| NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION | APPROVED BY OMB NO. 3150-0104 EXPIRES 5/31/95 |
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| **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 INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503. |

| FACILITY NAME (1) | DOCKET NUMBER (2) | PAGE (3) |
|---|---|---|
| Dresden Nuclear Power Station, Unit 2 | 05000237 | 1 OF 9 |

TITLE (4)
Containment Penetrations Outside Design Basis Due to Analysis of Thermally Induced Post-Accident Over-Pressurization

| 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 NAME Dresden Unit 3 | DOCKET NUMBER 05000249 |
| 01 | 27 | 97 | 97 | -- 003 -- | 01 | 07 | 11 | 97 | FACILITY NAME | DOCKET NUMBER |

| OPERATING MODE (9) | 1 |
|---|---|
| POWER LEVEL (10) | 100 |

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

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|---|---|---|---|---|---|---|---|
| | 20.2201(b) | | 20.2203(a)(3)(i) | | 50.73(a)(2)(iii) | | 73.71(b) |
| | 20.2203(a)(1) | | 20.2203(a)(3)(ii) | | 50.73(a)(2)(iv) | | 73.71(c) |
| | 20.2203(a)(2)(i) | | 20.2203(a)(4) | | 50.73(a)(2)(v) | | OTHER |
| | 20.2203(a)(2)(ii) | | 50.36(c)(1) | | 50.73(a)(2)(vii) | | (Specify in Abstract below and in Text, NRC Form 366A) |
| | 20.2203(a)(2)(iii) | | 50.36(c)(2) | | 50.73(a)(2)(viii)(A) | | |
| | 20.2203(a)(2)(iv) | | 50.73(a)(2)(i) | | 50.73(a)(2)(viii)(B) | | |
| | 20.2203(a)(2)(v) | X | 50.73(a)(2)(ii) | | 50.73(a)(2)(x) | | |

LICENSEE CONTACT FOR THIS LER (12)

| NAME | TELEPHONE NUMBER (Include Area Code) |
|---|---|
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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 |
|---|---|---|---|---|---|---|---|---|---|---|
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| 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 15 single-spaced typewritten lines) (16)

Between October of 1996 and January of 1997, systems that penetrate containment were reviewed to identify piping that is susceptible to the thermally induced pressurization issue identified in NRC Generic Letter 96-06. Based on the results of the review and subsequent operability determinations, on January 27, 1997 it was determined that the systems identified as susceptible to over-pressurization in post-accident conditions did not account for post-accident pressurization in their original design, and as a result were outside the design basis of the plant.

Operability Assessments were performed to document the basis for continued operability of these affected penetrations and systems/components. The systems were determined to be operable but degraded.

Permanent correction of the degraded condition will be accomplished by installing over pressure protection or by penetration specific analysis.

PLANT AND SYSTEM IDENTIFICATION:

General Electric - Boiling Water Reactor - 2527 MWt rated core thermal power.

Energy Industry Identification System (EIIS) codes are identified in the text as [XX] and are obtained from IEEE Standard 805-1984, IEEE Recommendation Practice for System Identification in Nuclear Power Plants and Related Facilities.

EVENT IDENTIFICATION:

Containment Penetrations Outside Design Basis due to Analysis of Thermally Induced Post-Accident Over-pressurization.

A. PLANT CONDITIONS PRIOR TO EVENT:

Unit: 2(3) Event Date: 1/27/97 Event Time: 1810

Reactor Mode: 1(4) Mode Name: Run(Shutdown Power Level: 100(0)

Reactor Coolant System Pressure: 990(0) psig

B. DESCRIPTION OF EVENT:

This LER is being submitted pursuant to 10 CFR 50.73(a)(2)(ii)(B) which requires the reporting of any event or condition that resulted in the nuclear power plant: In a condition that was outside the design basis of the plant.

