CATEGORY 1

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ACCESSION NBR:9806290181 DOC.DATE: 98/06/23 NOTARIZED: NO DOCKET #
FACIL:50-305 Kewaunee Nuclear Power Plant, Wisconsin Public Servic 05000305
AUTH.NAME AUTHOR AFFILIATION
HARRINGTON,G.I. Wisconsin Public Service Corp.
MARCHI,M.L. Wisconsin Public Service Corp.
RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 98-005-01:on 980224,inadvertent reactor trip occurred. Caused by improperly adjusted ESF relay following relay replacement.Adjusted feedwater isolation relay armature coil tension & conducted plant restart.W/980623 ltr.

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NRC-98-64

Wisconsin Public Service Corporation
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Green Bay, WI 54307-9002
1-920-433-5544 fax

June 23, 1998

10 CFR 50.73

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Ladies/Gentlemen:

Docket 50-305
Operating License DPR-43
Kewaunee Nuclear Power Plant
Reportable Occurrence 1998-005-01

In accordance with the requirements of 10 CFR 50.73, "Licensee Event Report System," the attached supplemental Licensee Event Report (LER) for reportable occurrence 1998-005-01 is being submitted.

Sincerely,

Mark L. Marchi
Site Vice President - Kewaunee Nuclear

GIH

Attach.

cc - INPO Records Center
US NRC Senior Resident Inspector
US NRC, Region III

IE50

NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

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

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), 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.

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TITLE (4)

Reactor Trip Due to Improperly Adjusted ESF Relay Following Relay Replacement

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	DOCKET NUMBER
									N/A	05000
02	24	1998	1998	005	01	06	23	1998	FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)			
POWER LEVEL (10)		20.2201(b)	20.2203(a)(2)(v)	50.73(a)(2)(i)	50.73(a)(2)(viii)
		20.2203(a)(1)	20.2203(a)(3)(i)	50.73(a)(2)(ii)	50.73(a)(2)(x)
		20.2203(a)(2)(i)	20.2203(a)(3)(ii)	50.73(a)(2)(iii)	73.71
		20.2203(a)(2)(ii)	20.2203(a)(4)	X 50.73(a)(2)(iv)	OTHER
		20.2203(a)(2)(iii)	50.36(c)(1)	50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 366A
		20.2203(a)(2)(iv)	50.36(c)(2)	50.73(a)(2)(vii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Gary I Harrington - Eng &Tech Support Analyst - Plant Licensing	(920) 388-8559

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).	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On February 24, 1998, while operating at 97% power, an inadvertent reactor trip occurred. The trip occurred during surveillance testing of the B train Engineered Safeguards Features (ESF) actuation logic circuits. While conducting the logic tests, the B train feedwater isolation relay actuated. The relay actuation initiated a turbine trip, a reactor trip, a trip of both main feedwater pumps, and closed the main feedwater flow control and isolation valves to the B steam generator.

The feedwater isolation relay actuated when a reduced voltage was applied to the relay. This is done as part of the testing to verify circuit continuity following actuation logic tests. The reduced voltage normally does not result in actuation of the relay. The event was caused by failing to set the relay armature coil tension when the relay was replaced on February 12, 1998.

The plant response to the trip was normal. No abnormal or unexpected conditions other than the initiation source of the trip were noted. There were some ESF equipment actuations; however, they were consistent with the originating trip signal and normal trip response. Subsequent to the trip the feedwater isolation relay armature coil tension was adjusted and a plant restart was conducted.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

DESCRIPTION OF EVENT

On February 24, 1998, while operating at 97% power, an inadvertent reactor trip occurred. The trip occurred during surveillance testing of the B train Engineered Safeguards Features (ESF)[JE] actuation logic circuits. While conducting the logic tests, the B train feedwater isolation relay (FB-2)[RLY] actuated. The relay actuation initiated; a turbine [TRB] trip which initiates a reactor [RCT] trip, a trip of both main feedwater [SJ] pumps [P], and a close signal to the main feedwater flow control [JB] and isolation valves [ISV] to the B steam generator [SG].

