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 8

TITLE (4)
Automatic Actuation Of Basic Plant Protective System (PPS) Actions

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 7	2 0	8 5	8 5	— 0 1 0	— 0 0	0 8	1 9	8 5	N/A	0 5 0 0 0
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OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 1 0 0	20.402(b)	20.405(c)	X 50.73(a)(2)(iv)	73.71(b)
		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 4

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	
D	A B	P D C	C 7 8 0	N							

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 fifteen single-space typewritten lines) (16)

On July 20, 1985, following an extended shutdown for CRD refurbishment, while preparations were underway to take the reactor critical, automatic Plant Protective System (PPS) actions were initiated by the primary coolant moisture monitoring system. These actions consisted of automatic Loop 1 shutdown and reactor scram on two loop trouble.

This unplanned actuation of the basic PPS actions was reported to the Nuclear Regulatory Commission at 2155 hours on July 20, 1985, pursuant to the requirements of 10 CFR 50.72(b)(2)(ii) "Four Hour Report", and is being reported herein pursuant to the requirements of 10 CFR 50.73(a)(2)(iv).

Following automatic actuation of the PPS scram circuitry, Control Room Operators inserted a manual scram by placing the reactor mode switch in the "OFF" position as required per procedure.

The automatic PPS actions occurred with the neutron detector channels still indicating source power and only two control rod pairs partially withdrawn, well before approaching reactor criticality (15 control rod pairs). Both control rod pairs that were partially withdrawn at the time of the incident were verified to be fully inserted into the core following the scram.

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FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Fort St. Vrain, Unit No. 1	0 5 0 0 0 2 6 7	8 5	— 0 1 0	— 0 0	0 2 OF 0 8

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

BACKGROUND:

The primary coolant system at Fort St. Vrain incorporates the circulation of helium through the reactor core to transfer heat to the secondary coolant system while maintaining acceptable temperatures in the core.

Since there are potential sources of water (as liquid and/or steam) leakage into the primary coolant which could result in oxidation of burnable poison and core graphite, or coolant pressure increases, primary coolant moisture content is constantly monitored during startup, low power and power operation. The Plant Protective System (PPS) primary coolant moisture monitoring system consists of two sets (three each) of low level monitors (set at 17.7°F dewpoint) and two high level monitors (set at 58°F dewpoint). Each loop has three low level monitors sampling the primary coolant from that loop's helium circulator sample rakes. The high level monitors are not loop oriented and sample the gas leaving each helium circulator.

Actuation of the PPS "high moisture actions" requires a trip of either two of the three low level monitors in a loop combined with one of the two high level monitors, or both high level monitors. The first situation (two of three lows combined with one of two highs) initiates a loop shutdown, steam/water dump, and reactor scram, while the second initiates a reactor scram and loop shutdown and steam/water dump of the preselected loop (the operator has manually preselected the loop). Note that the steamwater dump action only occurs if feedwater flow is greater than 20%.

For a given helium pressure, there is a unique dew or frost point temperature corresponding to the moisture content of the helium. The moisture detector incorporates a mirror, light source, photocell, and means for controlling the mirror temperature (see Figure 1). The mirror is positioned so that the incident light from the bulb is reflected off the mirror to the photocell. If the mirror surface is highly reflective, the output signal of the photocell is maximum; when the dew or frost point temperature is reached, the output signal drops due to scattering and refraction from the dew or frost formed upon the mirror.

The detector mirror is cooled by circulating gaseous nitrogen (GN_2) through a heat exchanger extending to the mirror (see Figure 1). Mirror temperature is sensed by a thermocouple which is used by the mirror temperature controller. Fine mirror temperature control is achieved by automatically adjusting current through a heater which is an integral part of the mirror assembly. Coarse mirror temperature control is provided by a pressure differential controller which regulates GN_2 flow through the detector cooling coil to keep the heater current operating in a band around the midscale of the desired mirror temperature setting.

GN_2 is supplied by four independent and separate liquid nitrogen storage Dewar containers, each with two sources of liquid nitrogen supply. Each container will supply gaseous nitrogen at -300°F to two detectors, one detector each from two of the three moisture monitor subsystems.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Fort St. Vrain, Unit No. 1	0 5 0 0 0 2 6 7	8 5	— 0 1 0	— 0 0	0 3 OF 0 8

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

The LN_2/GN_2 coolant supply system vaporizes liquid nitrogen from the Dewar storage containers to provide a pressure of approximately 20 psig, causing GN_2 (at approximately -300°F) to flow through the cooling coils of the associated detectors.

