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ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Serial No. 10-361
LIC/JG/RO
Docket No.: 50-305
License No.: DPR-43

DOMINION ENERGY KEWAUNEE, INC.
KEWAUNEE POWER STATION
LICENSEE EVENT REPORT 2010-001-00

Pursuant to 10 CFR 50.73, Dominion Energy Kewaunee, Inc., hereby submits the following Licensee Event Report applicable to Kewaunee Power Station.

Report No. 50-305/2010-001-00

This report has been reviewed by the Facility Safety Review Committee and will be forwarded to the Management Safety Review Committee for its review.

If you have any further questions, please contact Mr. Jack Gadzala at (920) 388-8604.

Very truly yours,

Stephen E. Scace
Site Vice President, Kewaunee Power Station

Attachment

Commitments made by this letter: NONE

IE22
NRR

cc: Regional Administrator, Region III
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NRC Senior Resident Inspector
Kewaunee Power Station

NRC FORM 366 (9-2007) U.S. NUCLEAR REGULATORYCOMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 08/31/2010

Estimated burden per response to comply with this mandatory collection request: 80 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@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.

LICENSEE EVENT REPORT (LER)

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

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Kewaunee Power Station	05000305	1 OF 6

4. TITLE

Safety Injection Pump Recirculation Line Isolation Results in Violation of Technical Specifications

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
09	20	2010	2010	- 001 -	00	11	17	2010	FACILITY NAME	

9. OPERATING MODE

N

10. POWER LEVEL

100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (*Check all that apply*)

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☒ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☒ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (*include Area Code*)
Daryn White	920-388-8715

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

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX		CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

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*)

On September 20, 2010, Dominion Energy Kewaunee (DEK) determined that both safety injection (SI) pumps had previously been rendered inoperable contrary to Technical Specifications (TS) requirements. The onsite NRC Resident staff had questioned the appropriateness of shutting the isolation valves on the common minimum flow recirculation line for both SI pumps while the reactor was in power operation mode. These valves had been routinely shut for short periods in the past to conduct required pump and valve testing. As a result of the evaluation of this condition, DEK determined that certain postulated accident scenarios could result in the SI pumps running when the recirculation line was needed for pump operability. Consequently, shutting the recirculation line isolation valves rendered both SI pumps inoperable. The recirculation valves were open and both SI pumps were in an operable status when this determination was made. DEK subsequently implemented administrative controls to preclude shutting these valves when the SI pumps were required to be operable. Kewaunee Power Station (KPS) TS do not allow both SI pumps to be inoperable concurrently, resulting in this condition being a violation of TS requirements.

This event is being reported pursuant to 10 CFR 50.73 (a)(2)(i)(B), any operation or condition which was prohibited by TS; and, pursuant to 10 CFR 50.73 (a)(2)(v), any event or condition that could have prevented the fulfillment of a safety function.

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NARRATIVE

Event Description:

On September 20, 2010, Dominion Energy Kewaunee (DEK) determined that both safety injection (SI) [BQ] pumps [P] had previously been rendered inoperable contrary to Technical Specifications (TS) requirements. The onsite NRC Resident staff had questioned the appropriateness of shutting the isolation valves (SI-208 and SI-209) [ISV] on the common minimum flow recirculation piping line for both SI pumps while the reactor was in power operation mode. These valves had been routinely shut for short periods (about one hour) in the past to conduct required pump and valve testing.

Valves SI-208 and SI-209 are series valves on the common minimum flow recirculation line for the two SI pumps. This recirculation line runs from the outlet of each SI pump, combining into a common piping header, and connecting to the refueling water storage tank (RWST) [TK]. The line provides minimum recirculation flow capability for each SI pump to prevent pump damage should the pump be running without an adequate discharge flow path. The SI pump shutoff head (2195 psig) is above the reactor coolant system (RCS) [AB] pressure setpoint for SI actuation (1815 psig). As such, the pumps were expected to generate adequate flow into the RCS (without the need for recirculation flow) in the event they were called upon to operate to mitigate a postulated accident.

As a result of the evaluation of this condition, DEK determined that certain postulated accident scenarios could result in the SI pumps running while reactor coolant system pressure was above the pumps' shutoff head. With the minimum flow recirculation line isolated under such a condition, a lack of minimum water flow through the pump may result in damage to the pump internals within a short period of time. Therefore, the recirculation line provides a required support function for SI pump operability. Consequently, shutting the recirculation line isolation valves rendered both SI pumps inoperable. Kewaunee Power Station (KPS) Technical Specifications (TS) do not allow both SI pumps to be inoperable concurrently, resulting in this condition being a violation of TS requirements.

Both recirculation valves were open and both SI pumps were in an operable status when this determination was made. DEK subsequently implemented administrative controls to preclude shutting these valves when the SI pumps were required to be operable.

