Public Service Company of Colorado

16805 Weld County Road 19 1/2, Platteville, Colorado 80651

November 13, 1979
Fort St. Vrain
Unit No. 1
P-79273

Mr. Karl V. Seyfrit, Director
Nuclear Regulatory Commission
Region IV
Office of Inspection and Enforcement
611 Ryan Plaza Drive
Suite 1000
Arlington, Texas 76012

REF: Facility Operating License
No. DPR-34

Docket No. 50-267

Dear Mr. Seyfrit:

Enclosed please find a copy of Reportable Occurrence Report No. 50-267/79-49/03-L-0, Final, submitted per the requirements of Technical Specification AC 7.5.2(b)4.

Also, please find enclosed one copy of the Licensee Event Report for Reportable Occurrence Report No. 50-267/79-49/03-L-0.

Very truly yours,

Don Warembourg

Don Warembourg
Manager, Nuclear Production

DW/alk

cc: Director, MIPC

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FORT ST. VRAIN NUCLEAR GENERATING STATION
PUBLIC SERVICE COMPANY OF COLORADO
16805 WELD COUNTY ROAD 19 1/2
PLATTEVILLE, COLORADO 80651

REPORT NO. 50-267/79-49/03-L-0

Final

IDENTIFICATION OF OCCURRENCE:

On October 14, 1979, an upset in the circulator buffer helium system caused a release of activity both in the reactor building and out the reactor building ventilation exhaust stack.

This is being reported at the request of the Inspection and Enforcement Resident Inspector under the provisions of Fort St. Vrain Technical Specification AC 7.5.2(b)4.

CONDITIONS PRIOR TO OCCURRENCE:

Steady State Power

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

Reactor Power	531	MWth
Electrical Power	200	MWe
Secondary Coolant Pressure	2,445	psig
Secondary Coolant Temperature	1,000	°F
Secondary Coolant Flow	1,400	K#/hr.
Primary Coolant Pressure	647	psig
Primary Coolant Core Inlet Temperature	682	°F
Primary Coolant Core Outlet Temperature	1,315	°F
Primary Coolant Flow	2,635	K#/hr.
Circulator 1A	7,400	RPM
Circulator 1B	7,400	RPM
Circulator 1C	7,400	RPM
Circulator 1D	7,400	RPM

DESCRIPTION OF OCCURRENCE:

Time	Description
0315	Buffer helium dryer swapped from "A" to "B" tower and cross-tower leakage was indicated by an increase in low pressure separator pressure.
0400	Began reducing power in preparation for bypassing buffer helium dryer to prevent moisture/oxidant problems. Reactor power approximately 63%.
0500	Reactor power approximately 59%.
0600	Reactor power approximately 50%.
Approximately 0630	Reduced buffer helium supply and return flows to 5.8 and 3.0 ACFM, respectively. Bypassed buffer helium dryer by opening HV-2152. PDIS-2152 indicated approximately 2 psid across dryer (normal). Ran approximately 15 minutes with this lineup and no buffer helium upset.
Approximately 0645	Shut V-21113 (dryer inlet block) and shut V-21615 (dryer outlet block) to isolate dryer. Also isolated purge line to dryer by shutting V-211450, shutting needle valve V-211641, and failing FCV-2151 shut (pneumatic). Started to open V-211413 and simultaneously close inlet block to HV-2152. Ran for approximately two minutes this way and then FV-2339 (purified helium compressor recirculation flow), PDV-2367-2 (buffer helium from purification system), and PDV-23111 (purified helium to PCRV relief valve penetration) began to hunt. PDV-2367-2 was hunting through its full cycle. Reactor operator placed PDV-2367-2 and PDV-23111 in manual to stop the hunting. Buffer supply did not stabilize so reactor operator returned PDV-2367-2 and PDV-23111 to automatic control.
0649	Reactor operator placed FC-2167 (buffer supply to "A" circulator) in manual to stabilize buffer supply flow. "A" circulator buffer-mid-buffer (BMB) differential pressure was cycling from about +70" water to about +17" water. "A" circulator shortly afterwards tripped on buffer-mid-buffer high at +80" water. Brake and seal set for "A" circulator automatically. This prevents loss of primary coolant down shaft of "A" circulator.
0650	FV-2339, PDV-2367-2, and PDV-23111 still cycling. PDV-2367-2 cycling full range.
0652	"D" circulator tripped on buffer-mid-buffer high. Brake and seal set for "D" circulator automatically.

