



R. Michael Glover
H. B. Robinson Steam
Electric Plant Unit 2
Site Vice President

Duke Energy Progress
3581 West Entrance Road
Hartsville, SC 29550

O: 843 857 1704
F: 843 857 1319

Mike.Glover@duke-energy.com

10 CFR 50.73

JUN 13 2016
Serial: RNP-RA-16-0035

United States Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/RENEWED LICENSE NO. DPR-23

LICENSEE EVENT REPORT NO. 2016-002-00:
UNANALYZED CONDITON RELATED TO MAIN STEAM LINE BREAK INSIDE CONTAINMENT

Ladies and Gentlemen:

Pursuant to 10 CFR 50.73, Duke Energy Progress, Inc. is submitting the attached Licensee Event Report. Administrative controls have been implemented to ensure full compliance with NRC regulations. Should you have any questions regarding this matter, please contact Mr. S. Connelly, Acting Manager – Nuclear Regulatory Affairs at (843) 857-1569.

This document contains no new regulatory commitments.

Sincerely,

R. Michael Glover For

R. Michael Glover
Site Vice President

RMG/jmw

Attachment

c: Regional Administrator, NRC, Region II
NRC Resident Inspector, HBRSEP
D. Galvin, NRR

United States Nuclear Regulatory Commission
Attachment to Serial: RNP-RA/16-0035
5 Pages (including this cover page)

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
UNANALYZED CONDITON RELATED TO MAIN STEAM LINE BREAK INSIDE
CONTAINMENT



LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of
digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollections.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. FACILITY NAME

H. B. Robinson Steam Electric Plant, Unit No. 2

2. DOCKET NUMBER

05000 261

3. PAGE

1 OF 4

4. TITLE

Unanalyzed Condition Related to Main Steam Line Break Inside Containment

| 5. EVENT DATE | | | 6. LER NUMBER | | | 7. REPORT DATE | | | 8. OTHER FACILITIES INVOLVED | |
|-------------------|-----|------|---|---|---------|--|-----|---|------------------------------|---------------|
| MONTH | DAY | YEAR | YEAR | SEQUENTIAL NUMBER | REV NO. | MONTH | DAY | YEAR | FACILITY NAME | DOCKET NUMBER |
| 04 | 13 | 2016 | 2016 | 002 | 00 | 06 | 13 | 2016 | FACILITY NAME | DOCKET NUMBER |
| | | | | | | | | | | 05000 |
| 9. OPERATING MODE | | | 11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply) | | | | | | | |
| 1 | | | <input type="checkbox"/> 20.2201(b) | <input type="checkbox"/> 20.2203(a)(3)(i) | | <input type="checkbox"/> 50.73(a)(2)(ii)(A) | | <input type="checkbox"/> 50.73(a)(2)(viii)(A) | | |
| | | | <input type="checkbox"/> 20.2201(d) | <input type="checkbox"/> 20.2203(a)(3)(ii) | | <input checked="" type="checkbox"/> 50.73(a)(2)(ii)(B) | | <input type="checkbox"/> 50.73(a)(2)(viii)(B) | | |
| | | | <input type="checkbox"/> 20.2203(a)(1) | <input type="checkbox"/> 20.2203(a)(4) | | <input type="checkbox"/> 50.73(a)(2)(iii) | | <input type="checkbox"/> 50.73(a)(2)(ix)(A) | | |
| | | | <input type="checkbox"/> 20.2203(a)(2)(i) | <input type="checkbox"/> 50.36(c)(1)(i)(A) | | <input type="checkbox"/> 50.73(a)(2)(iv)(A) | | <input type="checkbox"/> 50.73(a)(2)(x) | | |
| 10. POWER LEVEL | | | <input type="checkbox"/> 20.2203(a)(2)(ii) | <input type="checkbox"/> 50.36(c)(1)(ii)(A) | | <input type="checkbox"/> 50.73(a)(2)(v)(A) | | <input type="checkbox"/> 73.71(a)(4) | | |
| | | | <input type="checkbox"/> 20.2203(a)(2)(iii) | <input type="checkbox"/> 50.36(c)(2) | | <input type="checkbox"/> 50.73(a)(2)(v)(B) | | <input type="checkbox"/> 73.71(a)(5) | | |
| | | | <input type="checkbox"/> 20.2203(a)(2)(iv) | <input type="checkbox"/> 50.46(a)(3)(ii) | | <input type="checkbox"/> 50.73(a)(2)(v)(C) | | <input type="checkbox"/> 73.77(a)(1) | | |
| | | | <input type="checkbox"/> 20.2203(a)(2)(v) | <input type="checkbox"/> 50.73(a)(2)(i)(A) | | <input type="checkbox"/> 50.73(a)(2)(v)(D) | | <input type="checkbox"/> 73.77(a)(2)(i) | | |
| | | | <input type="checkbox"/> 20.2203(a)(2)(vi) | <input type="checkbox"/> 50.73(a)(2)(i)(B) | | <input type="checkbox"/> 50.73(a)(2)(vii) | | <input type="checkbox"/> 73.77(a)(2)(ii) | | |
| | | | | <input type="checkbox"/> 50.73(a)(2)(i)(C) | | <input type="checkbox"/> OTHER | | Specify in Abstract below or in NRC Form 366A | | |

