

SCRAM SUMMARY 91-01

At 0548 on August 13, 1991, Nine Mile Point Unit Two experienced a turbine trip and automatic reactor scram when the Main Transformer Phase B developed an internal fault (Main Transformer fault details discussed in separate report). The transformer fault created an electrical disturbance throughout the normal electrical distribution system. This electrical disturbance caused UPS 1A-D and G to trip off, de-energizing their respective loads. (Details of UPS trips and electrical system response are discussed in separate reports)

Initially the operators lost most BOP instrumentation and all control room annunciation which created several conflicting indications of reactor status. The SSS ordered the mode switch be placed in shutdown and the crew began to respond to the scram. The crew recognized that feedwater pumps had tripped and initiated Reactor Core Isolation Cooling (RCIC) to control a lowering reactor water level. Reactor systems responded to the turbine trip as expected including a EOC-RPT Recirc pump downshift. Two safety relief valves lifted to limit reactor pressure to 1070 psig. The Redundant Reactivity Control System initiated an Alternate Rod Insertion and Recirc Pump downshift signal on high reactor pressure. Post Accident Monitor recorders shifted to fast speed and continued to provide reactor pressure and water level indication.

99999 9.9999

When reactor water level reached Level 3 (159.3 inches), operators entered the Emergency Operating Procedures (EOPs) for RPV control. Due to lack of control rod position information, operators also entered C5, Level/Power Control. In accordance with C5, automatic ADS operation was inhibited. Because RCIC was running, operators placed RHR loop A in Suppression Pool cooling. Per EAP-2 the SSS/SED declared a Site Area Emergency due to loss of control room annunciators with a plant transient in progress. Reactor water level was recovered using RCIC. The lowest level reached was approx. 145 inches, well above any ECCS injection setpoints. When water level returned to the normal band, RCIC was realigned to pump CST to CST. As water level continued to rise, operators recognized that reactor pressure was below the discharge pressure of condensate booster pumps and tripped them off. Reactor water level at that time was approximately Level 8 (202.3 inches). The cold water expanded and water level continued to rise. One CRD pump was left running to support control rod insertion. Water level was offscale high on the only operating recorders for approximately 8 minutes. During this interval water level was conservatively estimated to reach a maximum of 243 inches (9 inches below the main steam lines).

At approximately 0622, operators restored power to the UPS buses. With power restored to Reactor Manual Control System, the Full Core Display, Rod Worth Minimizer, and Rod Sequence Control System gave some conflicting information on control rod position.



Using RPV control, section RQ, operators installed RPS jumpers and reset the scram. At that point all rods indicated full in.

With RCIC running CST to CST and condensate booster pumps secured, reactor water level decreased. Condensate Booster Pump P2A was restarted to control water level however the feedwater pump suction valves (CNM-MOV84) would not reopen presumed at the time due to high dp. Operators could not manually equalize pressure across the valves due to the SSS restricting access to the turbine building.

Operators used the low pressure/low flow valve (CNM-LV137) to control level. Water level dropped to Level 3 (159.3 inches) again and EOPs were reentered. Water level lowered to a minimum of approx. 124 inches (approx. 15 inches above an ECCS injection setpoint) before returning to the normal band.

At 0950 UPS 1C and 1D were restored to their normal power supplies UPS 1A and 1B had to be left on maintenance supply due to equipment failures. During the shutdown, several equipment failures created additional burden on the control room staff. These equipment problems are described in the Sequence of Events and the Deficiencies list.



In evaluating this transient against the USAR transient analysis the following conclusions were made:

- 1) Reactor pressure rise as shown on both Post Accident Monitoring recorders is much less severe than the pressure rise shown on Figure 15.2-1 of the USAR (Generator Load Rejection with Bypass) 1070 vs 1150.
- 2) Reactor water level as shown on both Post Accident Monitor recorders is slightly lower than the USAR, however this discrepancy was due to all feedwater pumps tripping off.
- 3) Neutron flux was not recorded however, the conditions used in the USAR which influence the flux spike such as pressure rise, scram speed and void fraction are all more severe than actual conditions. In addition N2-ISP-NMS-W@007 "APRM Functional Test" was performed on 8/14/91, and verified proper operation of APRM flux scrams.
- 4) Based on personnel interviews and review of as found conditions, we believe that all plant systems designed to mitigate the severity of this event, (ie EOC-RPT, Turbine bypass valves, SRVs, ARI) functioned as required.

