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LIC-96-0006

U. S. Nuclear Regulatory Commission
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Washington, D.C. 20555

References: 1. Docket No. 50-285
2. Combustion Engineering Owners Group (CEOG) Final Report, CE NPSD-1014, dated July 1995

SUBJECT: Request for Relief from the American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel Code, Section III, Overpressure Protection Requirements for Chemical & Volume Control System

The Omaha Public Power District (OPPD) requests relief from the ASME Boiler & Pressure Vessel Code, Section III overpressure protection requirements for the Chemical & Volume Control System (CVCS). Specifically, this ASME Code relief request pertains to the existing stop valves located upstream and downstream of the spring-loaded check valve CH-202 in the CVCS.

Valve CH-202 provides thermal overpressure protection for the regenerative heat exchanger CH-6. The CH-6 heat exchanger was built to the 1968 Edition of ASME Section III, Class C requirements. ASME Section III, Article 9 states that any stop valve on the inlet or discharge side of an overpressure protective device must be "positively controlled and interlocked" to ensure that the overpressure protection function is not defeated. While there are no interpretations of the phrase "positively controlled and interlocked" for the 1968 Edition, later versions of the ASME Code and Code Interpretations, which were issued after Fort Calhoun Station (FCS) was constructed, do address this issue.

An interpretation of Section III, Division I, NC-7142 (III-1-80-67, registered in 1980) explicitly states that operating procedures can be part of mechanical controls of a locked valve. However, a subsequent revision of the same interpretation (III-1-80-67R, dated 1989) stated that operating procedures are not acceptable. The revision of Code Interpretation III-I-80-67 casts uncertainty on the acceptability of having administratively-controlled intervening stop valves on CH-202. Therefore, OPPD requests relief from the ASME Section III overpressure protection requirements for the existing CVCS configuration at FCS.

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Please find attached OPPD's relief request for FCS. The attached relief request is based on one developed by the Combustion Engineering Owner's Group for FCS in Reference 2.

If you should have any questions, please contact me.

Sincerely,

T. L. Patt

T. L. Patterson
Division Manager
Nuclear Operations

TLP/dll

Attachment

c: Winston & Strawn
L. J. Callan, NRC Regional Administrator, Region IV
L. R. Wharton, NRC Project Manager
W. C. Walker, NRC Senior Resident Inspector

OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION (FCS) UNIT NO. 1

Request for Relief from ASME Boiler & Pressure Vessel Code Section III, Overpressure Protection Requirements

By this document, relief is requested from ASME Boiler & Pressure Vessel Code Section III (1968 Edition), Article 9, as allowed under 10 CFR 50.55a(a)(3). Specifically, this request for permanent relief is to allow a manual isolation valve to remain installed downstream and a remote-operated control valve installed upstream of a thermal overpressure relief device for the subject unit's regenerative heat exchanger in the Chemical and Volume Control System (CVCS).

It is the position of the Omaha Public Power District (OPPD) that the plant's existing design configuration satisfies the intent of ASME III, Article 9 for overpressure protection and therefore provides an acceptable level of quality and safety.

COMPONENT FOR WHICH RELIEF IS REQUESTED

Permanent relief is requested for the manual isolation valve CH-345 located downstream of spring-loaded check valve CH-202; and for the remote-operated control valve HCV-247 located upstream of CH-202 (see Figure 1). Valve CH-202 provides thermal overpressure protection for the shell side of the Regenerative Heat Exchanger CH-6, which is a Class C vessel per the 1968 Edition of ASME Section III. This heat exchanger transfers heat from the hot Reactor Coolant System (RCS) letdown fluid on the tube side of the heat exchanger to the cooler charging fluid on the shell side of the heat exchanger. CH-202 provides a thermal expansion flow path for the shell side fluid in CH-6 in the event that the charging side is isolated and hot RCS fluid continues to flow through the tube side of the heat exchanger. Valves CH-202 and CH-345 are located in a bypass line arrangement around charging line isolation valve HCV-238. HCV-247 is located upstream of HCV-238 and its bypass line.

CODE REQUIREMENTS FROM WHICH RELIEF IS REQUESTED

ASME Boiler & Pressure Vessel Code Section III (1968 Edition), Article 9, paragraph N-910.8 states: "Any stop valve or similar device on the inlet or discharge side of a protective device provided in conformity with N-910.7 shall be so constructed, positively controlled and interlocked that the requirement of N-910.1 will be complied with under all conditions of operation of the system."

PROPOSED ALTERNATIVE

It is proposed to maintain the plant in its current system configuration. That is, valves CH-345 and HCV-247 will be maintained in the locked-open position via the following:

- Manual isolation valve CH-345 is physically locked in position by a lock and chain. The valve is itemized on the locked component list (Standing Order O-44, "Administrative Controls for the Locking of Components") and in the applicable Operating Instruction checklist. Standing Order O-44 requires independent verification of correct component position.