A subsequent review of this condition determined that plant procedural steps, directing closure of valves SI-208 and SI-209 to support performance of pump and valve testing, existed since shortly after the initial plant operating license was issued in December 1973. These valves had been procedurally shut in the past both to periodically test the operation of the valves themselves and to support testing of the containment sump outlet valves (SI-350A/B and SI-351A/B) [V]. SI-208 and SI-209 were required to be shut during testing of the containment sump outlet valves due to an electrical interlock [IEL] between these sets of valves that prevents containment sump water from being pumped into the RWST.

KPS TS 3.3.b, "Emergency Core Cooling System", states (in part) the following.

1. The reactor shall not be made critical unless the following conditions are satisfied, except for LOW POWER PHYSICS TESTING and except as provided by TS 3.3.b.2 and TS 3.3.b.4.

   A. TWO SI/RHR trains are OPERABLE with each train comprised of:

      1. ONE OPERABLE safety injection pump.
      2. ONE OPERABLE residual heat removal pump.

2. During power operation or recovery from an inadvertent trip, ONE SI/RHR train may be inoperable for a period of 72 hours.

KPS TS 3.0, "Limiting Conditions for Operation", states (in part) the following.

c. Standard Shutdown Sequence

When a LIMITING CONDITION FOR OPERATION is not met, and a plant shutdown is required except as provided in the associated ACTION requirements, within one hour action shall be initiated to place the unit in a MODE in which the Specification does not apply by placing it, as applicable, in:

1. At least HOT STANDBY within the next 6 hours,

During periods from shortly after initial plant operation in 1973 to September 2010, with the reactor in power operation mode, both SI pumps were rendered inoperable due to their required supporting minimum flow recirculation line being isolated. Consequently, the TS limiting condition that a minimum of one SI train be operable during power operation was not met. Additionally, both SI pumps were likely inoperable during certain of these periods in excess of one hour without action being initiated to shut down the unit as required by TS 3.0.c, also resulting in a violation of TS requirements.

Time periods that the recirculation line was isolated were not required to be recorded. As such, precise times of when these valves were closed are unavailable. However, an assessment of the associated procedures determined that a typical length of time during which the recirculation was isolated, though varied, was about one hour. Two test procedures were associated with this activity; one was performed at a monthly interval, the other at a quarterly interval. The total time during the past year (mid-September 2009 to mid-September 2010) that the SI recirculation line was isolated was determined to be about 29 hours. The line was isolated about 87 hours during the past three years.

This event is being reported pursuant to 10 CFR 50.73 (a)(2)(i)(B), any operation or condition which was prohibited by TS; and, pursuant to 10 CFR 50.73 (a)(2)(v), any event or condition that could have prevented the fulfillment of a safety function.

Event and Safety Consequence Analysis:

The SI system is a subsystem of the emergency core cooling system (ECCS). The function of the ECCS is to provide core cooling and negative reactivity to ensure that the reactor core [AC] is protected after a design basis accident. In the injection phase of ECCS operation, borated water is taken from the RWST and injected, via the SI pumps, into the RCS. The SI system consists of two 100% capacity trains that are interconnected and redundant such that either train is capable of supplying 100% of the flow required to mitigate the accident consequences. The SI system is actuated upon receipt of an SI signal.

The SI recirculation line provides minimum recirculation flow capability for each SI pump to prevent pump damage should the pump be running without an adequate discharge flow path.

The SI pumps are credited in mitigating the consequences of a loss of coolant accident (LOCA), a main steam line break (MSLB), and a steam generator tube rupture (SGTR).

In the event of a LOCA, the RCS depressurizes as primary coolant is ejected through the break into the

containment. Following depressurization, emergency cooling water from the SI pumps is injected into the RCS cold legs and refloods the core. In the event of a MSLB, the SI pumps function to supply borated water to the reactor core to counter the reactivity addition due to the increased heat removal caused by the escaping steam. SI pumps are also used following a SGTR if charging pump capacity is insufficient to maintain RCS inventory.

An SI signal is generated when RCS pressure decreases to 1815 psig (following either a LOCA or MSLB). Both SI pumps start on receipt of the SI signal. Since the SI pumps have a shutoff head of 2195 psig, sufficient differential pressure (Δp) exists (between the pump head produced and the RCS pressure that exists when an SI signal is generated) for the pumps to produce the minimum flow required through the pumps without need for any recirculation flow. Thus, the SI recirculation line is not needed for SI pump operability in response to a LOCA or MSLB when the SI signal results from low RCS pressure.