NRC Generic Letter 96-06 was issued on September 30, 1996 and identified a thermally induced over pressurization issue that could occur under post-accident conditions. The concern was that isolated water filled piping sections that penetrate containment could become over-pressurized following an accident that released energy into the containment, and subsequently jeopardize the ability of accident mitigating systems to perform their safety functions or fail, resulting in a breach of containment integrity.

Over the next four months, a review was performed to identify the piping sections for which this pressurization could jeopardize the ability of accident mitigating systems to perform their safety functions or could lead to breach of containment or bypass leakage.

Of the systems reviewed, twelve Unit 2 penetrations and eleven Unit 3 penetrations were determined to be potentially susceptible to the over pressurization conditions discussed in the Generic Letter. The penetration and system descriptions are as follows:

| | |
|---|---|
| X-139B, X-144 (Unit 2), and X-139C (Unit 3) | - Control Rod Drive [CD] |
| X-119 (Unit 2 and 3) | - Demin. Water Piping [KC] |
| X-109B (Unit 2) and X-109A (Unit 3) | - Isolation Condenser Return [BL]* |
| X-117 (Unit 2 and 3) | - Drywell Floor Drain [WK] |
| X-118 (Unit 2 and 3) | - Drywell Equipment Drain [WK] |
| X-122 (Unit 2 and 3) | - Reactor Recirc. Sample Line [KN] |
| X-113 (Unit 2 and 3) | - Reactor Water Cleanup [CE] |
| X-111A and X-111B (Unit 2 and 3) | - Shutdown Cooling [BO] |
| X-123 and X-124 (Unit 2 and 3) | - Reactor Bldg. Closed Cooling [CC] |

* The penetrations were later found to be not susceptible.

These penetrations have valves on each side of the containment wall which are or may be closed during normal plant operation. The fluid trapped between the valves could be potentially heated during a loss of coolant accident or a main steam line break inside containment.

Since the post accident thermally induced pressures could be significant, the resultant pressure should have been included in the design basis of the containment penetrations. The significance of post accident thermally induced pressurization of containment penetrations was not known at the time the original design basis was established, and therefore, these pressures were not accounted for in the original design.

As systems were identified that could experience the thermal over-pressurization concerns, operability determinations were performed. These operability determinations were performed between January 7, 1997 and January 24, 1997 and determined the systems to be operable but degraded. The operability determinations were reviewed and the systems involved determined to be outside the design bases. The NRC was notified via the ENS phone on January 27, 1997 at 1843.

Each segment of piping system that could potentially be affected by post accident thermally induced pressurization including the specific circumstances involved, the basis for continued operability and the corrective actions are given below.

1. The isolated portion of the control rod drive system pipe lines at Unit 2 penetration X-139B and the Unit 3 penetration X-139C are susceptible to thermally induced pressurization. The flow paths associated with these lines are used for pressure testing of the reactor recirculation pumps, the lines are not used during normal plant operation and the containment isolation valves are closed during all plant operating modes except shutdown. The lines were partially drained to assure continued operability. ComEd is actively working with EPRI and NEI in determining the best options with respect to addressing thermally induced pressurization. The outcome of the subject industry efforts may be used to finalize the long term resolution for this penetration. If, the industry efforts are unsuccessful, Dresden intends to install a relief valve on the penetration piping inside drywell to eliminate reliance on draining to prevent thermally induced pressurization.

2. The isolated portion of the control rod drive system pipe line at Unit 2 penetration X-144 is susceptible to thermally induced pressurization. This line is non-safety related and is no longer used. The line was drained to assure continued operability. Dresden intends to install a blind flange to isolate the unused piping at the above penetration from the active part of the control rod drive system and drain the water in the penetration piping to eliminate the potential for thermally induced pressurization at penetration X-144.