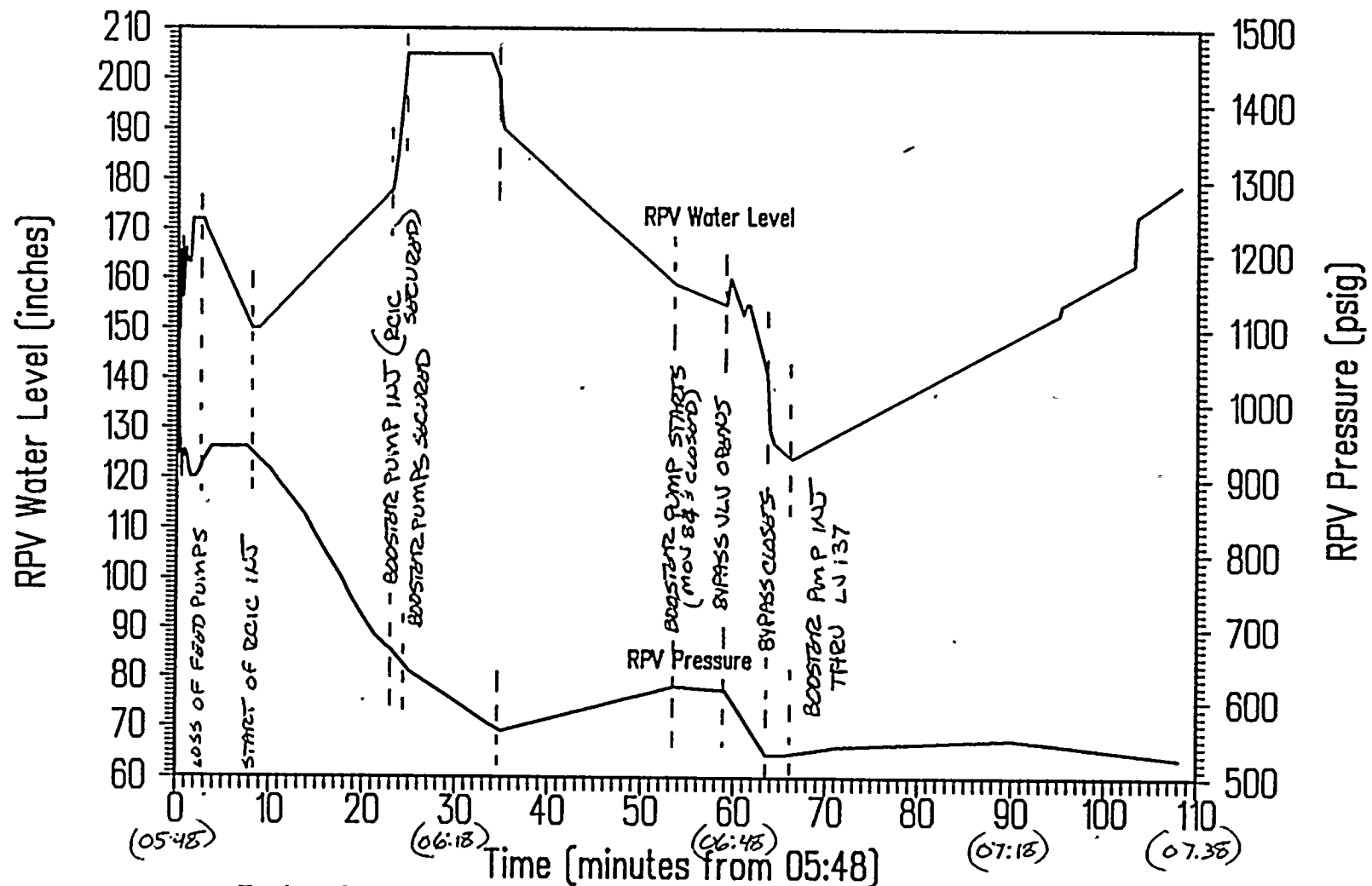


Based on the above conclusions, the results of this transient were within the bounds of current transient analysis.