However, the evaluation of this condition determined that an SI pump could procedurally be started manually in response to a SGTR with RCS pressure above the shutoff head (2195 psig) of the SI pump (normal RCS pressure is 2235 psig). Under such a condition (or other conditions where the SI pumps start with insufficiently low RCS pressure), the SI pump could not generate sufficient pressure to inject water into the RCS, necessitating the need for recirculation flow. With the minimum flow recirculation line isolated under such a condition, a lack of minimum water flow through the pump may result in damage to the pump internals within a short period of time. Although an operator manually starting an SI pump would likely ensure that it was operating properly (including availability of required flow), such an action is not assured. Therefore, the recirculation line provides a required support function for SI pump operability. Consequently, shutting the recirculation line isolation valves rendered both SI pumps inoperable.

Upon discovery of this condition, both recirculation valves were verified to be open and both SI pumps were in an operable status.

A significance evaluation of this condition is currently being performed. However, the large majority of postulated scenarios in which the SI pumps would be called upon to mitigate the consequences of an accident involve RCS pressure that is sufficiently low so as to assure sufficient flow through the SI pumps. Additionally, the times when the SI recirculation line was isolated occurred under procedurally controlled conditions for brief intervals, such that the heightened operator awareness during these activities would have provided reasonable assurance that the recirculation line would have been restored if the SI pumps were needed to operate. Therefore, DEK believes that the evaluation will conclude that this event had minimal risk significance. If the results of the significance evaluation conclude otherwise, that information will be provided in a supplement to this event report.

Because of the potential loss of high-head safety injection capability, this condition constituted a safety system functional failure.

Cause:

The primary cause of this event was that plant procedures directed the closure of SI recirculation line valves SI-208 and SI-209 for testing during power operation mode. These plant procedures had directed these actions since 1974, nearly back to the start of plant licensed operations. The impact on SI pump operability of shutting these valves was likely not recognized when the procedures were created. Opportunities to identify and correct this deficiency over the history of the station were not appropriately addressed because the processes previously used to address industry operating experience were not adequate to effectively evaluate the impact of an assessed condition on operability of the associated equipment.

The impact of minimum recirculation flow on SI pump operability was likely not as well understood when the procedures were first developed. NRC generic communications and operating experience activity over the ensuing years were evaluated without grasping the significance of this issue. Two examples are provided.

The station's review of NRC Information Notice 85-94: Potential Loss of Minimum Flow Paths Leading to ECCS Pump Damage During a LOCA, stated that for a small break LOCA) (SBLOCA) where RCS pressure is maintained above SI shutoff head, closure of either valve (SI-208 or SI-209) would render both SI pumps inoperable. However, the review concluded that due to the short period of time that the recirculation valves are closed during inservice testing, discontinuing quarterly cycling of valves SI-208 and SI-209 was not justified. Continuing the quarterly testing of these valves would ensure that the valves were capable of closing post-accident.

Likewise, the station's response to NRC Bulletin 86-03: Potential Failure of Multiple ECCS Pumps Due to Single Failure of Air-Operated Valve in Minimum Flow Recirculation Line, identified a concern about loss of the SI minimum flow bypass line when shutting valves SI-208 or SI-209 during testing. However, the response to this Bulletin stated that this concern was not a safety issue because the SI pump shutoff head is above the setpoint for SI initiation on low RCS pressure; and, each valve is in the closed position for only a very short period during valve stroke testing.

In summary, the preponderance of station documentation on this issue (along with the fact that this activity had been performed essentially since initial plant licensing and survived numerous past challenges to its practice), created a false certainty that shutting the SI recirculation line isolation valves for short periods, as required for testing, was an acceptable practice. This created an atmosphere of acceptance for shutting these valves during testing while tempering any consideration of this activity on SI pump operability.

A contributing cause was that operators were not provided with appropriate training regarding the impact that closure of SI-208 or SI-209 has on supported system (SI pump) operability while at power.

Corrective Actions:

Both recirculation valves were open and both SI pumps were in an operable status when this determination was made.

As immediate corrective action, DEK implemented administrative controls to preclude shutting these valves when the SI pumps were required to be operable.

An engineering technical evaluation was performed to allow the containment sump outlet valves (SI-350A/B and SI-351A/B) to be opened without reliance on position of SI-208 or SI-209. The revised activity involves installing an electrical jumper wire to simulate closure of SI-208 or SI-209 (to satisfy the interlock). The applicable station procedures were revised to incorporate this process.

Actions were initiated to perform the following activities to prevent recurrence:

1. Revise the applicable station procedures, including those procedures that test recirculation line isolation valves SI-208 and SI-209, to preclude shutting these valves under conditions when the SI pumps are required to be operable.

2. Revise operator training to include discussion regarding isolation of minimum flow at power and its impact on SI operability.

Similar Events:

A review of Licensee Event Reports covering the past three years identified the following similar events.

LER 2007-010: Allowed Outage Time of the Function for Automatic Initiation of the Control Room Post-Accident Recirculation System on a High Radiation Signal Not Met

LER 2009-007: Inadequate Station Procedures for Testing Containment Vacuum Breaker System Leads to a Violation of Technical Specification Requirements