3. The isolated portion of the demineralized water system line at Unit 2 and 3 penetration X-119 that supplies water to the drywell during plant outage is susceptible to post LOCA thermally induced pressurization. The flow path associated with this line is non-safety related. When the concern was identified Dresden Unit 3 was shutdown and the piping at Unit 3 penetration was drained from inside containment prior to the drywell close-out to assure continued operability. Subsequently, a relief valve was installed to prevent over pressurization. When the concern was identified Unit 2 was at full power and the line could not be drained and the operability was based on valve bonnet leakage. Subsequently the penetration was drained from inside drywell and Dresden intends to install a relief valve to eliminate the potential for thermally induced pressurization.

4. The isolation condenser system condensate return line at Unit 2 penetration X-109B and Unit 3 penetration X-109A has a normally closed isolation valve on the outside and a normally open containment isolation valve on the inside. The above penetration piping was initially identified to be susceptible to thermally induced pressurization if the inboard isolation valve is closed due to a Group V isolation signal, which indicates a failure in the isolation condenser system. However, due to the piping configuration the natural convective flow inside the pipe is expected to keep the penetration piping hot. The temperature of the Unit 2 and Unit 3 penetration piping outside drywell were measured and found to be over 300°F. Since, the post LOCA drywell ambient temperature does not exceed 300° F, the Unit 2 and 3 penetration piping are not susceptible to thermally induced pressurization.

5. The drywell floor drain (Reactor Building Equipment Drain System) sump pump discharge pipe at Unit 2 and 3 penetration X-117 is susceptible to thermally induced pressurization. The isolation valves are located outside containment. However, the isolated volume at penetration X-117 between the inboard isolation valve(located outside containment) and the check valves at the sump pump discharge is susceptible to thermally induced pressurization. Continued operability is assured by the non-safety related relief valve on connected high radiation sampling system branch lines. A relief valve was installed to provide over pressure protection for the Dresden Unit 3 penetration and Dresden intends to install a similar relief valve on the Dresden Unit 2 penetration.

6. The drywell equipment drain (Reactor Building Equipment Drain System) sump pump discharge pipe at Unit 2 and 3 penetration X-118 is susceptible to thermally induced pressurization. The isolation valves are located outside containment. However, the isolated volume at penetration X-118 between the inboard isolation valve (located outside containment) and the check valves at the sump pump discharge is susceptible to thermally induced pressurization. There is a normally open, air operated valve between the inboard isolation valve (located outside containment) and the check valves at the sump pump discharge. If the normally open air operated gate valve (AOV) is closed during the accident the isolated volume between the AOV and the inboard isolation valve could become susceptible to thermally induced pressurization. The allowable design pressure of the piping at containment penetration is three times that of the air operated gate valve and therefore the air operated valve is the weak link in this isolated volume. One of the AOV will develop a leak through either the bolted bonnet assembly, stem packing or the valve disk/plug and depressurize the isolated volume. The other isolation valves will remain intact and assure containment integrity. A relief valve was installed to provide over pressure protection for the Dresden Unit 3 penetration and Dresden intends to install a relief valve on the Dresden Unit 2 penetration.

7. The Reactor Recirculation system sample lines at Unit 2 and 3 penetration X-122 have normally open containment isolation valves and the lines are normally hot. However, if the lines are isolated prior to an accident, the lines could be cold and may be susceptible to thermally induced pressurization. The isolation valves are air operated. As thermally induced pressure increases between the isolation valves, the air operator spring force that keeps the valves closed will be overcome by the pressure force on the disk. The air operator on the outboard side of the drywell will lift, relieving the pressure buildup and subsequently reseating, assuring continued operability. However, when the line is isolated for maintenance during plant operation, the penetration may become susceptible to thermally induced pressurization and procedures were revised to prevent thermally induced pressurization as a result of maintenance. In order to eliminate reliance on procedures to prevent thermally induced over pressurization, Dresden intends to install a bypass line with a spring check valve around the inboard isolation valve. The check valves will function as a normally closed inboard isolation valve, open during accident condition to relieve thermally induced pressurization and then close after the pressure is relieved to the reactor pressure vessel (RPV).