Time	Description
Approximately 0656	Purified helium compressor (PHC) tripped. This was probably caused by the cycling of FV-2239, PDV-2367-2, and PDV-23111 which either caused a low purified helium flow (less than 18 ACFM) or a high compressor differential pressure (greater than 42 psid). Standby purified helium compressor did not start (start inhibited if purified helium compressor differential pressure is greater than 10 psid).
Approximately 0656 to 0658	Tried to get purified helium compressors started. Kept tripping due to high purified helium compressor differential pressure/low flow. During this time primary coolant was coming down the shafts of "B" and "C" circulators and entering circulator auxiliaries as follows: Discharge to Stack 1. It is not known for certain if the low pressure separator gas relief lifted at 50 psig. This relief is vented to the reactor building stack via the reactor building exhaust filters. It is in a common line with the helium dryer outlet knockout pot which also has a 50 psig relief (V-211266). This relief also relieves to the reactor building exhaust system and subsequently to the stack. The possible pressurization path of the low pressure separator would be from the buffer helium dryer purge line as follows: a. When the buffer helium dryer swapped from tower "A" to tower "B", the "B" tower purge valves shut (HV-21348 and HV-21352). b. Leakage past the seat of HV-21352 flows through cooler E-2102X and V-21524, to the dryer knockout pot, and then the low pressure separator increasing low pressure separator pressure. c. Leakage via this path was occurring as indicated by increasing pressure in the low pressure separator. Cross-tower leakage was verified in the control room by this method.

Time	Description
Approximately 0656 to 0658 (continued)	d. Note that at about 0630 RT-31193 began to increase indicating contaminated low pressure separator water. This increase slowly continued until the low pressure separator drains were directed to the liquid waste sump at about 0700.

2. Helium/water drains were discharged from the circulator to the high pressure separator, to the buffer helium recirculators, through vent valve V-211413 to the reactor building stack.

3. Circulator main bearing water drains discharged to the bearing water surge tanks, through an equilizing line to the suction of the recirculators and through V-211413 to the reactor building stack.

4. Steam/water drains discharged from circulators to low pressure separator, to helium recovery compressors (RIX), through vent HV-21334-1, to the reactor building stack.

These four possible vents to the reactor building stack caused RT-7324-1 monitor to trip (trips at 77,000 cpm). Within approximately 30 seconds, the reactor operator walked behind the panel observed that RIS-7324-1 was reading less than 100 cpm, and reset the RT. No other alarms from this RT were received.

Discharge to Reactor Building

Contaminated water in low pressure separators caused RT-21251 to trip, stopping the bearing water removal pumps and diverting low pressure separator drains to liquid waste sump via 1" drain line. Liquid waste sump was pumped to the liquid waste tank. Diminished draining capacity via 1" line allowed level in low pressure separator to increase, causing gas in low pressure separator to compress and lift the interstage reliefs on the RIX compressor at approximately 15 psig. This released contaminated helium to reactor building. Persons in the area observed the TRITON monitor respond as the RIX interstage reliefs lifted.

0700 Reactor power 39.7%.

Time	Description
Approximately 0700	After it became apparent the purified helium compressors would not stay on, reactor operator cut in high pressure helium bottles from storage to supply buffer helium via HV-2166-2. The bottles were in service approximately 1 to 2 minutes. They did not appear to re-establish stable buffer helium supply, so the reactor operator secured high pressure bottles. Both standby recirculators started automatically. Reactor operator secured standby recirculators.
Approximately 0705	Personnel opened inlet block to HV-2152, then shut V-211413 vent. This returned buffer helium lineup to normal with the exception of bypassing the buffer helium dryer.
Approximately 0708	Reactor operator started a purified helium compressor. Buffer helium supply and return stablilized to "B" and "C" circulators.
Approximately 0770	Reactor building sump pumps were placed in "pull-to-lock". Liquid waste tanks full. Low pressure separator drains were directed to the deaerator. RT-31193 tripped at 500 cpm, reached a maximum of 800 cpm, and then decreased.
Approximately 0720	Reactor power decrease was initiated from approximately 26%. Going to less than 2%.
0800	Main turbine generator tripped on low steam temperatures.
0900	Reactor Power 18.5%.
1000	Reactor power 8.8%.
1000	RT-31193 on SJAE reset at less than 500 cpm.
1030	"A" and "D" circulators to self-turbining.
1100	Reactor power 6.1%.

Time	Description
1130	Helium dryer returned to service; "B" tower in service, "A" tower at 60 psig. FCV-2151, V-211450, V-211641 all closed in purge line. Normally open valve V-21524 was left open because it cannot be reached in a Scott Air Pack.
1200	Reactor power 2.7%.
1300	Reactor power 1.9%.
1700	Low pressure separator activity less than 10,000 cpm. Reset RT-21251.