EVENT DESCRIPTION:

On July 20, 1985, preparations were being made to bring the reactor critical following an extended plant shutdown for CRD refurbishment. The reactor was pressurized to approximately 84 psig while core decay heat removal was being provided by the "B" and "C" helium circulators operating on steam and both steam generator economizer-evaporator-superheater sections operating on condensate. All six low range moisture monitors were out of service and placed in the "tripped" condition while preparations were being made to return them to service. Both high range moisture monitors, MM-1115 and MM-1119, were operable and in service monitoring primary coolant moisture levels. Under these conditions, a trip on either high range moisture monitor, MM-1115 or MM-1119, would complete the minimum actuation logic and initiate automatic PPS actions.

At 1209 hours, July 20, 1985, operators began to withdraw control rods to take the reactor critical. Criticality was predicted to occur with twelve control rod pairs fully withdrawn and three in mid-position. With one control rod pair withdrawn twenty inches and one control rod withdrawn four inches, MM-1115 tripped on low light level and initiated an automatic Loop 1 shutdown and reactor scram on Two Loop Trouble. These automatic PPS actions occurred while the reactor was still at source power, and subcritical.

Immediately following the automatic PPS actions, operators inserted a manual scram by placing the reactor mode switch to the "OFF" position as required per procedure, and verified both partially withdrawn control rods were fully inserted into the core.

Following insertion of the manual scram, Control Room operators inspected the moisture monitor instrumentation located on control room panel I-10. During this inspection, it was discovered that the mirror temperature for high range monitor MM-1115 had fallen substantially, to approximately -50°F and the monitor was tripped. The reactor side equipment operator then informed control room operators that he had completed filling the moisture monitor dewar containers just prior to the PPS actions.

The High Primary Coolant Moisture Scram was reset and the shutdown coolant loop (Loop 1) was recovered at approximately 2125 hours.

On July 28, 1985, again with the reactor shutdown, a similar incident occurred when automatic PPS actions were initiated by the moisture monitoring system while the equipment operator was filling the dewars. Due to the similarities in the cause and corrective actions associated with this event, it is being reported herein per the requirements of 10 CFR 50.73(a)(2)(iv).

CAUSE:

Multiple causes.

LN_2/GN_2 Dewar System

The Fort St. Vrain nitrogen system provides refrigeration for the low-temperature equipment of the helium purification system and primary coolant moisture monitoring system. There are four moisture monitor nitrogen supply tanks or dewars that store liquid nitrogen and provide cold nitrogen vapor to the moisture monitors. Each dewar has the capacity of approximately 50 gallons. Originally, liquid nitrogen level in the dewars was automatically controlled by a level indicating controller operating a valve in the nitrogen fill line. However, this system performed unsatisfactorily and dewar level control has since been maintained by manual operation of the fill system. The automatic level control system for the moisture monitor dewars has been redesigned, however installation of the new system is not yet complete.

Manual filling of the moisture monitor dewars is somewhat of a delicate operation. Equipment operators must admit liquid nitrogen into the dewar while venting off excess vapor pressure. Should a dewar become over pressurized or overfilled, the increased coolant flow to the associated moisture monitor mirror could significantly lower mirror temperature, thereby lowering the trip setting of the monitor. To prevent such an occurance, coolant flow across the mirror is regulated by a differential pressure control system.

Following the automatic PPS actions on July 20, 1985, the differential pressure control valve (PDV-2549) which regulates GN_2 flow to MM-1115 was inspected. During this inspection, the valve limit switch was found to be out of adjustment. This limit switch functions to stop the valve drive motor when the limit switch is picked, thereby insuring the valve disc is not driven into the seat or the stem is not twisted off. The desired limit switch setting is such that at normal dewar pressure, the valve maintains a maximum of approximately one psid of GN_2 flow to the monitor when fully closed. The "as found" condition of the limit switch on PDV-2549 was such that when fully closed, approximately seven psid of GN_2 flow continued through the mirror heat exchanger at normal dewar pressures. Therefore, given the status of PDV-2549, an increase in dewar T-2503 pressure could result in an increase in GN_2 flow through the heat exchanger of MM-1115 due to the inability of PDV-2549 to fully close and regulate properly.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Fort St. Vrain, Unit No. 1	0 5 0 0 0 2 6 7	8 5	— 0 1 0	— 0 0	0 5 OF 0 8

