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RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 95-005-01:on 931025,relief panels in NMP1 turbine & reactor buildings would not blow out at design pressure of 45 psf w/reactor at 100% power.Inadequate QC measures during initial construction.Personnel counseled.W/960626 ltr.

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NIAGARA MOHAWK
GENERATION
BUSINESS GROUP

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

June 26, 1996
NMP1L 1089

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

RE: Docket No. 50-220
LER 95-05, Supplement 1

Gentlemen:

In accordance with 10CFR50.73 (a)(2)(ii)(B), we are submitting LER 95-05, Supplement 1, "Building Blowout Panels Outside the Design Basis Because of Construction Error." This supplement contains additional information concerning the description, cause, analysis and corrective actions for this event. This supplemental information responds to comments contained in NRC Inspection Report 50-220/96-05 concerning this event.

Inspection Report 50-220/96-05 also contained an enclosure requesting additional information related to this event. Niagara Mohawk is preparing this information, as well as responses to additional questions posed during an Enforcement Conference on April 12, 1996. This information will be provided in a separate transmittal.

Very truly yours,

Norman L. Rademacher
Plant Manager - NMP1

NLR/AFZ/lmc
Attachment

xc: Mr. Thomas T. Martin, Regional Administrator, Region I
Mr. Barry S. Norris, Senior Resident Inspector

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NRC FORM 366 U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

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)	DOCKET NUMBER (2)	PAGE (3)
Nine Mile Point Unit 1	5000220	01 OF 07

TITLE (4)
Building Blowout Panels Outside Design Basis Because of Construction Error

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)
10	25	95	95		005		01	06	26	96	N/A	05000
											N/A	05000

OPERATING MODE (9): N

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check one or more of the following)* (11)

POWER LEVEL (10): 100

- ☐ 20.402(b)
- ☐ 20.405(a)(1)(i)
- ☐ 20.405(a)(1)(ii)
- ☐ 20.405(a)(1)(iii)
- ☐ 20.405(a)(1)(iv)
- ☐ 20.405(a)(1)(v)
- ☐ 20.405(c)
- ☐ 50.36(c)(1)
- ☐ 50.36(c)(2)
- ☐ 50.73(a)(2)(i)
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- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(b)
- ☐ 73.71(c)
- ☐ OTHER *(Specify in Abstract below and in Text, NRC Form 366A)*

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
Ken Sweet, Manager Technical Support NMP1	(315) 349-2462

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

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

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

At 1000 hours on October 25, 1993, with the reactor at 100 percent power, it was determined that the relief (blowout) panels in the Nine Mile Point Unit 1 (NMP1) turbine and reactor buildings would not blow out at the design pressure of 45 psf because the bolt fasteners for the panels were larger than designed and had a higher ultimate strength than designed. The initial engineering evaluation of this condition erroneously determined that the turbine and reactor building panels would blow out at 60 and 53 psf, respectively, to relieve internal building pressure prior to structural failure of the buildings, and the panels were declared operable.

On March 27, 1995, during refueling outage 13 (RFO13), it was determined that there was an error in the design assumptions for load distribution. Revised calculations confirmed that the relief panels would not blow out until the internal building pressure exceeded the minimum documented building structural design of 80 psf.

The cause of this event was inadequate quality control measures during initial construction which resulted in oversize bolts being installed in the relief panels.

Prior to restart from RFO13, the panel attachment design was revised, the size of the bolts was verified, and every other bolt was removed from the relief panels to reduce their blowout point to a value below the documented building structural capability. Additionally, appropriate Engineering personnel were counseled regarding verification of design assumptions.