Scram Evaluation Team:

Team Leader: Tom Tomlinson (SRO)
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Various System Engineers

Nine Mile Point Unit 2 Reactor Pressure and Water Level vs Time



Data from August 13, 1991 Site Area Emergency

SEQUENCE OF EVENTS SCRAM 91-01

The attached Sequence of Events is a reconstruction of the events that occurred on August 13, 1991. Due to the loss of Uninterruptible Power Supply (UPS) power, normal means of recording the event were initially unavailable. Control Room meters and recorders, powered from the affected UPSS, were inoperable during the first 34 minutes of the event. The Plant Process Computer was unavailable an additional 49 minutes. This Sequence of Events is based on operator interviews and written statements, operator logs, Post Accident Monitor (PAM) recorded plots, Turbine/Generator flags, and crew debriefs. Significant effort was made to ensure the validity of the event sequence and times of occurrences. However, due to the above-mentioned conditions, this Sequence of Events is essentially a "best approximation" of the actual event sequence.



TIME	INDICATIONS/PROBLEMS/ACTIONS	REASON/JUSTIFICATION
0548	Loss of Transformer 1B due to Fault	Under Investigation
	Customer Trip of Main Turbine, TSV/TCV shut. Reactor Scrams. Turbine bypass valves open.	See attached list of relay flags. TSV/TCV fast closure. Automatic to control pressure.
	Fast Transfer from Normal Station ¹ Power to Reserve Power.	See attached list of relay flags.
	Failure of UPS 1A-D,G, failed to maintain a power supply to non-safety vital buses. . - Loss of Radio Leaky Wire Antenna System. - Loss of Control Room Annunciators. - CWS-MOG 52s Cooling Tower Bypass Valves went open. - Loss of Computers (Process, SPDS/ERF, GETARS, GEMS, DRMS, 3D-Monicores). - Loss of Gaitronics. - Loss of BOP Instrumentation. - Loss of Essential Lighting. - Off Gas Isolation. - P603 panel Recorders Fail as is. - FWS-LV10s Lockup in open position. - Loss of Drywell Cooling. - Loss of Rod position indication. - Feedwater and Condensate Booster Pump minimum flow valves fail open.	UPS Failure Under Investigation. Resulting from Loss of UPS.

1 - As shown by Scriba Oscilloscope



TIME	INDICATIONS/PROBLEMS/ACTIONS	REASON/JUSTIFICATION
	ARI and PAM to fast speed at 1050 PSIG.	Normal response to hi pressure due to Turbine trip from high power.
	2 SRVs lift at 1070 PSIG.	
	After pressurization event PAM Recorders on P601 are used for Reactor level and Pressure Indication. Level ~ 175" Pressure ~ 920#	Used as reliable indication with redundant sources.
	Observed Scram Pilot lights are out.	Due to Auto Reactor Scram.
	APRM Meters and LPRM Lights on back panels are Downscale, Scram Logic Lights are out, Scram Discharge volume is full.	Operators used various methods to determine reactor power.
	Operators dispatched to verify scram air header pressure and monitor reactor pressure and water level on local indicators.	Backup indications.
	Recirc pumps Downshifted due to EOC RPT and RRCS Hi Reactor Pressure.	As designed.
	Observed Feedwater pumps and Condensate Booster pump 2A tripped. Condensate Booster pump 2C Auto Starts.	Minimum flow valves failed open - see attached memo.
	Division II H2/O2 Sample Pump Trips Off.	Spurious trip unrelated to UPS problems
0549	Mode switch is placed in shutdown.	Ordered by SSS as conservative action.
0555	Manually initiated RCIC due to lowering Reactor vessel level and no feed pumps running. Experienced flow, speed and pressure oscillations while in Auto Control, therefore transferred to Manual control.	Ordered by SSS to control water level.
	Reactor Recirc Runback at L4 (178.3").	Auto response.