RT	Time Up	Highest Counts	Alarmed	Remarks
21251	0700	10^5	Yes (10,000)	Low pressure separator drains to liquid waste sump.
6314-2	0215	60,000	No (2,300,000)	T-62 vent noble gas (unrelated to this event).
2263	0700	2,000	Yes (600)	Pump low pressure separator to deaerator.
2264	0700	300	No (570)	Pump low pressure separator to deaerator.
6212	0700	500	No (1,050)	Dissolved noble gases.
6213	0700	900	Yes (800)	Dissolved noble gases.
31193	0700	800	Yes (500)	Pump low pressure separator to deaerator.

Radiological Calculations

Conditions

Time of Release - Approximately 5 minutes = 8.3E-2 hours

Exhaust Stack Flow - 32,000 cfm = 9.06E+8 cc/min = 1.51E+7 cc/sec

Wind Speed - 10 mph

Wind Direction - 245° (SW)

Stability Category - D

Noble Gas

1. Noble gas released as indicated on RT-4802 (PING):

   Maximum Count Rate - 1,300 cpm

   Average Count Rate - 650 cpm

   Sensitivity - 3.70E-8μCi/cc/cpm

   Maximum Concentration in Stack - 4.85E-5 μCi/cc

   Average Concentration in Stack - 2.43E-5 μCi/cc

   Noble Gas Released = (2.43E-5μCi/cc)(9.06E + 8 cc/min)(5 min)

   = 1.10E+5 μCi

   = 0.11 Ci noble gas released

2. % of Technical Specification Limit = $\frac{(\text{release rate})(\Sigma \frac{\mu Ci/cc}{MPC})(100\%)}{3E+10}$

   = $\frac{(1.51E+7\ cc/sec)(\frac{2.43E-5 \mu Ci/cc}{2E-8\ \mu Ci/cc})(100\%)}{3E+10}$

   = 61.2%

3. Incident Dose at EAB

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   D = (Q)(T)(SD)/u

   where:

   D = incident dose

   Q = source term

   T = exposure time

3. (continued)

SD = standard dose factor (FSV Emergency procedure based on release of 1 Ci/sec, 1 mph wind, 1 hour exposure to noble gas)

u = wind speed

$Q = (2.43E\text{-}5\,\mu Ci/cc)(1.51E+7\ cc/sec)$

$= 3.67E+2\ \mu Ci/sec$

$= 3.67E\text{-}4\ Ci/sec$

$$D = \frac{(3.67E\text{-}4\ Ci/sec)(8.3E\text{-}2\ hr)\left(6E\text{-}3\ \frac{Rem\text{-}mph}{(Ci/sec)hr}\right)}{10\ mph}$$

$= 1.8E\text{-}8\ Rem$

^{131}I as Indicated by RT-7325-1 Cartridge

Cartridge ^{131}I activity = 8.61E-6μCi/cartridge

1. ^{131}I released $= \frac{(stack\ flow)(cartridge\ activity)}{sample\ flow}$

$$= \frac{(32{,}000\ cfm)(8.61E\text{-}6\mu Ci)}{1.4\ cfm}$$

$= .197\ \mu Ci$ released

2. % of Technical Specification Limit

$$= \frac{(1.51E+7\ cc/sec)\left(\frac{4.35E\text{-}11\ \mu Ci/cc}{1.43E\text{-}13\ \mu Ci/cc^{*}}\right)(100\%)}{3E+10}$$

$= 15.3\%$

*$\frac{MPC}{700}$ for Iodines with $T_{1/2} > 8$ days

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3. ^{131}I Incident Dose at EAB

$$Q = \frac{.197E\text{-}6\ Ci}{300\ sec} = 6.56E\text{-}10\ Ci/sec$$

$$D = \frac{(Q)(T)(SD)}{u}$$

$$= \frac{(6.56E\text{-}10\ Ci/sec)(8.3E\text{-}2\ hr)\left(76\ \frac{Rem\text{-}mph}{(Ci/sec)hr}\right)}{10\ mph}$$

$= 4.13E\text{-}10\ Rem$

Reactor Building

CAM EL 4740 4.15E-8 µCi/cc beta particulate

Concentration remained relatively constant until 1220, then started to decrease.

At 1700 concentration was 1.7E-10 µCi/cc beta particulate

No significant activity was found in the turbine building.

Environmental samples analyzed by CSU (10-16-79) showed no significant activity above background.

CALCULATION OF DOSE RECEIVED BY HEALTH PHYSICS TECHNICIAN 10-14-79

NOTE: Pocket dosimeter worn during exposure period showed 0 mr.

1. Particulate activity from Beta particulate CAM elevation 4740 4.15E-8 µCi/cc.

2. From previous releases into the building it has been determined that the radionuclides present are ^{88}Kr, ^{138}Xe, and ^{133}Xe, and daughters.

3. Assumptions

   a. The particulates are in equilibrium with the precursor.

   b. The dose is made up of exposure from ^{88}Kr, ^{138}Xe, and ^{133}Xe.

   c. The activity detected is the sum of the particulate activities from ^{138}Xe and ^{88}Kr daughters.