Surveillance Procedure (SP) 55-155B, "Engineered Safeguards Train B Monthly Logic Channel Test," was in progress at the time of the trip. This SP tests the signal actuation logic of the associated ESF relays. The SP is performed in two stages. The first stage verifies the signal logic for ESF relay actuation. This is performed while the relays are blocked from actuating. The second stage verifies relay circuit continuity by applying a reduced voltage through each of the ESF relays. Normally the reduced voltage is below that which will pick up the relay. However, during the continuity stage of testing relay FB-2, "ESF Feedwater Isolation Train B," actuated.

The plant response to the trip was normal. No abnormal or unexpected conditions other than the originating trip signal were noted. Some ESF equipment actuations occurred; however, all were consistent with the originating signal and a normal plant trip response.

The initiating trip signal is part of Kewaunee's feedwater isolation logic design. Train B feedwater isolation is initiated by either one of two signals; safety injection (SI), or two out of three high high level logic in the B steam generator (SG). Either of the two signals actuates relay FB-2. FB-2 energizes and initiates a turbine trip, both feedwater pump trips, closure of FW-10B, "Feedwater to SG B Bypass Control Valve," closure of FW-7B, "Feedwater to SG B Main Flow Control Valve," and closure of FW-12B, "SG B Feedwater Isolation Valve." The turbine trip initiates a reactor trip, and the main feedwater pump trips actuate a start of the motor driven auxiliary feedwater (AFW)[BA] pumps.

The only ESF equipment actuation direct from the initiating signal was FW-12B closure. The most significant indirect ESF equipment actuation was start of the two motor driven AFW pumps. The motor driven pumps also get a start signal in response to an at power trip due to SG level shrink, one of the AFW pump start features is low low SG level. Additional indirect ESF equipment actuations were, SG blowdown isolation valves closing (normally close on an AFW pump start signal), turbine driven AFW pump start (normal response to SG level shrink), and letdown isolation. Letdown isolation is a normal expected response to the reactor coolant system (RCS)[AB] temperature response resulting in a reduced pressurizer [PZR] level.

CAUSE OF THE EVENT

This event occurred due to the ESF feedwater isolation train B relay not being adjusted to the proper armature coil tension (pick-up voltage), when the relay was replaced on February 12, 1998. There were two missed opportunities to identify the inadequate pick-up voltage setting when the relay was replaced. The first was failing to implement manufacturer installation guidance for setting the relay pick-up voltage when the relay was replaced. The second was failing to test the relay reduced voltage continuity test circuit after the relay was replaced.

On February 11, 1998, while the plant was in cold shutdown for reactor coolant pump seal repairs, SP 05A-202, "Feedwater Regulation and Bypass Valves Timing Test," was performed. During testing it was discovered that relay FB-2 was not latching properly. The relay is a Westinghouse MG-6 style relay. The relay was replaced under a work request. The efforts undertaken to replace the relay included; bench testing the relay to ensure the relay operated properly prior to installation, and functionally testing the relay after installation to ensure it operated properly and initiated the required turbine trip, pump trip and valve closure features. The post-maintenance test evaluation focused on ensuring proper operation of the relay given a valid ESF signal.

Subsequent to the trip, a review of an uncontrolled historical file for the MG-6 relays was performed. This review revealed a Westinghouse letter dated May 1, 1974 providing instructions for installing the MG-6 style

relays which suggested setting the pick-up voltage after relay installation. This file had been reviewed prior to the relay replacement; however, the earlier review was conducted looking for torque values for the relay contacts. The installation instructions provided by the letter were not recognized at that time. The letter also indicated the potential for this event and noted that incorporation of these instructions into appropriate guidance documents should preclude the event.

