

PRECURSOR DESCRIPTION SHEET

LER No.: 338/87-017 R1
Event Description: Steam generator tube rupture and plant trip
Date of Event: 7/15/87
Plant: North Anna 1

EVENT DESCRIPTION

Sequence

At 0630 h during operation, a high radiation alarm was received from the SG C main steam line. Simultaneously, pressurizer pressure and level began to rapidly decrease.

At 0635 h the pressurizer level had fallen to 45% and pressure had fallen to 2100 psig from 2235 psig. The operators manually tripped the plant, and 20 s later the safety injection system automatically actuated on low-low pressurizer pressure (less than 1765 psig on two of three channels). Based on SG indications, by 0648 h the operators had determined that a SG tube had ruptured in SG C, and they isolated the SG.

An orderly plant shutdown was begun at 0718 h to bring the plant to cold shutdown conditions.

Prior to the event the condenser air ejector radiation monitor had been declared inoperable due to erratic operation, but all other safety systems were operable. This monitor would divert air release from the environment to the containment on detecting high radiation. Because of the radiation monitor's inoperability, a potential radiological release path to the environment existed until the operators manually realigned the system.

The C SG steam supply to the TDAFW pump turbine was isolated. Two relief valves, one on the MFWP B suction line and the other on the 2A feedwater heater tube side, lifted and failed to reseal. They were manually closed 30 min into the event. Data analysis indicated 1.59×10^{-1} Ci were released, mostly as gases.

Corrective Action

An investigation into the cause of the tube rupture was begun.

Plant/Event Data

Systems Involved:

Steam generator
Main feedwater

Components and Failure Modes Involved:

SG tube ruptures in operation
Two MFW relief valves stick open

Event Identifier: 338/87-017 R1

Component Unavailability Duration: N/A
Plant Operating Mode: 1 (100%)
Discovery Method: Operational event
Reactor Age: 9.3 y
Plant Type: PWR

Comments

None.

MODELING CONSIDERATION AND DECISIONS

Initiators Modeled and Initiator Nonrecovery Estimate

SG tube rupture	1.0	No recovery rupture
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Branches Impacted and Branch Nonrecovery Estimate

None

Plant Models Utilized

PWR plant Class A

CONDITIONAL CORE DAMAGE PROBABILITY CALCULATIONS

Event Identifier: 338/87-017R1
 Event Description: Steam generator tube rupture and plant trip
 Event Date: 07/15/87
 Plant: PWR STGR

INITIATING EVENT

NON-RECOVERABLE INITIATING EVENT PROBABILITIES

SGTR 1.0E+00

SEQUENCE CONDITIONAL PROBABILITY SUMS

End State/Initiator	Probability
CD	
SGTR	7.7E-04
Total	7.7E-04

ATWS

SGTR	3.4E-05
Total	3.4E-05

SEQUENCE CONDITIONAL PROBABILITIES (PROBABILITY ORDER)

Sequence	End State	Prob	N Rec**
102 sgtr -rt -afw -hpi rcs.depr<sg.rv.setpoint	CD	4.1E-04	1.0E+00
103 sgtr -rt -afw hpi	CD	2.5E-04	8.4E-01
101 sgtr -rt -afw -hpi -rcs.depr<sg.rv.setpoint ruptured.sg.isol r cs.cold.prior.to.rwst.depl	CD	1.0E-04	1.0E+00
108 sgtr rt	ATWS	3.4E-05	1.2E-01

** non-recovery credit for edited case

SEQUENCE CONDITIONAL PROBABILITIES (SEQUENCE ORDER)

Sequence	End State	Prob	N Rec**
101 sgtr -rt -afw -hpi -rcs.depr<sg.rv.setpoint ruptured.sg.isol r cs.cold.prior.to.rwst.depl	CD	1.0E-04	1.0E+00
102 sgtr -rt -afw -hpi rcs.depr<sg.rv.setpoint	CD	4.1E-04	1.0E+00
103 sgtr -rt -afw hpi	CD	2.5E-04	8.4E-01
108 sgtr rt	ATWS	3.4E-05	1.2E-01

** non-recovery credit for edited case

SEQUENCE MODEL: c:\asp\newmodel\pwrsgtr.cmp
 BRANCH MODEL: c:\asp\newmodel\pwrsgtr.new
 PROBABILITY FILE: c:\asp\newmodel\pwr_bnew.pro

No Recovery Limit

BRANCH FREQUENCIES/PROBABILITIES

Branch	System	Non-Recov	Opr Fail
sgtr	5.0E-03	1.0E+00	
rt	2.8E-04	1.2E-01	
afw	3.8E-04	2.6E-01	
mfw	2.0E-01	3.4E-01	
hpi	3.0E-04	8.4E-01	
ruptured.sg.isol	1.0E-02	1.0E+00	
rcs.depr<sg.rv.setpoint	1.0E-05	1.0E+00	4.0E-04

Event Identifier: 338/87-017R1

rce.cold.prior.to.rwst.depl	1.0E-02	1.0E+00	4.0E-04
* branch model file			
** forced			

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