I. DESCRIPTION OF EVENT

At 1000 hours on October 25, 1993, with the reactor at 100 percent power, it was determined that the relief (blowout) panels in the Nine Mile Point Unit 1 (NMP1) turbine and reactor buildings would not blow out at the design pressure of 45 psf because the bolt fasteners (shear bolts) for the panels were larger than designed and had a higher ultimate strength than designed. The initial engineering evaluation of this condition determined that the turbine and reactor building panels would blow out at 60 and 53 psf, respectively, to relieve internal building pressure prior to structural failure of the buildings, and the panels were declared operable. The calculation supporting this conclusion considered the effect of the larger bolts. A one-way span analysis determined the failure of the bolts at an internal pressure of about 93 psf, and a two-way span analysis determined a failure mode of tearing of the sheet metal at 53 psf (reactor building) and 60 psf (turbine building). It has subsequently been determined that use of the two-way analysis results was inappropriate. However, at that time, the condition was determined to be not reportable since the function of the panels, which is to protect the buildings from structural collapse, would have been achieved since the Updated Final Safety Analysis Report (UFSAR) indicated that the building structure would not fail until the internal pressure exceeded 80 psf.

On March 27, 1995, during refueling outage 13 (RFO13), it was determined that there was an error in the design assumptions for load distribution used in the 1993 calculations. Revised calculations determined that the relief panels would not blow out until the internal building pressure reached about 93 psf which exceeds the documented building structural design of 80 psf. In March 1995, the revised calculations indicated that the blowout panels were inoperable. Prior to restart from RFO13, every other shear bolt was removed from the relief panels to reduce their blowout point to a value below the building structural capability. Since pressure profile loads from a High Energy Line Break (HELB) outside containment were not included in the structural design, it was erroneously concluded that this condition was not reportable. Since Nine Mile Point Unit 1 (NMP1) was designed and licensed prior to the issuance of the General Design Criteria (GDC), 10CFR50 Appendix A, it was concluded that protection from the dynamic effects of a high energy pipe break, GDC 4, was not a design basis requirement and this deficiency was not considered a reportable event.

Another opportunity to evaluate reportability occurred in July 1995 when the Station Operations Review Committee (SORC) met and discussed the closure of the initial Deviation/Event Report (DER) 1-93-2526 that was written to address this issue. At that time SORC was advised again that a HELB outside containment was not included in the structural design and, therefore, was not reportable.

On October 31, 1995, management conducted an additional review of this event and determined it to be reportable. This review determined that the use of engineering judgement, as discussed in NUREG-1022, was improperly credited in previously concluding that this event was not reportable and that the Final Safety Analysis Report (FSAR) inferred that the relief panels were credited with functioning for certain events; specifically UFSAR Sections III.A. and VI.C. indicate that the building pressure relief function is part of the design bases. Deviation/Event Report (DER) 1-95-3012 was issued to document this reportability deviation, initiate a cause evaluation, and determine appropriate corrective actions, which are described in Section IV of this LER.

II. CAUSE OF EVENT

The cause of this event was inadequate quality control measures during initial construction which resulted in oversize shear bolts being installed in the relief panels. The original design drawings specified 3/16 inch bolts for these panels, however, 1/4 inch bolts were used.

Causes of Delay in Reporting

The discovery of the improper bolts in 1993 provided an opportunity to identify the significance of this deficiency. However, the engineer evaluating this condition made a cognitive error in establishing the load distribution assumption for the engineering calculation, and this error was not identified during the design review process. Specifically, the two-way span analysis was erroneously used to establish panel failure, and the results were used in the operability determination. The resulting failure mode of metal tearing was not consistent with the UFSAR description of failure by bolt shearing. Furthermore, neither the supervisor nor the checker recognized the misuse of the calculation information.

The blowout panel design uses panels of corrugated siding approximately 2 feet high by 20 feet long. The horizontal ends of these panels are firmly fastened to steel angle bars which are then connected to the building structural steel by shear bolts. The top and bottom of the individual panels are not structurally fastened to adjacent panels, and, because of the corrugation, the panels are relatively flexible in the vertical direction. For these reasons, the load resulting from an internal pressure is transferred horizontally only, however, the engineer evaluated both a horizontal and vertical transfer of load in the design calculation. As a result, the incorrect calculation conclusions were used to determine the blowout panels would separate from the building structures at internal pressures of 60 psf (turbine building) and 53 psf (reactor building) by tearing of the panel metal at the top and bottom of the Blowout Panels. These deficiencies contributed to the length of time that the construction error existed.

