

(PLEASE PRINT ALL REQUIRED INFORMATION)

EVENT
TYPE

VIOLATION

DISCOVERY DESCRIPTION

LOCATION OF RELEASE

GPO 881-667

REPORT DATE: March 25, 1976

UNUSUAL EVENT 76/03

Page 1 of 11

OCCURRENCE DATE: (Determined) February 26, 1976

FORT ST. VRAIN NUCLEAR GENERATING STATION
PUBLIC SERVICE COMPANY OF COLORADO
P. O. BOX 361
PLATTEVILLE, COLORADO 80651

REPORT NO. 50-267/76/03

Preliminary

IDENTIFICATION OF
OCCURRENCE:

On February 25, 1976, water migrated up the shaft of Helium Circulator 1C and into the primary coolant system. This is identified as an unusual event per Fort St. Vrain Technical Specification, Section 7.6, Reporting - Administrative Controls, Non-Routine Reports, Section C, paragraph 2.

CONDITIONS PRIOR
TO OCCURRENCE:

<u> </u>	<u>Steady State Power</u>	<u> </u>	<u>Routine Shutdown</u>
<u> </u>	<u>Hot Shutdown</u>	<u> </u>	<u>Routine Load Change</u>
<u> X </u>	<u>Cold Shutdown</u>	<u> </u>	<u>Other (specify)</u>
<u> </u>	<u>Refueling Shutdown</u>	<u> </u>	<u> </u>
<u> </u>	<u>Routine Startup</u>	<u> </u>	<u> </u>

The major plant parameters at the time of the event were as follows:

Power	RTK	<u> 0 </u>	MWth
	ELECT	<u> 0 </u>	MWe
Secondary Coolant	Pressure	<u> 0 </u>	psig
	Temperature	<u> 0 </u>	°F
	Flow	<u> 0 </u>	#/hr.
Primary Coolant	Pressure	<u> 24 </u>	psia
	Temperature	<u> 100 </u>	°F Core Inlet
		<u> 100 </u>	°F Core Outlet
	Flow	<u> 2 circulators @</u>	#/hr.
		<u> self-turbining</u>	

DESCRIPTION OF
OCCURRENCE:

On February 25, 1976, the plant was being operated with two Loop 2 circulators in the self-turbining mode. The primary coolant system was depressurized, to about 12 psig, and buffer helium makeup to the helium circulators was being supplied from the high pressure helium storage bottles.

At approximately 6:25 pm, the circulator buffer helium return flow decreased rapidly to zero ACFM (① on attached recorder traces). All other readings remained normal. Approximately five minutes later the circulator buffer-mid-buffer differential pressure changed from a plus ten inches of water differential pressure to zero inches of water differential pressure. It then decreased to a minus ten inches of water differential pressure. The negative differential indicates flow up the circulator shaft. No automatic trip of the circulator was initiated because a Loop 1 shutdown trip inhibits a Loop 2 circulator trip due to a buffer seal malfunction.

Indications were that a problem existed in the buffer return portion of the system. The operators started the standby recirculator and attempted unsuccessfully to establish a circulator buffer helium return flow.

APPARENT CAUSE
OF OCCURRENCE:

<u> </u> Design	<u> </u> Unusual Service Cond. Including Environment
<u> </u> Manufacture	<u> </u> Component Failure
<u> </u> Installation/Const.	<u> X </u> Other (specify)
<u> </u> Operator	<u> </u> Power cord to a controller
<u> </u> Procedure	<u> </u> became disconnected.

ANALYSIS OF
OCCURRENCE:

The attached curves show that while self-turbining 1C and 1D circulators, the buffer helium return flow rapidly decreased to zero (0) ACFM (① on the attached curves). This occurred when the power cord to PDC-2367 became disconnected.

Referring to attached PI-23-4 and PI-21-3, the loss of power to PDC-2367 reduced the controller output signal to zero (0) ma. This minimum signal opened PDV-2367-1 and PDV-2367-2 which admitted eighty (80) psig helium, through 1 1/2" line 2357-D32, to the helium dryer outlet. The buffer helium recirculators are capable of developing approximately 25 psi differential pressure and their suction is maintained near reactor pressure. In this incident reactor pressure was

ANALYSIS OF
OCCURRENCE (continued):

twelve (12) psig, and due to the low head characteristic of the recirculators, the eighty (80) psig on the outlet of the helium dryer prevented C-2106 from pumping through the helium dryer. The recirculator bypass valve, which controls recirculator differential pressure, opened and bypassed all recirculator flow to the suction side of the recirculator. However, this was not obvious to the operators in the Control Room.