- Remote-operated valve HCV-247 is maintained locked open via a keylock-type control switch in the Control Room. The correct position of this valve is confirmed through a step in the applicable Operating Instruction.

Background

As a result of actions by Baltimore Gas and Electric Co. (BGE) for the Calvert Cliffs Nuclear Power Plants (CCNPP), an issue was raised as to whether the location of a manual isolation valve downstream of a thermal overpressure relief valve for the regenerative heat exchanger complied with the original intent of the ASME Code. The CVCS at CCNPP was designed by Combustion Engineering, Inc. (CE).

FCS, like the CCNPP, has the standard CE design for the CVCS. That is, a manual isolation valve (CH-345) exists downstream of a spring-loaded check valve (CH-202), which is acting as a relief device. Remote-operated valve HCV-247, and its twin HCV-248, were installed for the specific purpose of assuring positive isolation of the charging lines in the post-Loss-of-Coolant-Accident (LOCA) long-term cooling condition. These valves provide additional isolation capability to assure that all redirected High Pressure Safety Injection (HPSI) system flow is delivered to the RCS hot leg via the pressurizer auxiliary spray line to avoid boron precipitation. An evaluation was conducted to ascertain whether the current system configuration satisfies the intent of the ASME Code with respect to overpressure protection.

The regenerative heat exchanger was constructed as a Class C vessel per the 1968 Edition of the ASME Code, Section III. As described in the Updated Safety Analysis Report (USAR) Section 9.2.3.1, the heat exchanger was subject to additional quality control and fatigue analysis requirements beyond those normally required of a Class C vessel. A thorough review of the various ASME Code and Code interpretations for locating stop valves downstream of pressure relieving devices was performed in support of this relief request.

Class C requirements, as described in Article 21, for the most part are referenced to ASME Section VIII. However, for overpressure protection requirements, Article 21 references the requirements in ASME III Article 9, namely Class A. Paragraph N-2111 states, "The requirements of Section VIII of the Code shall apply to the materials, design, fabrication, inspection and testing, and certification of Class C vessels except that the following additional requirements shall apply." Paragraph N-2114 describes that for overpressure protection, the rules of Section VIII, UG-125 through UG-134 do not apply and the requirements in Article 9 shall be substituted. ASME Section III, Article 9, Paragraph N-910.8 therefore requires that valves CH-345 and HCV-247 be "positively controlled and interlocked."

Please note that ASME Section VIII, Paragraph UG-134(e)(2) states that there shall be no stop valves between the protective device and its point of discharge except under the conditions set forth in Appendix M. Appendix M, Paragraph UA-355 allows stop valves on the discharge side of a pressure relieving device provided that the stop valve "can be locked or sealed in either the open or closed position, and it shall be locked or sealed in either position only by an authorized person." If the regenerative heat exchanger had been designed to ASME Section VIII, the Code would allow the locked-open valve configuration.

While there are no interpretations of the Article 9 phrase "positively controlled and interlocked" for the 1968 Edition, later versions of the ASME Code and Code Interpretations (issued after Fort Calhoun was constructed) do address this issue. An interpretation of ASME Section III, Division I, NC-7142 (interpretation III-1-80-67, registered in 1980) explicitly states that operating procedures can be part of mechanical controls of a locked valve. However, a subsequent revision of the same interpretation (III-1-80-67R in 1989) states that operating procedures are not acceptable.

Since it is not possible to clearly determine the 1968 Edition ASME III intent for the words "positively controlled and interlocked," OPPD is seeking recognition of the existing CVCS design in the form of Code relief.

Evaluation

OPPD has evaluated the existing system configuration. This evaluation of the existing system condition considered the following alternate arrangements:

- Removal of CH-345 and making necessary piping changes so that the branch to CH-202 is upstream of HCV-247. BGE estimated the cost of removing only the manual downstream valve (comparable to CH-345) would be approximately $290,000 and would involve significant radiation exposure. It is expected that the cost to OPPD would be higher because the scope of the design change would be greater than that considered in BGE's estimate.

- Removal of the bypass line around HCV-238, including removal of CH-345 and CH-202, and installation of a dedicated, conventional spring-loaded thermal relief valve for the regenerative heat exchanger. Based upon estimates prepared by BGE, such a modification would cost approximately $1 million and involve extended activities in a high radiation area.

- Installation of electrical-mechanical interlocks between CH-345, HCV-238, and HCV-247. Based upon estimates prepared by BGE, the cost of this modification would be approximately $685,000 and would likewise involve significant radiation exposure. This modification would also result in a more complicated system and additional potential single failures, as well as additional components to monitor in the plant's Equipment Qualification program.

