NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

# LICENSEE EVENT REPORT (LER)

| FACILITY NAME (1) | DOCKET NUMBER (2) | PAGE (3) |
|---|---|---|
| Fort St. Vrain, Unit No. 1 | 0 5 0 0 0 2 6 7 | 1 OF 0 7 |

TITLE (4)
Spurious RWP Actuations

| 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 NAMES | DOCKET NUMBER(S) |
| 0 1 | 1 6 | 8 6 | 8 6 | 0 0 4 | 0 0 | 0 2 | 1 5 | 8 6 | N/A | 0 5 0 0 0 |
| | | | | | | | | | | 0 5 0 0 0 |

| OPERATING MODE (9) | | THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11) | | | |
|---|---|---|---|---|---|
| N | | 20.402(b) | 20.405(c) | XX 50.73(a)(2)(iv) | 73.71(b) |
| POWER LEVEL (10) | 0 0 0 | 20.405(a)(1)(i) | 50.36(c)(1) | 50.73(a)(2)(v) | 73.71(c) |
| | | 20.405(a)(1)(ii) | 50.36(c)(2) | 50.73(a)(2)(vii) | OTHER (Specify in Abstract below and in Text, NRC Form 366A) |
| | | 20.405(a)(1)(iii) | 50.73(a)(2)(i) | 50.73(a)(2)(viii)(A) | |
| | | 20.405(a)(1)(iv) | 50.73(a)(2)(ii) | 50.73(a)(2)(viii)(B) | |
| | | 20.405(a)(1)(v) | 50.73(a)(2)(iii) | 50.73(a)(2)(x) | |

LICENSEE CONTACT FOR THIS LER (12)

| NAME | TELEPHONE NUMBER |
|---|---|
| Jim Eggebroten, Superintendent, Technical Services Eng. | AREA CODE 3 0 3 — 7 8 5 - 2 2 2 3 |

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 |
|---|---|---|---|---|---|
| XX YES (If yes, complete EXPECTED SUBMISSION DATE) | NO | | 0 5 | 1 5 | 8 6 |

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


ABSTRACT:

During control rod testing from January 16, 1986, through February 14, 1986, the Plant Protective System (PPS) Rod Withdrawal Prohibit (RWP) function was spuriously actuated on numerous occasions. These spurious RWP actuations resulted from electronic noise on the startup channels and from erroneous rod withdrawal circuit overcurrent trips. A total of one hundred twenty-five spurious actuations were experienced. In every incident, the reactor remained shutdown, and no abnormal rod withdrawal or core neutron flux conditions were identified.

Following RWP actuation, control room operators verified single rod withdrawal and normal core neutron flux levels using control rod position indication and nuclear instrumentation.

The RWP function of the PPS is not classified as an Engineered Safety Feature, nor is it considered part of the Reactor Protection System, i.e., reactor scram system. Therefore, spurious/unplanned actuations of the RWP circuitry are not considered to require Nuclear Regulatory Commission notification, nor submittal of a Licensee Event Report per the requirements of 10CFR50.72 and 50.73. However, due to concerns expressed by the Senior Resident Inspector, spurious RWP actuations will be reported until this issue can be reviewed by the Regional and NRR offices.




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BACKGROUND:

The RWP circuitry is part of the overall Plant Protective system that monitors various plant parameters and automatically initiates corrective action upon the onset of abnormal or unsafe plant conditions. Actuation of the RWP system automatically terminates withdrawal of any control rod pair. In detail, actuation of the RWP circuitry will result upon occurrence of the following:

Neutron Countrate Low. Neutron countrate indication from startup channels I or II (FSAR Section 7.3.1) is below a set minimum, 5 cps. This prevents control rod withdrawal without adequate neutron flux indication.

Rate of Neutron Flux Change. High rate of neutron flux rise (short reactor period) from startup channels I or II and/or two of the three wide range logarithmic channels III, IV, V. Setpoint 1.5 DPM.

Neutron Flux Level. High neutron flux level from power range channels III, IV, and V (2 of 3) or power range channels VI, VII, and VIII (2 of 3); setpoint ≤ 120% rated power.