The buffer helium supply flow remained constant and the loss of buffer return flow permitted all supply flow to pass up the circulator shaft and into the PCR.V. With loss of helium flow to the helium-water drain, the buffer-mid-buffer pressure decreased to a negative value ((2) on the attached curves). The negative buffer indicates flow up the circulator shaft and into the primary coolant. The Loop 2 circulators did not automatically trip, on negative buffer-mid-buffer pressure, because there was a Loop 1 shutdown trip which inhibited the Loop 2 helium circulator buffer-mid-buffer trips.

The operators started the standby recirculator, tripped the operating recirculator, and manually increased supply flow in an attempt to restore buffer return flow ((3) on attached curves).

It is postulated that this action filled the buffer-mid-buffer differential pressure instrument lines with water and caused the buffer differential pressure change to a high positive indication ((4) on the attached curves). The high buffer ΔP differential pressure was a false indication.

An operator was sent to check the buffer-mid-buffer water knockout tanks (reference PI-21-9, attached) for water and subsequently removed a significant quantity of water. This action probably upset the buffer to main drain differential pressure and caused the high pressure separator to flood ((5) on attached curves. Also note discussion on PDT-2176-1 on Page 4). It is speculated that water out of the high pressure separator flooded the buffer return laminar flow element and gave a false high indication of buffer return flow. The high level in the high pressure separator served to aggravate the water flow into the primary coolant. The major portion of water ingress, occurred on 1C circulator, during operation with the high pressure separator flooded; however, water was flowing up the shaft of both 1C and 1D circulators as indicated by the negative buffer-mid-buffer differential pressure.

This condition existed for thirty five minutes at which time the operators manually tripped and isolated 1C circulator ((6) on the attached curves). The curves for 1D circulator are similar to 1C except the high pressure separator level remained near normal so the circulator was allowed to continue to self-turbine.

ANALYSIS OF
OCCURRENCE (continued):

On February 25, 1976, the dew point temperature of the primary coolant was -40°F, and at noon, February 26, 1976, the dew point temperature was 74°F. This was a moisture change from 100 PPMV to approximately 6,700 PPMV as a result of water ingress.

The recent problem of possible condensation in the control rod drive position potentiometers (Unusual Event Report No. 50-267/75/4A) prompted a decision to remove all DC power to the drives on February 26, 1976. The maximum dew point temperature of the primary coolant was 93°F. Table 1 shows that the PCRV cooling water temperature was maintained at or above 105°F. Because the liner temperature was always higher than primary coolant dew point temperature, no moisture was deposited in the control rod drive housings or penetrations. The primary coolant pressure and temperature were increased to improve water removal rate through the helium purification system. The liner temperature was increased to 118°F to force moisture out of the liner insulation.

Reference Unusual Event Report No. 50-267/75/18A. The moisture in the primary coolant does not seriously affect the reserve shutdown system boron carbide material.

Reference FSAR, Section 14.5.2.2. The moisture in the primary coolant would have no affect on either the core graphite or the fuel.

Due to the low oxygen content of the primary coolant the reactor internals will not be affected by this incident.

The power connector on PDC-2367 has a locking device to prevent it from coming loose. If the plug is not fully inserted, the locking device is not engaged. There were workmen behind the control boards at the time but not in the vicinity of the controller. No reason for PDC-2367 plug to become unplugged could be determined.

A recent problem with the LC circulator main drain system indicated a control system malfunction. The ensuing investigation isolated the problem to the main drain to buffer helium differential pressure controller (PDT-2176-1 on attached PI-21-9). This transmitter output would "lock up" in its minimum output signal position if the buffer to main drain differential pressure is sufficiently upset. The minimum signal from the controller forces the main drain valve to its minimum opening and therefore forces additional water up the circulator shaft. This additional water must go to either the high pressure separator or into the primary coolant. It is believed the main drain controller malfunction is the cause for flooding circulator LC high pressure separator.

ANALYSIS OF
OCCURRENCE (continued):

In summary, the loss of power to PDC-2367 upset the helium buffer system and allowed water to enter the primary coolant. The preventive measure of removing all DC power, and maintaining PCRV cooling water temperature above the dew point temperature of the primary coolant will prevent control rod drive problems previously experienced (Unusual Occurrence Report No. 50-267/74/06 and Unusual Event Report No. 50-267/75/04).