Removal of HCV-247, or rerouting the CH-202 branch to be upstream of it, could reduce the assurance of isolation of the charging leg and introduce the potential for diversion of some HPSI flow away from the pressurizer auxiliary spray line, during post-LOCA long-term core cooling. The safety significance of the existing CVCS design is addressed in the following subsection.

Safety Significance

Valve CH-202 provides thermal overpressure relief protection for the regenerative heat exchanger. The manual isolation valve CH-345 provides downstream positive isolation capability for maintenance on CH-202. Valve CH-345 is maintained normally locked open, and is located inside containment. There are administrative controls and physical restraints in place to prevent inadvertent closure of this stop valve. Valve CH-345 can be unlocked and manually closed when needed in support of maintenance activities, but will otherwise remain locked open. Controlling valve CH-345 in this manner poses no threat to plant safety.

Remote-operated isolation valve HCV-247 is maintained normally locked open via a keylock control switch in the Control Room. It is a solenoid-operated valve which fails open on a loss of power. Identification of a procedural mispositioning of the control switch is enhanced by the switch's location inside the Control Room. The valve remains open except when aligning hot leg injection in the long-term cooling phase of a large LOCA. A thermal overpressure condition is not credible on the shell side of the regenerative heat exchanger in this mode, because there is no "hot side" letdown flow through the tube side of the heat exchanger. The letdown isolation valves fail closed and are closed automatically on a Containment Isolation Actuation Signal (CIAS), so letdown flow is not in service in a post-accident condition.

The concern associated with an isolation valve in the relief path is that if a thermal transient were to occur with all normal flow paths and the overpressure relief path isolated, damage could occur to the regenerative heat exchanger. This would be a highly improbable occurrence due to inherent plant design and existing operating procedures.

In order for a thermal overpressure condition to occur, CH-345 and/or HCV-247 would first have to be mispositioned closed. This would be a violation of plant procedure for normal plant operations. Secondly, both charging flow paths and the pressurizer auxiliary spray flow path would have to be isolated to create a closed volume of water in the shell side of the regenerative heat exchanger. This is not a normal operating condition of the system; both charging line control valves (HCV-238, HCV-239) are normally open valves which fail open on a loss of instrument air or control power and receive no auto-closure signal. Inadvertent closure of these valves would only result from procedural violations. Thirdly, the shell side of the regenerative heat exchanger would have to be isolated while the tube side letdown flow remains in service. Again, this is not a normal operating alignment of the CVCS and would constitute yet another procedural violation.

Note that a loss of instrument air or DC power supply would isolate letdown (letdown isolation valves fail closed), while the charging line isolation valves (HCV-238, HCV-239, HCV-247 and HCV-248) fail open. Consequently, a loss of instrument air or DC power would not compound the previously described procedural violations.

Creation of a thermal overpressure condition in the regenerative heat exchanger is therefore considered a highly improbable event because it would require multiple procedural violations to create the required off-normal CVCS alignment.

In the unlikely event that the above sequence of events were to occur, the worst-case damage to the regenerative heat exchanger would be an external rupture of the outer shell. In this situation, the event is identifiable and isolable. The leak would be inside containment, thus minimizing external release possibilities. The event would be identifiable by a loss in RCS inventory such as a drop in pressurizer level, due to a mismatch in charging and letdown. Local instrumentation for radiation and/or temperature would identify the failure location. The regenerative heat exchanger is capable of being isolated via remote valves, and as described in the USAR, an alternate charging flow path can be aligned via the HPSI header.

In the event that the charging header becomes unavailable during a LOCA, due to an overpressure-induced regenerative heat exchanger failure, the HPSI system would not be affected. The long-term cooling flow path arrangement via the pressurizer auxiliary spray line is not the sole long-term cooling flow path.

An alternate hot leg injection flow path via the low pressure safety injection (LPSI) system and the shutdown cooling system suction line is described in the emergency operating procedures.

If the component were to rupture internally (i.e., into the tubes), this would be inconsequential from a radiological release point of view, since this would not be a system boundary breach.

Please note that the original Code classification of the regenerative heat exchanger as a Section III Class C component (vs. Class A) infers a reduced safety significance relative to failure of that component.

Conclusion

The options available to upgrade the CVCS system configuration to the current ASME Section III Editions and Interpretations would require significant modifications to the system. All of the modification options evaluated present a significant hardship without a compensating increase in the level of plant quality or safety. The current system configuration adequately controls the position of the stop valves such that the overpressure protection function of CH-202 will not be defeated, which satisfies the intent of the Code provisions.

COMPENSATORY ACTIONS

Maintain the existing plant configuration.