8. During normal plant operation, the reactor water clean-up system containment isolation valves at Unit 2 and 3 penetration X-113 are open, and the lines have continuous flow and are normally hot. However, if the line is isolated prior to the accident the containment penetration piping and the isolation valves at penetration X-113 will be susceptible to thermally induced pressurization. The reactor water clean-up piping inside drywell at penetration X-113 is insulated and will heat up and pressurize at a significantly slower rate than uninsulated pipe. The continued operability of the above isolated section is based on the slower pressurization rate due to pipe insulation and the measured air leakage rate from the latest valve local leakage rate tests. However, when the line is isolated for maintenance during plant operation, the penetration may become susceptible to thermally induced pressurization and procedures were revised to prevent thermally induced pressurization during system shutdown for maintenance. In order to eliminate reliance on procedures to prevent thermally induced over pressurization, Dresden intends to install a bypass line with a spring check valve around the inboard isolation valve. The check valves will function as a normally closed inboard isolation valve, open during accident condition to relieve thermally induced pressurization and then close after the pressure is relieved to the reactor pressure vessel (RPV).

9. The shutdown cooling system at Unit 2 and 3 containment penetrations X-111A and X-111B is susceptible to thermally induced pressurization. Since the continuation piping outside containment are non-safety related, the valves are not required to operate after the accident. However, the shutdown cooling containment penetration piping and isolation valves are required to maintain structural integrity. The shutdown cooling piping inside drywell between the inboard isolation valves and the penetration are insulated and therefore will heat up and pressurize at a significantly slower rate than uninsulated pipe. The continued operability of the above isolated piping section is based on the slower pressurization rate due to insulation and the measured air leakage rate from the latest valve local leakage rate tests. A relief valve was installed to provide over pressure protection for the Dresden Unit 3 penetration and Dresden intends to install a relief valve on the Dresden Unit 2 penetration.

10. The reactor building closed cooling water (RBCCW/CC) system supply to the containment enters the drywell through Unit 2 and 3 penetration X-123, supplies water to the non-safety related cooling needs in the containment and leaves the containment through Unit 2 and 3 penetration X-124. At the supply penetration there is a motor operated valve (MOV) on the outside and a check valve on the inside. At the return penetration there is a MOV on the inside and another MOV on the outside. All piping inside the drywell other than those between the containment isolation valves are non-safety related. The isolation valves and the safety related piping between them are required to maintain structural integrity. However, the valves are not required to open after an accident. The RBCCW(CC) containment isolation valves do not automatically close due to any isolation signal. During and after an accident the RBCCW(CC) continue to operate and supply water to the non-safety related cooling needs in the drywell. As long as the isolation valves remain open the RBCCW(CC) piping will not be subject to thermally induced pressurization. However, following an accident the RBCCW(CC) inside drywell may be manually isolated due to RBCCW pump trip or low RBCCW(CC) expansion tank level. If and when the containment isolation valves are manually closed, the RBCCW(CC) inside containment will become susceptible to thermally induced pressurization.

    (a) The non-safety related RBCCW(CC) piping inside containment form a closed volume that contains seven drywell coolers, the Recirculation pump coolers and the drywell equipment sump heat exchanger that is susceptible to thermally induced pressurization. The above closed volume contain many non-safety related cooling units that are not designed for the high pressures associated with thermally induced pressurization. The tube wall thickness is sized for heat transfer performance. The non-safety related cooling coils will develop a leak and depressurize the piping before significant pressures that challenge the integrity of the safety related inboard isolation valves at penetrations X-123 and X-124 are developed. Continued operability is assured by the above leakage through the non-safety related cooling coils. A relief valve was installed to provide over pressure protection for Dresden Unit 3 and Dresden intends to install a relief valve on the Dresden Unit 2.