CORRECTIVE
ACTION:

The failure mode of PDV-2367-1 will be changed to fail closed on loss of controller power or instrument air.

The main drain differential pressure transmitter manufacturer has been contacted for hardware or calibration procedural changes to prevent the instrument output from locking up.

A review of inhibiting buffer-mid-buffer trips at refueling conditions is being conducted.

Moisture will continue to be removed from the primary coolant until it decreases to an acceptable level.

FAILURE DATA/SIMILAR REPORTED OCCURRENCES:

Abnormal Occurrence Report No. 50-267/75/3A was a similar occurrence but was reported due to a moisture monitor failure to trip.

Unusual Occurrence Report 50-267/75/1A was a similar occurrence but was reported due to a reactivity change.

Unusual Event Report No. 50-267/75/18A was a similar occurrence but was reported as a result of high primary coolant moisture.

PROGRAMMATIC IMPACT:

None

CODE IMPACT:

None

1015

CIRCULATOR MANUALLY TRIPPED

⑥

~~02030~~
2-25-76

④

②

③

⑤

①

HP Sep
Lvl

B.W. Supply
Flow

Speed

-10 +90

0 10

0 6

0 70

0 5 200

0 6 12

Buff- Midbuff
ΔP

Buff
He Supply

Buff
He return

H.P. Sep.
level

Bearing
water flow

Speed

IN. H₂O

ACFM

ACFM

Inches

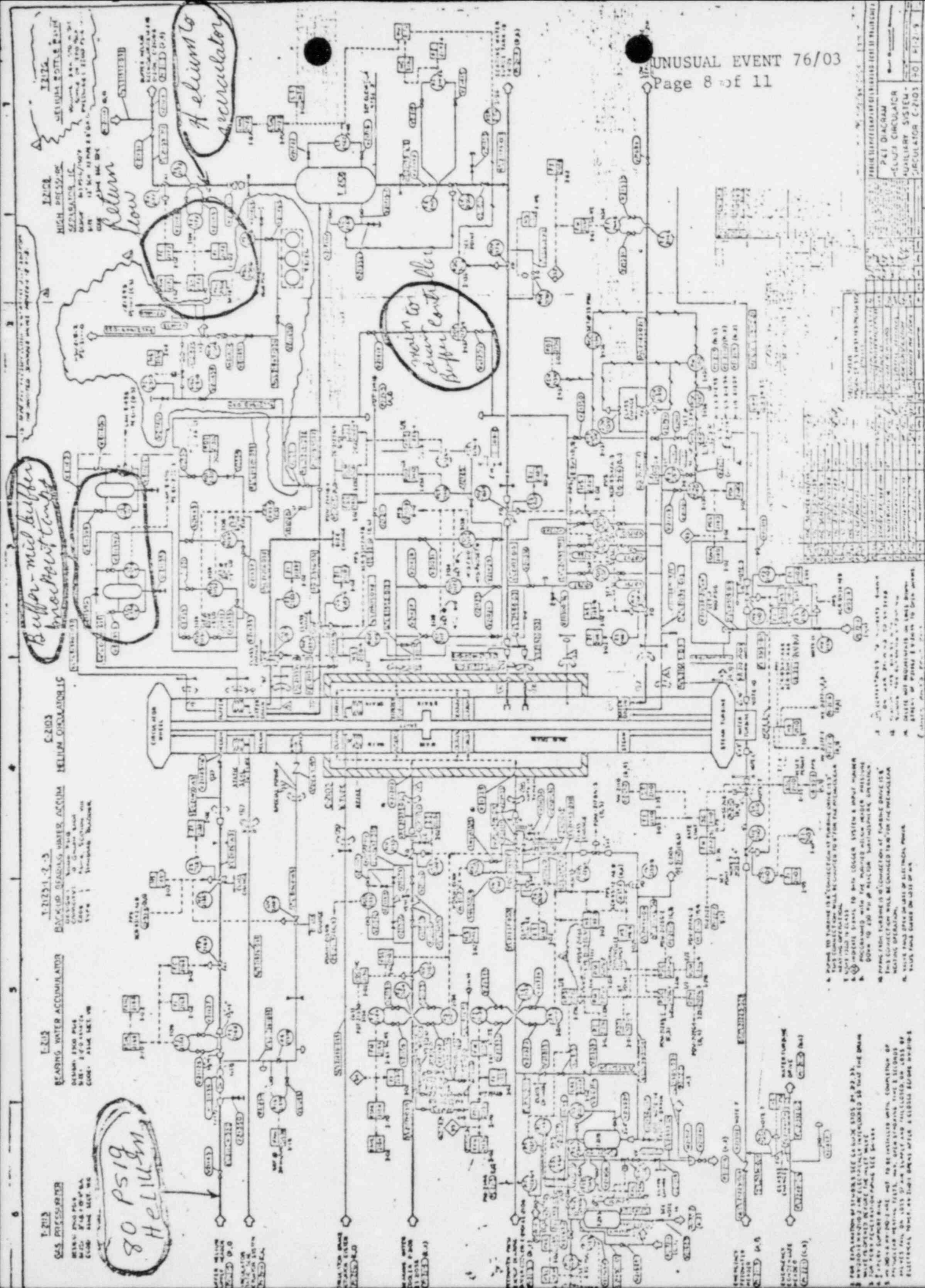
GPM

1000 RPM

1000/1000
2-25-76

C.W.

1C Circulator



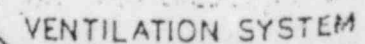


TABLE 1

Date	Time	Primary Coolant				PCRV Cooling Water Temperature °F	
		Pressure psia	Temp. °F	Dew Point °F	PPMV Moisture	Loop I Temp.	Loop II Temp.
2/25/76	0200	27.8	131	-36.4	86	105	105
2/25/76	1400	26.3	103	-40	100	105	105
2/26/76	1100	62.3	98	74	6,718	105	105
2/27/76	0100	116	100	86	5,500	105	105