TIME	INDICATIONS/PROBLEMS/ACTIONS	REASON/JUSTIFICATION
	Groups 4 and 5 Isolations at L3 (159.3")	
0556	Entered RPV control EOP. Entered C5. ADS inhibit switch to on.	Reactor Vessel Water level <159.3" and lowering. No rod position indication. Required by C5.
	Initiated suppression pool cooling using RHS*P1A.	Ordered by SSS due to RCIC operation.
0600	Declared Site Area Emergency.	EAP-2, Loss of all control room annunciators with plant transient in progress.
	Operators dispatched to verify UPS operation.	Ordered by SSS due to diagnosis of control room indications.
0607	Commenced logging cooldown.	EOP-RPV, verify cooldown.
0608	Notified State and local authorities.	EPP-20
0612	Initiated NRC Contact	EPP-20
0612	Controlling Reactor Vessel Water level with RCIC in manual. Reactor level rising. Reactor Pressure lowering.	As directed by C5.
0614	Secured RCIC injection, started pumping tank-to-tank.	Maintaining level control.
0615	L8 (202.3) is reached, Condensate Booster pumps are secured.	Maintaining level control.
	Operator reports that series UPS 1A-D,G have tripped.	
0620	Secured condensate pumps except for P1A. Reactor Vessel Water level is lowering.	Standard operating practice.
0622	Restore UPS 1A-D,G by manually transferring to maintenance bus. Annunciator Power and other indications are restored.	As directed by SSS.

TIME	INDICATIONS/PROBLEMS/ACTIONS	REASON/JUSTIFICATION
	Group 9 Isolation	Restoration of Power to UPSS
	FWS-LV10s closed.	
0630	All rods in except 6 which have no indication on Full Core Display (Rod 14-31 has no indication on RWM, and 15 without full-in indication on RSCS).	Loss of power. See attached memo.
	CNM-MOV84s closed.	OP-3 prerequisite for starting a condensate booster pump.
	Restored Drywell Cooling Highest Temperature -165°F. Lowest Temperature -120°F	Per Operating procedures.
0640	Started Condensate Booster Pump P2A to maintain Reactor Water level 165" - 180".	Level steadily lowering.
	Attempted to open MOV 84A & B after booster pump running. Received dual indication.	Under Investigation.
	Opened FWS-LV55A in an attempt to establish feed flow to vessel. No flow due to CNM-84S closed.	
	Re-entered RPV EOP on level. Using LV-137 to control Reactor Vessel Water level.	
0645	Reset Rod Drive Control System.	RDCS not scanning due to loss of power.
0650	Installed RPS jumpers per EOP-6 Att. 14.	To enable resetting scram.
0653	Reset scram.	EOP-RPV, Section RQ
0700	All rods indicated full in. Controlling Reactor Press on bypass valves.	
0711	Process computer restored.	

TIME	INDICATIONS/PROBLEMS/ACTIONS	REASON/JUSTIFICATION
	Division II H ₂ O ₂ Sample Pump restarted.	Found tripped by operator.
0729	Started mechanical air removal pumps. No Auxiliary Steam to Clean Steam Reboilers. Started Aux Boiler. Had to pin open AOV-145.	Maintain condenser vacuum.
0732	Main Turbine would not go on turning gear.	See attached memo.
0738	Started Condensate Pump P1B.	To clear high stator temp on P1A due to high flow.
0740	RCIC Shutdown to standby.	No longer needed.
0750	SPDS restored.	
0758	Hydraulic Power Units Reset.	Normal response.
0805	Stack Gems reported Inop. Computer department started rebooting system.	Computer did not restore itself properly after power was restored.
0806	RCS Flow Control Valves full open.	N2-OP-29
0810	Completed restoring RHR Loops B and C to operable.	B and C loops were marked up prior to the event for corrective and preventative maintenance on various valves and instruments.
0821	ADS inhibit switch to Normal, RPS jumpers removed.	EOP Recovery.
0847	Stack Gems computer restored.	
0937	RCIC INOP AOV156 did not indicate shut, MOV126 de-energized shut per Technical Specifications.	Technical Specifications 3/4.6.3
0950	UPS 1C & 1D restored to Normal Power, could not restore 1A & 1B to Normal Power, left selected to maintenance.	Per SED
1006	Drywell vacuum breaker operability test was performed as required by Tech Specs.	Had just determined that two SRVs had lifted at the beginning of the event.