    (b) The RBCCW(CC) containment penetration piping at the supply penetration X-123 has a motor operated valve on the outside and a check valve on the inside. The leak in the drywell cooling coils discussed above will relieve the thermally induced pressure in the non-safety related piping inside drywell. As the non-safety related closed loop depressurizes, the inboard check valve will open, relieve the pressure and assure continued operability. The relief valve that is installed to provide over pressure protection for the closed non-safety related loop inside drywell also provides over pressure protection for the isolated volume at penetration X-123.

(c) The RBCCW(CC) containment penetration piping at drywell penetration X-124 has a motor operated valve on the inside and another motor operated valve on the outside. The RBCCW(CC) piping inside the drywell is not insulated and is susceptible to rapid heat-up due to the post accident hot drywell environment. The allowable design pressure of the piping at containment penetration is approximately three times that of the valve and therefore the valve is expected to be the weak link in this isolated volume. Therefore, one of the valves is expected to develop a leak through either the bolted bonnet assembly, stem packing, or the valve disk/plug and depressurize the isolated volume. The other isolation valves will remain intact and assure containment integrity. A relief valve was installed to provide over pressure protection for the Dresden Unit 3 penetration and Dresden intends to install a relief valve on the Dresden Unit 2 penetration.

No systems or components were inoperable at the start of this event which contributed to the event. In addition, no manual or automatic engineered safety feature (ESF) actuation occurred as a result of this event.

C. CAUSE OF EVENT:

The cause of the event was Design Deficiency (NRC Cause Code B) in that the original plant design did not account for the possibility of overpressurization of isolated portions of piping penetrating containment. The thermally induced pressurization is a new issue identified in NRC Generic Letter 96-06 and the significance of it was not considered at the time the original design basis of the Dresden Station was established.

D. SAFETY ANALYSIS:

Dresden Operability Assessments 96-70, 97-10 and 97-11 were completed by January 24, 1997 in accordance with Generic Letter 91-18 to document the basis for continued operability of these affected penetrations and systems/components.

The basis for operability of these affected penetrations includes consideration of one or more of the following: leakage from one of the containment isolation valves (seat, packing, or body to bonnet flange), insulation of piping to delay the temperature increase, lifting of air operated valves due to the pressure increase and draining of the isolated portion.

If an accident had occurred which resulted in containment temperature increase, and subsequent isolated piping pressurization, these relief paths were available which would have made it less likely that piping or containment failure would have occurred. Had containment failure occurred that resulted in a release path to the Reactor Building, secondary containment and Standby Gas Treatment would have been mitigating factors for the event. Since the failure of the system boundary or an isolation valve would not necessarily cause a breach of containment, and given the redundant containment systems in place, the impact on the health and safety of the public is not significant. As a result, the safety significance of the event is minimal.

E. CORRECTIVE ACTIONS:

1. An extensive review of isolated piping sections that affect containment integrity has been performed. (Complete)

2. Operability determinations were performed on piping affected by post-accident thermal over-pressurization. (Complete)

3. The piping between the closed containment isolation valves was drained on Unit 2 and Unit 3 Control Rod Drive System [CD] and Unit 3 Demineralized Water System [KC]. Additional thermal insulation was installed on piping inside the containment on Unit 3 Reactor Building Closed Cooling system [CC]. (Complete)

4. To provide permanent corrective action, either over-pressure protection will be installed or penetration specific analytical considerations that confirm over pressurization is not a concern will be generated.(NTS #2371809700305S1 and 2371809700306S1)

5. The modification process will be evaluated to ensure that future modifications account for overpressurization concerns. (Complete)

6. To ensure that appropriate lines are drained following future outages, procedures will be evaluated and changes made as necessary. (Complete)

7. Evaluate measured leakage rates from LLRT program until the long term resolution is carried out and confirm that the operability determination is not affected by the changes in measured LLRT leakage rates.(NTS #2371809700307S1)

F. PREVIOUS OCCURRENCES:

No similar previous occurrences of this nature were identified.

G. COMPONENT FAILURE DATA:

Not Applicable