The reason for the erroneous reportability decision in 1995 was an improper application of "Design Basis" as relating only to "Design Basis Events." Other "design basis" features described in the UFSAR were not properly considered in the reportability evaluation until October 1995. The original 1995 reportability decision was questioned by NMP1 staff personnel, which led to the reconsideration and re-evaluation of this event by the SORC in October 1995. The re-evaluation determined that this event was reportable after considering the UFSAR in its entirety, and, particularly, the specific description of the blowout panels in the design basis sections related to the reactor and turbine buildings.

III. ANALYSIS OF EVENT

This event is reportable in accordance with 10CFR50.73(a)(2)(ii)(B), "a condition that was outside the design basis of the plant." Specifically, the bolt fasteners of the turbine and reactor building relief panels were

III. ANALYSIS OF EVENT (cont'd)

oversized, and the panels would not blowout before the building internal pressure exceeded the building structural design as described in the UFSAR. The UFSAR indicated that structural failure of the buildings would occur at some internal pressure greater than 80 psf, but did not specify a particular value. Subsequent to the original submittal of this LER, analyses, using conservative assumption, were performed to determine the actual internal pressure required for building structural failure. These analyses determined that structural failure of the reactor and turbine buildings would not occur, at a minimum, below an internal pressure of 143 psf and 135 psf, respectively. These analyses were performed using the lowest building column strengths from Certified Material Test Reports (CMTRs). The results of these analyses represent the lowest internal pressure which could cause a structural failure in these buildings.

As a result of the engineering analyses and calculations performed to evaluate this event, Niagara Mohawk has concluded that the original design calculations performed during the 1960s and the calculations performed in 1993 and 1995 used certain design assumptions which may not have been appropriate to establish a conservative upper-bound value for the panel blowout point. Most significant, in this regard, was the assumption and use of a linear shear/tension relationship in the design calculations. Niagara Mohawk considers that this relationship would be conservative and appropriate for the design of normal building siding, but that an elliptical shear/tension relationship is more appropriate for the design of a blowout panel, where a conservative upper-bound failure point must be established. Calculation results suggest that a linear shear/tension relationship was used in the original design. In the calculations performed in 1993 and 1995, Niagara Mohawk continued to use this relationship.

Subsequent to the original submittal of this LER, Niagara Mohawk used the elliptical shear/tension relationship to calculate an upper bound value panel blowout point for both the original and current configuration. Niagara Mohawk also performed a walkdown of the current as-built configuration to verify that all potential impacts to the panel relief function were accounted for in the analysis. For the original configuration, these calculations indicate the panel blowout points could be as high as 128 psf and 122 psf for the reactor and turbine buildings, respectively. For the current configuration, these calculations indicate the blowout points are a maximum of 65 psf and 62 psf for the reactor and turbine buildings, respectively. However, subsequent evaluation, as discussed below, determined that the panels were operable and the condition not reportable.

Niagara Mohawk also evaluated several other aspects of the design in calculating the above values to ensure the results represent an upper bound for the blowout panel function. These other aspects are the structural capability of the mechanical connection (J Joint) at the top and bottom edges of each two-foot wide panel section and the actual strengths of the installed shear bolts. An analysis of the J Joint indicates that the ability of this mechanical connection to transfer shear load or membrane stress is insignificant compared to the internal pressures at the blowout point. This analysis confirms that the one-way span analysis for the blowout

III. ANALYSIS OF EVENT (cont'd)

panels is appropriate. Since a total of 13 bolts were removed from the blowout panels and tensile tested, the highest tested tensile strength (which is greater than the mean plus one standard deviation) was conservatively used in these calculations.

Since the relief points of the originally installed blowout panels are less than the structural capability of the reactor and turbine buildings, the blowout panels would have been capable of performing their design function. Since the relief points of the currently installed panels are less than the UFSAR value of 80 psf for building structural capacity, Niagara Mohawk considers these panels operable. The following section describes the corrective actions being taken to bring the UFSAR into agreement with the as-built condition.

NMP1 was designed and constructed prior to 10CFR50 Appendix A GDC 4, and was not designed in accordance with this criterion. As stated in the FSAR, Section XVI, Paragraph 2.0, "The original design basis for Unit 1 is that the probability of double-ended guillotine pipe rupture is extremely low such that protection from the dynamic effects of that rupture were not considered. The licensing basis is that the inherent features and capabilities provide basis for reasonable assurance that the facility design meets the intent of the criteria."