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

Manual refilling of the moisture monitor dewars is a routine task, performed approximately once every eight hours. While performing routine rounds on July 20, 1985, the reactor side equipment operator began filling dewar T-2503 at approximately 2100 hours. Although no procedural errors were identified, it is speculated that while filling dewar T-2503, internal dewar pressure increased over that of normal dewar pressure. The increased dewar pressure combined with the out-of-adjustment condition of PDV-2549's limit switch, presumably resulted in an increase of GN_2 flow through the heat exchanger of MM-1115. This caused mirror temperatures to fall and eventually reach the dewpoint temperature of the primary coolant. The resulting dew formation scattered the light reflecting off the mirror and the monitor tripped on low light level.

ANALYSIS:

During rod withdrawal to achieve reactor criticality, an automatic reactor scram was actuated by the primary coolant moisture monitoring system. This unplanned actuation of the basic PPS actions satisfies the reporting criteria of 10 CFR 50.73(a)(2)(iv).

The reactor had been shutdown for an extended period of time while CRD refurbishment and various other maintenance activities were performed. Since the low range moisture monitors were out of service and placed in the tripped condition, a trip of either high range monitor, MM-1115 or MM-1119, would initiate automatic PPS actions.

Per Fort St. Vrain Technical Specification 4.4.1, if the primary coolant moisture monitoring system becomes inoperable, the reactor shall be shut down within twelve hours.

The moisture monitoring system is intended to prevent significant increases in primary coolant pressure due to a large steam generator leak, and to minimize the effects of moisture reaction with graphite at elevated core temperatures, by initiating an automatic reactor scram, loop shutdown, and steam water dump.

In the unlikely event of failure of the redundant moisture monitors to select the leaking steam generator following a tube rupture, primary coolant pressure might rise. Should primary coolant pressure reach a preset limit (7.5% over normal working pressure), an automatic reactor scram, loop shutdown, steam water dump of a manually preselected steam generator loop, and main steam depressurization in the remaining loop, will be automatically initiated. These actions serve as a backup for the moisture monitoring sytem.

During reactor shutdown/cooled down conditions, moisture ingress into the primary coolant system is of less concern since core temperatures and pressures will not result in steam flashing and subsequent increases in PCRV pressure or graphite oxidation. Therefore, during reactor shutdown conditions, the need to detect primary coolant moisture and initiate automatic protective action is not as limiting.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Fort St. Vrain, Unit No. 1	0 5 0 0 0 2 6 7	8 5	— 0 1 0	— 0 0	0 6 OF 0 8

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

Proper operation of the moisture monitors is dependent on proper coolant flow from the dewars. The manner in which the dewars are filled can affect this coolant flow. As long as normal dewar pressure is maintained and the dewar is not overfilled, moisture monitor system transients are not likely to occur. However, if the dewars are overpressurized or overfilled, monitor mirror temperature may be lowered due to either an increase in GN_2 flow from over pressurizing or from LN_2 entering the mirror heat exchanger due to overfilling. Nevertheless, in either case, the resulting decrease in mirror temperature is conservative in that it lowers the affected monitors trip setting, thereby causing protective action to occur at lower primary coolant moisture levels.

Manual filling of the dewars will always result in a slight increase in dewar pressure. However, in the event that dewar pressure decreases to a point where GN_2 flow to the mirror stops, mirror temperature will rise. Excessive mirror temperature actuates a malfunction alarm via a malfunction detection circuit. Therefore, should coolant flow to the monitor mirror stop for any reason the resulting condition is safe in that the inoperable moisture monitor is manually placed in the tripped condition.

CORRECTIVE ACTION:

Immediately following automatic actuation of the PPS scram circuitry, control room operators verified that both partially withdrawn control rods were fully inserted into the core.

Reactor operators inserted a manual scram by placing the reactor mode switch to the "OFF" position as required per procedure.

The control room operators recovered the shutdown loop and returned to two loop operation.

The equipment operators have been reminded of the need to exercise caution while filling the moisture monitor dewars. With proper caution, manual filling is considered adequate based on previous satisfactory performance.

The limit switch on PDV-2549 was adjusted to the proper setting, and the valve seat was replaced.

Modifications to the liquid nitrogen dewar fill system are planned. These modifications will allow for automatic filling of the moisture monitor dewars and should be completed during the next refueling outage.