TIME	INDICATIONS/PROBLEMS/ACTIONS	REASON/JUSTIFICATION
1020	UPS 1G restored to normal power.	Per SED.
1031	Group 9 Isolation Reset.	Normal Recovery.
1055	Started Reactor Water Cleanup Pump P1B for full reject.	For chemistry and water level control.
1056	Reactor Water Cleanup Pump P1B trips when Reactor Water Cleanup Isolates due to Delta Flow.	Root cause in progress. No equipment damage. See Engineering memo.
1158	Secured RHS Pump P1A.	Needed to stroke MOV40A for PMT. Two loops of shutdown cooling are required by Tech Specs.
1217	Reset RHR shutdown cooling, RWCU, and Group 4 Isolations.	
1415	Shut Condensate AOV109 (condensate bypass).	For chemistry concerns.
1458	Shutdown RCS Pump P1B for shutdown cooling.	OP-31
1508	Started RHS Pump P1B in shutdown cooling mode.	OP-101C/31
	Experienced difficulty in controlling Reactor Vessel Water Level.	Initially unable to properly throttle RHS*MOV142, RHR Discharge to Radwaste, from Control Room. Opened locally.
1519	Shutdown Condensate Booster Pump P2A.	OP-101C
1520	Shutdown Condensate Pump P1A.	OP-101C
1807	Shut 2FWS-MOV21A & 21B.	OP-101C
1846	Reactor is in Cold Shutdown.	
1943	Terminated Site Area Emergency.	Per SED.

Deficiencies Noted during the Event and Open Items

- 1) Reactor Water Chemistry Excursion
 - Yang Soong of Nuclear Technology has analyzed the chemistry excursion. His recommendations to Chemistry were that 1) this startup occur at a slower rate than normal in order to minimize the effect of any remaining chemical species in the vessel, and 2) Maximum RWCU flow be maintained throughout startup.
- 2) Water hammer in WCS
 - Engineering evaluation - memo SM2-M91-0213
 - Inspection of WCS piping was performed on August 13, 1991, at approximately 1950 hours by Engineering and Radiation Protection. This inspection revealed no abnormal conditions and Engineering has no reservations regarding return of WCS back to service.
- 3) 2ASS-AOV145 had to be pinned open
 - WR 178843, WR 164466, WR 193588
 - ASS-AOV145, Aux Boiler Steam Inlet Control to Reboilers, has an air leak at its control block. The leak causes a loss of air to the valve and subsequent valve closure. Once opened, the valve had to be pinned open.
- 4) Water hammer in RHR
 - Engineering Evaluation - memo NMP77864
 - Inspection of the RHR Piping System was performed on August 13, 1991, at approximately 1350 hours by Engineering and Radiation Protection. This inspection revealed no abnormal conditions and Engineering has no reservations regarding return of RHR back to service. This inspection was performed while the loop was warmed up for the second time. No procedural problems were identified.
- 5) Friskall on Reactor Building Exit
 - WR 192659
 - During the Site Area Emergency, two of the three Friskalls at the Reactor Building were initially not available. One was reset by 0700 and the other required a Work Request. The WR was completed August 17, 1991.
- 6) 2CNM-MOV84s couldn't be open
 - WR 192891, WR 192892, WR 194591, Engineering Evaluation
 - Attempts to open the feedwater suction valves were unsuccessful due to differential pressure (approximately 500 psig) across the valves. WRs were submitted to check torque settings. Investigation is continuing.

7) Chemistry Sampling and Analysis

- Chemistry Evaluation
- The normal sample tap was not available due to the WCS isolation, requiring operator action to valve-in the alternate sample tap. The Loop A tap is not normally valved into service as a result of an engineering assessment of flex hose failure. Chemistry is to submit a DER to request Loop A sample tap continuous service.
- Loss of power to chiller caused the temperature switch to trip. The local thermal reset was required to be depressed and held for five seconds. The Chemistry Technician did not wait the required time and the temperature switch didn't reset. This delayed the sample approximately 15 minutes. An Operator Aid has been developed to identify the five second time requirement.
- The gamma spectrometer was in use for the stack sample analysis. The spare gamma spectrometer is under repair. The unit is to be repaired consistent with department priorities.
- Communication was sometimes confusing between lab, OSC, and TSC. Emergency Planning is to revise OSC to facilitate control of Chemistry Sample teams.
- Ion Chromatographic analysis dilution and contamination problems were encountered. All chem techs qualified in ion chromatography will be requalified by September 5, 1991.