In August 1984 Niagara Mohawk issued a report, "Leak Before Break Analysis of High Energy Piping Systems," which supported the original design basis and demonstrated the adequacy of internal structures such as masonry walls in the reactor and turbine buildings. Since the probability of a large pipe break before leak in a high energy system is very small, the inadequate construction of the relief panels did not result in a significant increase to the risk for the public or plant personnel.

Furthermore, the results of the NMP1 Individual Plant Examination (IPE) concluded that High Energy Line Break (HELB) events were of little risk significance due to low probability of occurrence. The IPE also concluded that there were numerous areas in the reactor building capable of relieving pressure even if the blowout panels fail.

During the period this construction error existed, there was no transient which challenged the function of the relief panels. Had a transient occurred during this period, the Blowout Panels would still have functioned to relieve internal pressure before the calculated failure point of the reactor or turbine building superstructure. Therefore, this event had no adverse consequences. It did not adversely affect any other safety system nor the operators' ability to maintain safe reactor plant conditions.

IV. CORRECTIVE ACTIONS

Prior to restart from RFO13, the panel attachment design was revised, the size of the shear bolts was verified, and every other shear bolt was removed from the relief panels to reduce their blowout point to a value below the building structural capability. Since the initial construction of NMP1, additional quality control and quality assurance requirements have been implemented for design and construction activities, which would prevent similar deficiencies.

Additionally, the Supervisor of the Structural Engineering Group has counseled his personnel regarding the importance of an adequate review of documents and, particularly, the verification of assumptions, prior to final issue. The Branch Manager has counseled the Supervisor of Structural Engineering and has also reviewed this event with all of his direct reports.

The following corrective actions have been identified.

1. An independent review has been completed of 29 of approximately 600 Unit 1 Structural Engineering calculations performed since 1993 to ensure they were performed correctly. The review identified no technical errors.

2. An evaluation of the root cause and human performance issues related to the calculation error is being conducted (DER 1-96-0922), and corrective and preventive actions resulting from the evaluation will be implemented. Additionally, a lessons learned will be issued to appropriate personnel to convey the lessons of supervisory oversight and independent review. Completion date: July 31, 1996.

3. Training on reportability (including NUREG-1022, 10CFR50.72, and 10CFR50.73) is planned for key branches. Completion date: October 31, 1996.

4. A specific Lessons Learned has been issued for appropriate plant personnel, including Operations and the Station Operations Review Committee (SORC) regarding the evaluation of reportability for design basis issues.

5. A review is being conducted of selected previous Deviation/Event Reports (DERs) which involved potentially reportable design basis issues. This review will be conducted to ensure that potentially reportable DERs are dispositioned appropriately with a correct reportability decision. Completion date: June 30, 1996.

6. A Licensing Document Change Notice (LDCN) will be been initiated to document and track the actions to revise the UFSAR to reflect the currently calculated panel blowout points of 65 psf and 62 psf for the reactor and turbine buildings, respectively. This action will be taken in accordance with 10CFR50.59 and with an appropriate safety analysis. Completion Date: July 31, 1996.

IV. CORRECTIVE ACTIONS (cont'd.)

In addition, the following actions, implemented for reasons separate from this event, will have a positive effect in preventing the deviations described in this report.

1. The DER process has been revised since 1993 to improve the plant management oversight, review and approval of DER dispositions and implementation. This oversight is intended to ensure that the resolution of identified deficiencies and the proposed dispositions, including implementation schedules, are approved at the appropriate management level.

2. A branch specific "Back-to-Basics" training program covering "licensing basis" issues is being conducted. This training has heightened awareness of the relationship of procedures and review processes to the UFSAR and design bases.

V. ADDITIONAL INFORMATION

A. Failed components: none.

B. Previous similar events: none.

C. Identification of components referred to in this LER:

COMPONENT	IEEE 803 FUNCTION	IEEE 805 SYSTEM ID
Reactor Building	N/A	NG
Turbine Building	N/A	NM
Reactor Building Blowout Panel	RPD	NG
Turbine Building Blowout Panel	RPD	NM