Neutron Flux Level Interlocks with Interlock Sequence Switch. A Rod Withdrawal Prohibit (RWP) interlock is actuated when: (1) indicated reactor power is above 5% with the Interlock Sequence Switch (ISS) in the "Startup" position, or (2) indicated reactor power is less than 5% or greater than 30% with the ISS in the "Low Power" position, or (3) indicated reactor power is less than 30% with the ISS in the "Power" position. These ensure that the operator does not increase or decrease power beyond these power levels without advancing the ISS accordingly.

Rod Control Circuit Load. Rod control current sensor senses withdrawal of more than one control rod pair; setpoint 3.85 volts.

Rod Withdrawal Sequencing. Indicated power less than 6% and attempted rod withdrawal out of the correct pre-arranged group withdrawal sequence.

Power Range Downscale Failure. Downscale failure of a power range channel III, IV, VI, VII, and VIII. The rod withdrawal prohibit may be manually bypassed by placing the failed channel in a tripped condition.

Rod Control Circuit. Momentary restoration of power to the rod drive motor control centers via the bypass contactors automatically initiates a rod withdrawal prohibit if manual rod insertion is attempted following a reactor scram.

There are no automatic corrective actions initiated by the RWP system directed towards reducing reactor power or actuating engineered safety features.

EVENT DESCRIPTION:

During the time period of January 16, 1986 through February 14, 1986, the RWP circuitry was spuriously actuated a total of one hundred twenty-five times. Of these actuations, sixty-six resulted from erroneous rod withdrawal circuit overcurrent sensing, and fifty-nine from noise spikes tripping the startup channel "rate of rise" RWP function. Throughout this time period, the reactor was shutdown with the PCRV pressurized to approximately 170 psia. Core cooling was provided by the four helium circulators operating in various combinations. Average core fuel temperatures ranged from 130 to 330 degrees Fahrenheit.

From January 16, 1986, through February 8, 1986, sixty-two spurious "overcurrent" and fifty-three spurious "rate of rise" RWPs were received during performance of interim Technical Specification surveillance SR 4.1.1.d-X, "Full Stroke Scram Test". During this test, all thirty-seven control rod pairs were individually withdrawn to the "full out" position, scrammed, and the "full in" insertion time recorded. The sixty-two "overcurrent" actuations occurred during rod pair withdrawal. The fifty-three "rate of rise" actuations occurred at random.

On February 14, 1986, two spurious "rate of rise" RWP's were received, one during pre-critical surveillance testing, the other during rod withdrawal to take the reactor critical.

The remaining eight spurious RWP actuations (4 "overcurrent" and 4 "rate of rise") occurred on January 22, 24, and 29, 1986. The "overcurrent" actuations occurred during rod pair withdrawal for RWP investigative purposes, while the "rate of rise" actuations occurred randomly.

Control room operator action following "overcurrent" RWP actuations was to verify single rod withdrawal using rod position indication. Following "rate of rise" RWP actuations, control room nuclear instrumentation was checked to verify normal core neutron flux levels.

In every incident during this reporting period, RWP actuation resulted from erroneous signals. At no time were the "out" contactors energized to more than one control rod pair, nor were any abnormal core neutron flux levels identified on control room nuclear instrumentation.

ANALYSIS OF EVENT:

Fort St. Vrain FSAR Section 14.2 addresses postulated reactivity accidents and transient response. Pertinent analyses and corrective action include:

Multiple control rod pair withdrawal accidents terminated by the 140% reactor power scram function (FSAR Section 14.2.2.6). Various control interlocks decrease the likelihood of such an incident.

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Maximum worth control rod pair withdrawal accident at full power terminated at 140% rated power by an automatic scram, or 60 seconds after accident initiation by operators manually inserting a scram or 105 seconds after accident initiation by an automatic scram signal on high reheat steam temperature, 1075 degrees Fahrenheit.

Maximum worth rod pair withdrawal at source power, terminated at 140% rated power by an automatic reactor scram (FSAR Section 14.2.2.7). The five decade per minute rate of power change scram decreases the likelihood of such an incident.

As stated in the basis of Fort St. Vrain Technical Specification LSSS 3.3, "Based on complete evaluation of the reactor dynamic performance during normal operation and expected maneuvers and during and following various assumed mechanical failures, it was concluded that sufficient protection is provided by the single fixed point scram setting." This "High Neutron Flux" scram setting of ≤140% rated thermal power is initiated by the six power channels, independent of either startup channel.