8) Trouble with getting turbine on turning gear

- System Engineer Evaluation, DER 2-91-Q0868
- Following turbine coastdown, the turning gear motor tripped on overcurrent and allowed the rotor to come to a complete stop. Subsequent attempts to put the turbine on the turning gear resulted in motor overloads due to the thermally induced bowing of the rotor. The rotor cooled for approximately eight hours and was then placed on the turning gear. A subsequent walkdown revealed no unusual conditions. It is known the turning gear occasionally trips on overcurrent during coastdown and there are no special recommendations for turbine startup or shutdown as a result of this event. A DER was initiated to address this recurring problem.

9) ICS Outboard check valve 2ICS-AOV156 indication

- WR 193343, WR 194584
- With the ICS system secured, testable check valve AOV156 indicated full open on PNL601. During performance of WR 193343 for correction of the indication problem, it was noted the valve packing was leaking. Performance of WR 194584 corrected the packing leak.

- 10) Two sumps on Rx 175' slightly overflowed
 - WR 193371
 - All Equipment Drain Sumps on Rx 175' overflowed to Floor Sumps with only DER Tank 2A (at ramp) exceeding boundary area. Walkdown on August 26, 1991, showed leakage to be from DFR TK2A discharge hose within the sump.
- 11) MSIV AOV6D Dual Indication
 - WR 193349
 - 2MSS*AOV6D indicated dual position when taken to close. The WR is complete.
- 12) No Aux Main Steam to Clean Steam Reboilers due to PV113
 - WR 193207
 - 2ASS-PV113, Clean Steam Reboilers Control Valve, does not control steam pressure when 2ASS-STV112 is open. Scheduled for work August 27 and 30, 1991.
- 13) LOCA Bypass Switches do not work without UPS (Black) Power
 - Plant Change Request - PC2-0258-91
 - Request for LOCA override switches and logic to be able to function without (Black) UPS power.
- 14) 2CNM-AOV101 Open
 - Procedure Change Evaluation
 - PCE submitted to add reclosure of AOV101, bypass around low pressure feedwater heaters, and AOV109, bypass around condensate demineralizers, after scram to OP-101C. AOV109 was closed to address potential chemistry concerns. AOV101 was closed after cold shutdown.
- 15) ODI 5.16 Skills of the Trade
 - Procedure Change Evaluation
 - PCE submitted to add manual breaker operation for 600V and less. This change has been completed.
- 16) Reactor Vessel Upset range not available on Process Computer and not powered from Safety Related Bus
 - Plant Change Request PC2-0257-91
 - Request that Reactor Vessel Upset range instrumentation be powered from a Safety Related bus and recorded on the process computer in order that level may be recorded during transients that involve power failure.
- 17) RHS*MOV142, RHR Discharge to Radwaste, would not initially open from PNL601
 - WR 193350
 - The throttle discharge to radwaste would not open from the control room and had to be manually opened at the valve. The WR was completed on August 13, 1991.

- 18) Cooling Tower Bypass Gates fail open on loss of power to temperature instruments.
- Plant Change Request - PC2-0288-91
 - Loss of UPS power caused the temperature instruments in the basin to fail downscale, sending a signal for the bypass gates to open. This could have caused an overflow of the basin (in this event the basin did not overflow) and a loss of the circulation water heat sink. The plant change request was submitted to change the logic so that the bypass gates fail closed.

- 19) Transformer 1B Fault
- Root Cause being investigated
 - Transformer being removed. Spare Transformer to be used.

- 20) UPS1A-D and G failed to transfer
- System Engineer Evaluation continuing

- 21) Feedwater and Condensate Booster Pumps trip off
- System Engineering Evaluation
 - Loss of UPS1A and 1B resulted in loss of flow signals to the minimum flow valves for both the feedwater and condensate booster pumps. This caused the system flow to exceed the supply capacity of the condensate system, causing system pressure to decrease.

The operating "B" and "C" feed pumps and "A" condensate booster pumps tripped on low suction.

