAR) Subsection V-E 3.3, System Leaks, describes the function of the radiation monitors in the vent lines which provide alarm indication in the control room. This subsection further states that closure of the inlet and outlet valves to the system is initiated manually. NMP1 personnel thoroughly assessed the increased steaming by evaluating the available parameters, and took actions to manually isolate EC Loop 12. The increases in loop temperatures and vent radiation monitor readings were very small (approximately two degree increase in temperatures and 0.3



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RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY  
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**III. ANALYSIS OF EVENT (cont'd)**

mRem/hr increase in radiation readings). The NMP1 TS contains quarterly dose limits for gamma and beta exposure due to noble gases and doses due to particulate iodine and tritium. Dose calculations for the quarter ending September 1997 show that doses from the EC vents for that quarter were less than 0.1 percent of these TS dose limits.

The EC system provides decay heat removal from the reactor in the event that feedwater capability is lost and the main condenser is not available. In addition, the EC system is credited as a mitigation system for both 10CFR50 Appendix R (App. R) and Station Blackout (SBO) events. The following summarizes NMPC's evaluation of the events which are based largely upon engineering judgement:

Decay Heat Removal

Each EC vent line is provided with two radiation detectors to monitor noble gas radioactivity in accordance with Technical Specification 3/4.6.14, "Radioactive Effluent Instrumentation." Based upon our review of historical reactor water radioactivity data and the leakage rates estimated for this event, the EC system radiation monitors for either EC Loop 11 or 12 would not have reached their alarm setpoints due to low radioactivity levels in the vent line. Therefore, both EC loops could have been placed into service, if required, with leakage. The combined leakage, prior to September 11, 1997, has been estimated to be less than 10 gpm. The EC system would therefore have performed its function to remove decay heat, if required. For the period between the discovery of the leak on EC Loop 12 until the plant was shutdown, the analysis is identical to that discussed below for SBO and Appendix R.

Station Blackout and Appendix R

The EC system is credited during SBO and Appendix R scenarios to achieve hot shutdown. The assumptions used for the bounding SBO coping analysis include assumed leakage of 25 gpm TS limit plus 18 gpm from each of the five recirculation pumps. The assumptions for SBO leakage are more restrictive than Appendix R and thus bound the Appendix R analysis. As discussed above, both EC loops could have been initiated with leakage. Prior to September 11, 1997, the combined leakage has been estimated to be less than 10 gpm, which is bounded by the seal leakage assumptions used for the NMP1 coping analysis. Based upon testing of the recirculation pump seals performed as part of the NMP1 SBO evaluations, the maximum seal leakage during SBO conditions has been shown to be less than 0.5 gpm per pump. Therefore, the EC system would have performed its function for both SBO and Appendix R scenarios.



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### III. ANALYSIS OF EVENT (cont'd)

NMPC has determined that the tube rupture on EC Loop 12 occurred at approximately 0600 on September 11, 1997. Based upon post event investigation and data retrieved from the NMP1 process computer, it was determined that there was a change in shell temperature and radiation levels at that time. The EC Loop 12 operated from approximately 0600 on September 11, 1997 until approximately 0100 on September 12, 1997 with leakage increasing to approximately 122 gpm, based upon conservative calculation, when the EC was isolated. Actual drywell leakage including any contribution from the recirculation pump seals was 3.37 gpm. During an SBO, had the operators chosen to place the EC loop 12 in service, total leakage is estimated to be approximately 125 gpm, which exceeds the 115 gpm assumed in the SBO analysis. However, the SBO analysis is based upon a bounding assumption on leakage behavior using a constant leakage rate of 115 gpm during the event, neglecting the fact the leakage is expected to decrease as the reactor pressure decreases during the progression of the event. The reactor would have depressurized and thus the leakage would have reduced. Overall, the total leakage would have been bounded by the analysis and actions taken in response to an SBO.

After EC Loop 12 was isolated, the plant remained in operation until September 16, 1997. During that period, EC Loop 11 remained available to mitigate an SBO or Appendix R event. Since the leakage in EC Loop 11 was less than 2 gpm, its performance would not have been affected.

Based upon the preceding, the event did not pose a threat to public safety or plant personnel.

### IV. CORRECTIVE ACTIONS

1. EC Loop 12 was manually isolated to secure the increased steaming to the atmosphere and TS 3.1.3.b was entered.
2. NMP1 was subsequently shutdown to further inspect and test all four EC condensers.
3. The EC tube bundles were replaced with new bundles.
4. A keep full modification was made to the EC system to provide constant water level above the tubes.



LICENSEE EVENT REPORT (LER)  
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-330), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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IV. CORRECTIVE ACTIONS (cont'd)

- 5. Chemistry personnel have been trained on this event and appropriate Chemistry procedures will be revised by March 31, 1998.

V. ADDITIONAL INFORMATION

A. Failed components:

Component Description: EC Condensers HTX-60-42 (EC 122), HTX-60-44 (EC 121), HTX-60-45 (EC 112), and HTX-60-46 (EC 111)

Manufacturer: Foster Wheeler Corporation

Model Number: Foster and Wheeler Diag. # (1692-655-21)

Serial Number: Contract No. 2-33-116-119

B. Previous similar events: none

C. Identification of components referred to in this LER:

COMPONENT	IEEE 803 FUNCTION	IEEE 805 SYSTEM ID
EC Condensers (Heat Exchangers)	HX	BL