There was no procedure used when the relay was replaced. The task of replacing a relay is a direct installation and termination at the same locations for the contacts. This activity is normally well within the skill of Instrument and Control (I&C) Technicians' craft. However, in the case of the MG-6 relay applications where the reduced voltage test circuit is used, the unique feature of the relay's armature tension adjustment makes this a critical task which should have been incorporated into appropriate guidance documents. In general, the technicians and or support staff review the manufacturer's instruction manuals for guidance. Therefore, as a minimum the information provided by the Westinghouse letter should have been referenced in the vendor manual.

Failing to implement the post-installation testing suggested by the manufacturer is judged to be the primary cause which led to this event. Why the instructions were not incorporated into the vendor's manuals and/ or into a relay replacement procedure is indeterminate. During the period of time that the letter was received there were no formal controls for incorporating this type of information into the vendor manuals. The time that has elapsed since the letter suggesting the relay adjustment was received precludes obtaining a definitive root cause.

As mentioned above, the post-maintenance test evaluation focused on the safety function of the relay. Personnel involved in the post-maintenance testing determination did not consider testing the reduced voltage test circuit necessary. This is based upon the assumption that the testing that was performed was consistent with normal post-maintenance test activities, i.e., test the relay's capability to perform its intended function. They did not consider the potential for inadvertent actuation. Their decision not to test has a legitimate basis;

in order to conclude that it would be necessary to test the reduced voltage circuit, one would have to make the assumption that the relay would not function as it was understood to be designed, this style of relay had been replaced in the past with no problems which would not lead plant personnel to suspect the vulnerability to the event that occurred, and the manufacturer's instruction manual notes that no adjustments should be necessary for installing the relay. However, it can not be denied that had this type of testing been done, the trip would have been precluded. Therefore, failing to do the test is considered a causal factor.

While in the process of troubleshooting and correcting the FB-2 relay setting, further efforts were undertaken to determine if any other MG-6 style relays were installed which would be vulnerable to the same failure potential. Four additional relays were found which may have been replaced since original construction. This determination was based upon the physical appearance of the relays, they looked newer. A work history data search of the electronic work request system for ESF relay related work requests was conducted back to 1986. Only one, CIB-1, "Containment Isolation Train B Auxiliary Relay," was found with a work history documenting replacement in 1994. The three remaining relays were; CIA-1, "Containment Isolation Train A Auxiliary Relay," CPA, "Train A Containment Spray Auxiliary Relay," and CPB, "Train B Containment Spray Auxiliary Relay." Since 1994 there have been no experiences with inadvertent actuation of the relays during monthly tests. However, there is also no evidence to indicate that relay armature coil tension adjustments or verifications were made. Since there is no guarantee that the relays are actuating at the proper voltage, a corrective measure is being implemented to preclude the possibility of inadvertent actuation.

The surveillance procedures used to test MG-6 relays are being revised to instruct the performer to confirm that DC system batteries are not on equalize charge prior to performing the tests. When the DC system is on equalize charge the system voltage is increased from approximately 125 to 138 volts. This will preclude the possibility that a higher than normal test circuit voltage will be applied to the relay during continuity checks. The reason for the change is to account for the possibility that the factory setting of the relays is just marginally above normal test circuit voltage.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

ANALYSIS OF THE EVENT

This event is being reported under 10CFR50.73(a)(2)(iv), "any event or condition that resulted in an ESF or reactor protection system actuation." This event was initially reported via the Event Notification System (ENS) on February 24, 1998. Other than the transient the plant underwent in response to a turbine/reactor trip there were no adverse consequences to the trip. All plant equipment responses were normal. There were no radiological releases or challenges to plant personnel or public health and safety.

Although the direct cause of the event is understood, the investigation into this event was expanded to include a focus on administrative controls and processing of vendor information. The investigation has not revealed any weaknesses in the Kewaunee Vendor Technical Information Program (VETIP) which would lead to a similar occurrence. The investigation showed that plant personnel process information received from vendors through the VETIP program as required and information provided due to vendor contacts is included in the appropriate manuals.