      ^{88}Kr = 2.08E-8 µCi/cc
      ^{138}Xe = 2.08E-8 µCi/cc

   d. ^{133}Xe is present at a concentration of 2.08E-8 µCi/cc.

   e. One year's exposure time = 2,080 hours.

4. Reference Regulatory Guide 1.109, Table B-1.

5. Whole Body Dose Received by individual exposed 2.68 hours.

6. From Step 4 above Dose Factor for Exposure

   ^{88}Kr 1.47E-2 (mrem-m^3)/(ρCi - year)

   ^{138}Xe 8.83E-3 (mrem-m^3)/(ρCi - year)

   ^{133}Xe 2.94E-4 (mrem-m^3)/(ρCi - year)

7. Dose rate (mrem/hour) =

$$\frac{(2.08E\text{-}8\ \mu Ci/cc)\left(\frac{1\ year}{2080\ Hrs}\right)}{(1E\text{-}12\ \mu Ci/cc/\rho Ci/m^3)}\ (\text{Dose Factor mrem/year}/\rho Ci/m^3) =$$

   ^{88}Kr (1E1)(1.47E-2) = 1.47E-1 mrem/hour

   ^{138}Xe (1E1)(8.83E-3) = 8.83E-2 mrem/hour

   ^{133}Xe (1E1)(2.94E-4) = 2.94E-3 mrem/hour

   Total dose rate = 2.38E-1 mrem/hour

8. Total Dose (2.68 hours exposed)(2.38E-1 mrem/hour) = 6.38E-1 mrem.

APPARENT CAUSE
OF OCCURRENCE:

Cross-tower leakage in the buffer helium dryer due to a leaking valve, HV-21352.

ANALYSIS OF
OCCURRENCE:

The problem with the dryer valves has existed for quite awhile. Various attempts have been made to fix this dryer, but have been unsuccessful so far. The valve seats are a teflon material which has either been too soft and unable to take the temperatures encountered or too hard and subject to cracking during valve operations. When this occurrence started, due to dryer cross-tower leakage, instrumentation personnel expected to temporarily bypass the buffer helium dryer and repair the leaking regeneration valve. A temporary system operating procedure deviation was prepared and the job started. At approximately 0645 hours (see event description) an upset in the buffer helium system occurred that could not be restabilized until after two circulators had tripped and activity had been released to the reactor building and the plant exhaust stack. There was no evidence of improper or inadequate plant operation or job planning during this evaluation. All plant personnel involved responded properly in attempting to restore the circulator's buffer helium auxiliary system to a stable condition.

CORRECTIVE
ACTION:

The committee investigating this occurrence made several recommendations as follows:

Place RT's on continuous recorders. At present, a plotted point every five minutes is inadequate.

RT-21251 needs to have flushing capability. At present when the bearing water removal pumps are tripped, the monitoring leg for the RT is static and thus not representative of the low pressure separator activity.

Investigate possibility of automatically isolating quench water to the low pressure separator when RT-21251 trips. This may prevent an increasing separator level and lessen the chances of RIX reliefs lifting.

Investigate possibility of bypassing buffer helium return to purification system just downstream of V-2383. Direct flow to on service purification system dryer by placing manual bypass valve around HV-2305 or HV-2306. Dryers would need regeneration more often if this path were used but it would save a lot of helium and eliminate one major flow path of contaminated helium up the stack.

Investigate possibility of shutting buffer supply and return valves for the operating circulators after loss of buffer helium. This would lock in primary coolant inside circulator and minimize escape (assuming no loss of bearing water below normal cavity levels).

CORRECTIVE
ACTION (continued):

Besides investigating these recommendations several actions have been taken to reduce the problems with the buffer helium system and in case of an upset to reduce the possibility of affecting the bearing water system or releasing activity from the buffer system. These are being done under Change Notice 990 and include an automatic drain on the buffer dryer knockout pot, an automatic isolation valve on the line from dryer purge to low pressure separator which isolates on high pressure or high activity in thelow pressure separator. Also an automatic drain line from the helium recovery compressors knockout pots, and the vent and relief valves from the low pressure separator and buffer helium dryer are routed to the reactor building ventilation exhaust stack by this change notice.

FAILURE DATA/SIMILAR REPORTED OCCURRENCES:

Reportable Occurrence Report No. 50-267/79-43.

PROGRAMMATIC IMPACT:

None

CODE IMPACT:

None

Prepared by: Asa B. Reed
Asa B. Reed
Technical Services Technician

Reviewed by: J. W. Gahm
J. W. Gahm
Technical Services Supervisor

Reviewed by: Frank M. Mathie
Frank M. Mathie
Operations Manager

Approved by: Don Warembourg
Don Warembourg
Manager, Nuclear Production

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