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT

S. Connelly - Acting Manager, Nuclear Regulatory Affairs

TELEPHONE NUMBER (Include Area Code)

(843) 857-1569

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

| CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE TO EPIX | CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE TO EPIX |
|-------|--------|-----------|--------------|--------------------|-------|--------|-----------|--------------|--------------------|
| B | SJ | N/A | N/A | Y | | | | | |

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE) ☒ NO

15. EXPECTED SUBMISSION DATE

| MONTH | DAY | YEAR |
|-------|-----|------|
| | | |

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

At 1430 hours EST on 4/13/2016 with H. B. Robinson Steam Electric Plant, Unit No. 2 in Mode 1 at 100 percent power, it was determined that the source document for the mass and energy release parameters used to determine the containment pressure and temperature response to a main steam line break inside containment does not adequately account for all possible single active failure scenarios in the steam or feedwater line isolation provisions. The source document addresses the active failure of the main feedwater regulating valves to close in the faulted steam generator feedline, but not the failure of a feedwater regulating bypass valve to close in that feedline. An active failure of a feedwater regulating bypass valve whereby the valve fails to close will increase the secondary mass available for release to the containment structure. This can result in higher peak containment pressure that could challenge the containment design pressure. This condition is only a concern when the feedwater regulating bypass valves are in the open position in Modes 1, 2, or 3, and they fail to close on an engineered safeguards actuation signal. Administrative controls and corrective actions have been implemented to maintain design control of the feedwater regulating bypass in these modes of operation.

**LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET**

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollect.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

| 1. FACILITY NAME | 2. DOCKET | 6. LER NUMBER | | | 3. PAGE |
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| H. B. Robinson Steam Electric Plant, Unit No. 2 | 05000 261 | YEAR | SEQUENTIAL NUMBER | REV NO. | 2 OF 4 |
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NARRATIVE**BACKGROUND****Regulatory**

Technical Specification (TS) Limiting Condition For Operation (LCO) 3.7.3 requires three Main Feedwater Isolation Valves (MFIVs) [ISV], three Main Feedwater Regulating Valves (MFRVs)[FCV], and three bypass valves[V] to be operable, except when valves are closed or isolated by a closed manual valve[V]. The capability for these valves to close following a steam line break is relied upon to terminate core response to excess feedwater flow induced Reactor Coolant System (RCS)[RCS] cooling, and to terminate mass energy release inside containment[VSL]. Continued feedwater flow to a faulted Steam Generator (SG)[SG] will provide additional secondary mass available for release to Containment resulting in a calculated exceedance of the structure's design pressure and its operability. Per T.S. 3.6.1, Containment shall be operable in Modes 1, 2, 3, and 4. This scenario was not considered in the plant safety analysis, and is therefore an unanalyzed condition.

The regulatory impact to the station as a consequence of this condition necessitates a 60-day licensee event report (LER) to the Nuclear Regulatory Commission (NRC) under 10 CFR 50.73(a)(2)(ii)(B), "Degraded or Unanalyzed Condition," and required an 8-hour non-emergency notification per 10 CFR 50.72(b)(3)(ii)(B), "Degraded or Unanalyzed Condition."

Technical

H. B. Robinson Steam Electric Plant, Unit No. 2, (HBRSEP2) is equipped with three steam generators (SGs). Feedwater (FW) is independently supplied to each SG through a main feedwater isolation valve (MFIV) followed in series by a main feedwater regulating valve (MFRV). Both valves are designed to close on a Feedwater Isolation signal for the purpose of isolating FW. Each main feedwater line includes a bypass line with a smaller regulating valve known as the feedwater regulating bypass valve (FRBV). This line bypasses both the MFIVs and MFRVs and is connected upstream of the MFIVs. The FRBVs are normally closed during full power operation, will automatically close on Feedwater Isolation signal, and are used primarily during startup and shutdown when reduced feedwater flow is required to maintain SG water inventory. These valves may also be used during full power operation when automatic control of the MFRVs is not available. Because the bypass line is connected upstream of the MFIVs, there is no redundancy to automatic flow isolation through this bypass line. With the FRBV open during a faulted SG event, there could be continued FW if the FRBV failed to close as designed.

EVENT DESCRIPTION

At 1430 hours EST on 4/13/2016, with the plant in Mode 1 at 100 percent power and no involvement of out-of-service structures, systems or components, a condition was identified with the Main Feedwater system [SJ] whereby the current MSLB accident analysis does not consider a single active failure of the FRBVs (FCV-479, FCV-489 and FCV-499) to close coincident with a MSLB inside containment. This resulted in an unanalyzed condition that is contrary to the plant's design basis.