The operability of the PPS reactor scram function was not affected by the spurious actuations of the RWP system. The power channel's DC output signal is less susceptible to noise induced spiking and can be filtered more easily of spurious AC noise. Therefore, during the period of January 16, 1986, through February 14, 1986, the PPS automatic and manual scram functions were operable to perform as designed upon the onset of an unsafe condition.

Following RWP actuation, control room operators utilized control room instrumentation to determine the necessary course of action required. Since no abnormal conditions were identified, the RWP circuitry was reset and rod withdrawal continued.

Public Service Company recognizes the importance of reducing the frequency of spurious RWP actuations as to prevent operator desensitizing towards the RWP function. Therefore, various corrective actions are being pursued.

Similar incidents were reported in LERs #85-019 and 85-025.

CAUSE DESCRIPTION:

Startup Channel "Rate of Rise" actuations:

The startup channel RWP function operates on a one of two logic scheme. Startup channel "rate of rise" RWP actuations will occur if the neutron flux rate signal to the PPS exceeds 1.5 DPM. Investigations have identified two apparent causes of spurious "rate of rise" actuations, rod withdrawal handswitch noise, and variance in the rate of neutron flux level transmitted through the startup channels.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

1) Rod Withdrawal Handswitches

A direct relationship has been identified between rod withdrawal handswitch operation and startup channel noise. It is suspected that noise interference resulting from inductive arcing across the actuator handswitch contacts during peak current flow through the contactor coil is being picked up in the startup channel circuitry.

2) Variance in Startup Channel Neutron Flux Rate:

Startup channel signal variance is under investigation. Originally, plant equipment was suspected to be the primary contributor of noise in the startup channel cables that run from the detectors to the control room. However, continued investigation suggests that other causes of startup channel signal variance may exist.

Control Rod Withdrawal Circuit Overcurrent:

It has been determined that operation of the rod withdrawal handswitches is related to spurious overcurrent RWP actuations. While monitoring current sensor output during control rod withdrawal, a small voltage spike was detected simulateneously with an overcurrent RWP actuation. The cause of the voltage spike is suspected to be inductive arcing across contacts in the rod withdrawal circuit during peak current flow through the contactor coil.

CORRECTIVE ACTION:

Completed Actions:

Startup Channel II was recalibrated in accordance with Technical Specification Surveillance SR 5.4.1.1.3c-R.

The current sensor trip setting was evaluated by monitoring current sensor output during single rod withdrawal and simulated multiple rod withdrawal. Test results showed the current sensor output with a single "out" contactor coil energized to be approximately 2.7 volts. The overcurrent RWP setpoint is 3.85 volts, thereby allowing single rod withdrawal while inhibiting multiple rod withdrawal. There are no plans to raise the current sensor trip setpoint at this time.

Continued/Planned Actions:

Both the current sensor and RWP trip module (bistable) will be removed for testing to verify proper operation.

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The suspected inductive arcing between rod withdrawal circuit contacts will be investigated to determine if it actually exists and the necessary corrective actions required to correct the problem.

The operation of both startup channels will be thoroughly reviewed and checked/tested. This will verify whether problems exist within the channel components. If proper component operation is verified, any further signal spiking must be attributed to noise introduced into the channels from external sources. If the noise source(s) can be identified and suppressed, actions will be taken to do so.

The startup channel "rate of rise" function is being evaluated to determine whether it should be modified to reduce the likelihood of spurious "rate of rise" RWP actuations.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

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February 15, 1986
Fort St. Vrain
Unit No. 1
P-86106

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

Docket No. 50-267

SUBJECT: Licensee Event Report 86-004, Preliminary Report

REFERENCE: Facility Operating License No. DPR-34

Gentlemen:

Enclosed please find a copy of Licensee Event Report No. 50-267/86-004, Preliminary, submitted per the requirements of 10 CFR 50.73(a)(2)(iv).

Sincerely,

J. W. Gahm
Manager, Nuclear Production

Enclosure

cc: Regional Administrator, Region IV
Attn.: Mr. J. E. Gagliardo, Chief
Reactor Projects Branch

cc: Director of Nuclear Reactor Regulation
Attn.: Mr. H. N. Berkow, Project Director
Standardization and Special
Project Directorate

cc: Director, MIPC

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