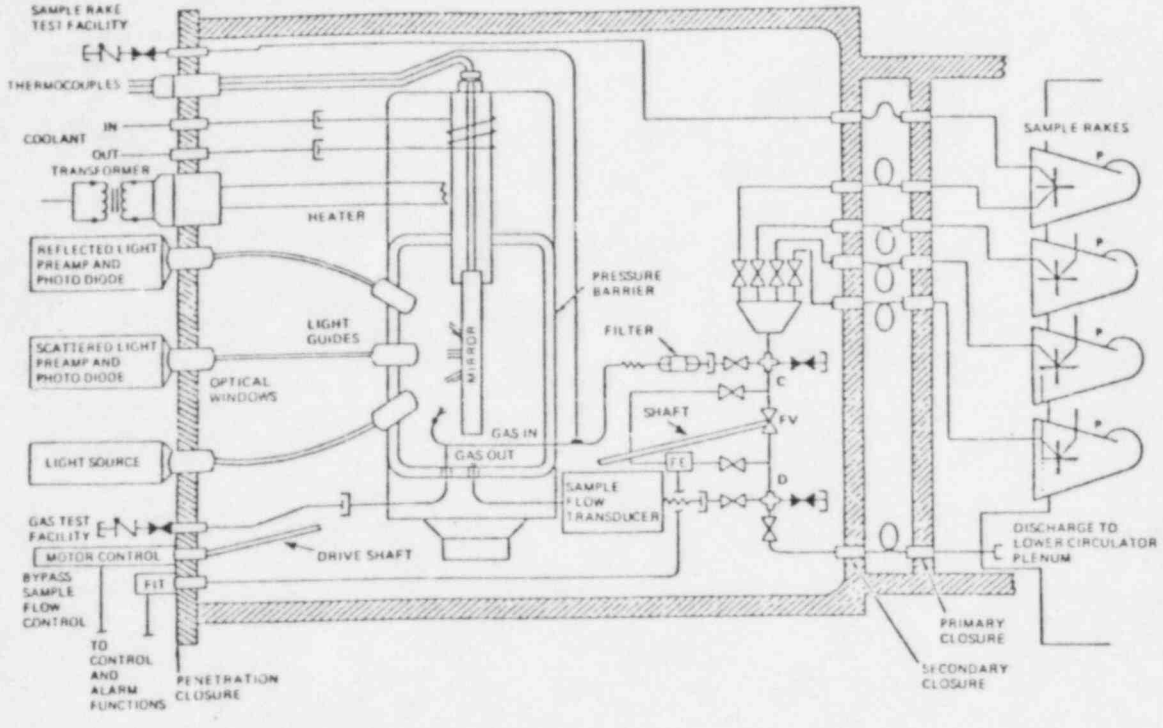
The PDV's for the other moisture monitor penetrations will be adjusted if necessary and verified operable with proper control settings.

The calibration frequency for these PDV's will be changed to better assure proper operation of the moisture monitoring system.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Fort St. Vrain, Unit No. 1	0 5 0 0 0 2 6 7	8 5	— 0 1 0	— 0 0	0 7 OF 0 8

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

FIGURE 1



MOISTURE DETECTOR

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Fort St. Vrain, Unit No. 1	0 5 0 0 0 2 6 7	8 5	— 0 1 0	— 0 0	0 8 OF 0 8

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

Jim Hill
Technical Services Technician

Jim Eggebroten
Superintendent, Technical Services Eng.

Licensing Review By: Scott Hoffstetter

Jim Gramling by Scott Hoffstetter
Jim Gramling
Nuclear Licensing-Operations Supervisor

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Station Manager

J. W. Gahm
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Company of Colorado

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AUG 21 1985

August 19, 1985
Fort St. Vrain
Unit No. 1
P-85290

Regional Administrator
Region IV
U. S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 1000
Arlington, TX 76011

Attn: Mr. Dorwin Hunter

Docket No. 50-267

SUBJECT: Licensee Event Report
85-010, Final Report

REFERENCE: Facility Operating
License No. DPR-34

Dear Mr. Hunter:

Enclosed please find a copy of Licensee Event Report No. 50-267/85-010, Final, submitted per the requirements of 10 CFR 50.73(a)(2)(iv).

Sincerely,

J. W. Gahm
Manager, Nuclear Production

Enclosure

cc: Director, MIPC

JWG/djm

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