Westinghouse report, WCAP-15305, "Carolina Power & Light Company H.B. Robinson Steam Electric Plant Unit No. 2, Steam Line Break Containment Integrity Analysis," is the source document for the mass and energy release parameters to determine the containment pressure and temperature response to a MSLB. Nuclear Regulatory Commission (NRC) guidance provides that for steam and feedwater line break analyses the analysis should assume a single active failure in the steam or feedwater line isolation provisions or feedwater pumps[P] to maximize the containment peak pressure and temperature. The active failures in the feedwater line isolation provisions included in the WCAP only include failure of the main feedwater control valves (FCV-478, FCV-488 and FCV-498) to close in the faulted SG feedline. The WCAP does not address failure of the FRBVs (FCV-479, FCV-489 and FCV-499) to close in the faulted SG feedline. Operating Procedure (OP)-106, "NORMAL PLANT OPERATIONS," contains provisions for operation of the FRBVs in Mode 1. These valves are also open during plant startup. Upon a MSLB or a loss of coolant accident (LOCA) in containment the engineered safety features actuation system (ESFAS)[JE] is designed to actuate Feedwater Isolation which isolates feedwater (including tripping the main feed pumps[P]), by closing the MFRVs, the FWRVs, and the MSIVs.

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EVENT DESCRIPTION (Continued)

An active failure of a FRBV whereby the valve fails to close will increase the secondary mass available for release to the containment as well as increase the heat transferred to the secondary fluid. During an ESFAS initiation or Feedwater Isolation signal, the condensate pumps[P] and the heater drain pumps[P] (until low level trip) would continue to provide feedwater to the failed open FRBV. Increased secondary mass available for release to the containment will result in a higher peak containment pressure that would exceed the containment design pressure of 42 pounds per square inch gauge (PSIG), and can alter the offsite and control room total effective dose equivalent (TEDE) doses.

The relevant analyses that appear to be unanalyzed for this scenario are Updated Final Safety Analysis Report (UFSAR) Chapter 6.2.1.4, "Containment Analysis for Postulated Secondary System Pipe Ruptures," (WCAP-15305) related to containment design, and UFSAR Chapter 15.1.5, "Main Steamline Break Event," (ANP-2560) related to radiological consequences for both 102% power and Hot Zero Power conditions.

WCAP-15305 and ANP-2560 do not address a single failure of a feedwater bypass valve, and based on the estimated flow rates through the feedwater bypass valves following a feedwater pump trip. The resulting increase in secondary mass available for release to the containment under this postulated single failure is considered an unanalyzed condition.

A Prompt Determination of Operability (PDO) was prepared that recommended the Containment be considered operable but in a non-conforming condition while the plant was in Modes 1, 2, and 3, and that the FRBVs should remain closed and/or isolated while operating in these Modes. Administrative controls and corrective actions have been established to ensure this configuration.

CAUSAL FACTORS

The cause analysis resulting from this event has determined that during the establishment of the plant's current licensing basis for MSLB inside containment, the postulated single failure of the feedwater regulating bypass valve to close was not considered. This is a combination of original design issues and plant engineering decisions and activities that took place during the 1980s.

CORRECTIVE ACTIONS

Corrective actions in response to the condition and to restore compliance with regulations are listed below.

Immediate:

1. CR 2012658 generated to capture conditions in Corrective Action Program.
2. CR 2020495 generated to capture extent of condition in Corrective Action Program.
3. CR 2018710 generated to capture incorrect response to NRC IE Bulletin 80-04.
4. Standing Instruction 16-0003 implemented and Caution Tags placed on the FRBVs.

Planned:

1. Revise plant containment analysis input documents to complete a single failure analysis to address all the secondary side assumptions and make provisions for implementing further corrective actions as necessary.
2. Complete engineering change to update single failures to containment analysis inputs and licensing basis for MSLB to incorporate the feedwater isolation single failures as defined in related calculation into the current licensing basis.

SAFETY ANALYSIS

Failure of the feedwater bypass valves to automatically close following a main steamline break inside containment was found to be an issue as a single failure may lead to containment overpressure. This scenario was assessed utilizing probabilistic risk assessment methodology to determine the likelihood of this scenario occurring. Using conservative modeling techniques and conservative failure frequencies for the postulated events, this scenario was assessed and determined to have a very low safety significance. Two different failure modes were postulated for the valves: failure to close on demand and spuriously open during operation (and relevant common cause failures). These failure modes were evaluated for time frames determined from plant operation data and limited operator action was credited. The assessment determined that the scenario has a low safety significance for the periods with the valve(s) open. In addition this analysis did not credit any other potentially mitigating system to avert core damage in order to bound the analysis.

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NARRATIVE

ADDITIONAL INFORMATION

A review of the industry Operating Experience (OE) was performed for a five (5) year span from 2011 to 2016. The search produced 433 reports. Several reports were reviewed for applicability based on subject titles, however no OE reviewed had the same circumstances as the subject condition, where an inadequate single failure analysis of the system was utilized in containment structure design pressure determination.

Energy Industry Identification System (EIIS) codes for systems and components relevant to this event are identified in the text of this document within brackets [].