2/27/76	1200	97	100	83.3	5,797	105	105
2/27/76	2300	91	191	93.2	8,000	105	105
2/28/76	1200	86	202	93.2	9,000	105	105
2/29/76	0100	87	206	87.8	7,500	105	105
2/29/76	1245	84.5	205	9.14	8,655	105	105
2/29/76	2200	87	205	92.3	8,000	105	105
3/1/76	1000	89	204	82.4	6,500	107	110
3/2/76	0000	141	234	80.6	3,600	117	120
3/2/76	1230	136	234	86	4,600	118	120
3/3/76	0000	147	245	77	3,500	119	120
3/3/76	1230	145	257	91.4	4,800	119	120
3/4/76	0000	143	261	95	5,500	119	120
3/4/76	1230	146	275	82.4	3,800	119	120
3/5/76	0000	144	281	98.6	6,000	119	120

Submitted by:

H. W. Hillyard, Jr.
H. W. Hillyard, Jr.
Technical Services Supervisor

Reviewed by:

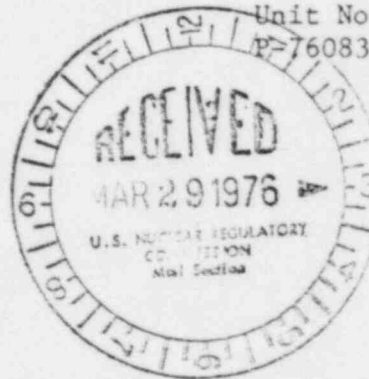
H. Larry Brey by O. Rodgers
H. Larry Brey
Superintendent, Operations

Approved by:

Frederic E. Swart
Frederic E. Swart
Superintendent, Nuclear Production

Public Service Company of Colorado
P. O. Box 361, Platteville, Colorado 80651

March 25, 1976
Fort St. Vrain
Unit No. 1
P-76083



Mr. E. Morris Howard, Director
Nuclear Regulatory Commission
Region IV
Office of Inspection and Enforcement
Suite 1000
Arlington, Texas 76012

REF: Facility Operating License
No. DPR-34

Docket No. 50-267

Dear Mr. Howard:

Enclosed please find a copy of Unusual Event Report No. 50-267/76/03, Preliminary, submitted per the requirements of the Technical Specifications.

Also please find enclosed one copy of the Licensee Event Report for Unusual Event Report No. 50-267/76/03.

Very truly yours,

A handwritten signature in cursive script that reads "Frederic E. Swart".

Frederic E. Swart
Superintendent, Nuclear Production
Fort St. Vrain Nuclear
Generating Station

FES/alk

cc: Mr. Roger S. Boyd

3183