The investigation to date has also revealed inconsistencies in the information being provided by Westinghouse contacts, the Westinghouse letter and vendor instruction manuals. Specifically, the recent contacts with Westinghouse personnel indicate they feel that the instructions provided from 1974 should not be necessary.

CORRECTIVE ACTIONS

Trouble-shooting of relay FB-2 consisted of applying the reduced voltage to the relay to confirm the relay did actuate. Further trouble-shooting was also conducted to confirm; the relay had not been actuated from high high SG level or SI, no failure of the resistor in the test circuit occurred, and that no abnormal ESF contact configuration existed which could have caused a 'sneak' circuit. The test bulb in the circuit as well as the relay coil resistances were also checked to ensure a change in the test circuit overall resistance did not cause FB-2 to actuate. These activities confirmed that the operation of FB-2 during SP 55-155B caused the isolation signal. Once the actuation mechanism was confirmed, relay FB-2 was adjusted according to the manufacturer's recommendations and confirmed to operate properly. The as-found voltage where the

relay actuated was 36 volts, the as-left (adjusted) voltage is 69 volts. The manufacturer's instructions for installing and adjusting the MG-6 relays confirms that the relay will not actuate when the test circuit test light is depressed. Testing was also conducted on the relay that was removed on February 12. The actuation voltage for this relay was 69 volts.

Corrective actions to be taken are:

1) An I&C procedure for installing relays will be developed. This procedure will include the installation guidance of the Westinghouse letter.

2) Work Requests will be issued for testing the armature coil tension settings of the remaining MG-6 relays in the ESF relay racks during the next refueling outage.

3) The importance of identifying comprehensive post-maintenance retests will be discussed with the I&C staff.

4) As a minimum, the vendor manuals will be updated with the Westinghouse letter instructions for MG-6 style relay applications using a reduced voltage test circuit.

5) Resolution of the information inconsistencies between the vendor contacts, the instruction manual and the Westinghouse letter will be pursued.

6) Revisions to surveillance procedures for ESF logic testing will be submitted to add a step for the performers to confirm that the DC batteries are not on equalizing charge, prior to performing the ESF tests. This corrective action may only be an interim measure until relay pick-up voltage for the relays suspected as having been replaced without confirmation of pick-up voltage have been tested.

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ADDITIONAL INFORMATION

The relay that was replaced was a Westinghouse Electric Corp. Model #MG-6/STYLE 1163828 relay. This relay is directly replaced by the ABB type MG-6 Multi Contact Auxiliary Relay.

The following information is being provided on an additional factor involved in the event. Although we feel that it is not a contributor to or a cause of the event based upon the testing we performed, it is being provided for completeness.

As noted in the description, the event occurred during performance of SP 55-155B. During the investigation into how the trip occurred, a disparity between what the performer of the procedure recalled and the equipment actuation surfaced. According to the performer, the feedwater isolation relay actuated at, what he succinctly remembers, step 6.24.17.5 of the SP. Step 6.24.17.5 instructs the performer to press the steam line isolation loop B test lamp. This test circuit has no interconnection to the feedwater isolation circuit. Step 6.24.17.7 tests the feedwater isolation circuit.

The test lamp for feedwater isolation (#860) is located directly below the steam line isolation test lamp (#806). The test lamps are within one to one and one half inch of each other. The performer, when questioned, does not believe he depressed lamp #860. This disparity lead to the extent of testing that we performed to determine the cause of the event. None of the testing revealed any interconnections, cross talk (electro-magnetically induced voltage from an adjacent circuit) or failed components which could support the performer's recollection. The testing could not repeat actuation of the relay at step 6.24.17.5. Therefore, consideration was given to the possibilities that either the performer failed to accurately remember his actions or he inadvertently depressed test lamp #860 while testing lamp #806. Neither could be supported or refuted. Regardless of not being able to conclusively determine the impact of this disparity, the reduced armature tension setting of the relay caused the event. Even if there was cross talk or a hidden failure which energized the feedwater isolation test circuit, eventually the trip would have occurred when the performer reached step 6.24.17.7.

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SIMILAR EVENTS

None