Valves CH-345 and HCV-247 will be maintained in the locked open position via the following:

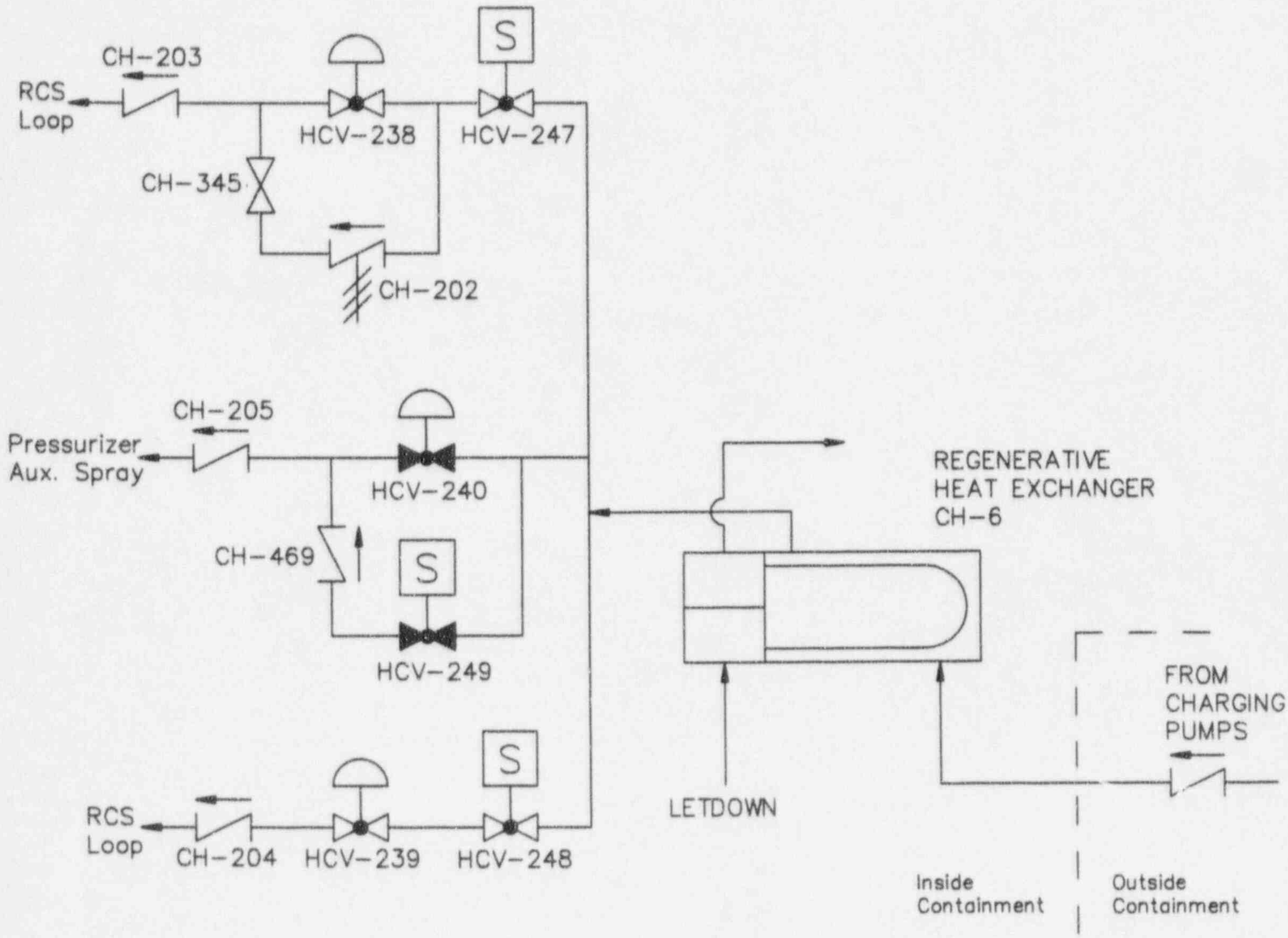
- Manual isolation valve CH-345 is physically locked in position by a lock and chain. The valve is itemized on the locked component list (plant Standing Order O-44) and in the applicable Operating Instruction checklist. Standing Order O-44 requires independent verification of correct position.

- Remote-operated valve HCV-247 is maintained locked open via a keylock-type control switch in the Control Room. The correct position of this valve is confirmed through a step in the applicable Operating Instruction.

IMPLEMENTATION SCHEDULE

Implementation is immediate, as the requested relief represents the plant's CVCS in its current configuration.

Figure 1


CH-203
RCS Loop
HCV-238
HCV-247
S
CH-345
CH-202
CH-205
Pressurizer Aux. Spray
HCV-240
CH-469
S
HCV-249
REGENERATIVE HEAT EXCHANGER CH-6
FROM CHARGING PUMPS
S
RCS Loop
CH-204
HCV-239
HCV-248
LETDOWN
Inside Containment
Outside Containment