- 22) Control Rod position indications not consistent
- System Engineering Evaluation
 - During two verifications the following conditions were noted:
 - a) RSCS indicated that 15 rods were not full in.
 - b) The Full Core Display (DMM) indicated that 6 rods were not full in.
 - c) The RWM indicated that all rods were full in.
 - The operation and indications produced by the Reactor Manual Control System are different for each of the three indicating sub-systems.
 - a) RSCS ----"Full-In" and no "Data Fault".
 - b) DMM ----"Full-In"
 - c) RWM ----(Tens, Units 0,0) or "Full-In" or Latch Function.

The solutions could be to use RWM and DMM for full-in rod position verification or change the data fault data-bit... on the Probe Data Processor III Card. Use of the RWM in conjunction with the Full Core Display and RSCS vise RSCS alone is highly recommended.

(This method of verification of rod position post scram is already incorporated in current operating procedures.)

- 23) Stack GEMS Computer did not properly restart when power was restored
- DER 2-91-Q-730, Chemistry Evaluation
 - The Stack GEMS was operable during and after the site area emergency although the Control Room Chart Recorder lost communication with GEMS for a brief period. Particulate and iodine sample acquisition was continuous during and after the event. Computer Control of the system was interrupted for two (2) brief periods.
- 24) The following ESF Actuations will be covered by LER 91-17
- Scram DER 2-91-Q-708
 - Group 9 Isolation DER 2-91-Q-773
 - RWCU Isolation DER 2-91-Q-710
 - Group 4 Isolation DER 2-91-Q-798
- 25) Missed required Tech Spec Surveillance
- DER 2-91-Q-709, System Engineer Evaluation
 - Tech Spec 3/4.6.4, Suppression Chamber/Drywell Vacuum Breaker, require that...operability shall be demonstrated within 2 hours after any discharge of steam to the suppression chamber from the safety/relief valves, by cycling each vacuum breaker through at least one complete cycle of full travel". The actuation of two safety/relief valves wasn't discovered until approximately four hours after they actually lifted so this Tech. spec. was not met within the required time limit.
- 26) Missed required Tech Spec Action (RPS Inop due to EOP Jumpers)
- DER 2-91-Q-74B & Section from J. Helker's report "Assessment of Operator Response"
 - Defeating of RPS interlocks is authorized by the EOPs for this particular scenario in order to provide the ability to reset the scram and perform multiple scrams. This Tech Spec action request specifies placing at least one RPS trip system in a tripped condition within one hour. Using N2-EOP-6 Attachment 14 operators had defeated all RPS interlocks (except for manual) as directed by the EOPs for a period of approximately one and one half hours. The basis for the procedures and safety evaluations recognize the potential for this condition, thus, the action taken by the operators and direction by two procedures was appropriate.

- 27) DIV II H₂/O₂ Sample Pump Trip (2CMS*P2B)
- WR 190966 & 196053
WR 190966 (910824) is closed. Work Item Description: During Plant Transient on 910813 Div. II Pump (2CMS-P2B) tripped for no obvious reason. Div. I CMS and all other Div. II CMS SOVs were found in their normal positions. Determine cause of pump trip and correct if required. Cause of failures: None found, possibly spurious.
 - Following completion of the WR I&C traced the wires through the electrical downings and determined that pump *P2B was wired to the correct power panel.
 - Subsequently NMP2 Operations tripped pump *P2B by opening its power panel breaker.
 - WR 196053 (910829) is still open. Work Item Description: check the breaker for pump *P2B.
- 28) RCIC Flow Oscillations
- WR 184909 and 189944
 - WR 184909 (910814) is still open. Work Item Description: After several minutes of operation during the RCIC Quarterly Surveillance the RCIC Flow Controller in auto began to hunt at approximately plus or minus 50 GPM about its set point of 600 GPM. Need Control Loop Setting Verification per attached and troubleshoot as necessary.
 - WR 18994 (910627) is still open. Work Item Description: RCIC Turbine Speed Exhibits hunting during surveillance test; perform applicable procedure steps (N2-IMP-ICS-001) to tune up the RCIC Control System.
- 29) Drywell Temp indicator discrepancy CMS*TRX130
- WR189947
 - WR 189947 (910819) is still open. Work Item Description: Pen showing elevation 307 temperature on the Drywell temperature recorder did not move during temperature transient in the Drywell.
- 30) Fire panels affected by transient
- Letter from A. Andersen dated August 15, 1991.
 - 18 of 20 fire panels at Unit 2 maintained normal power supply. Two fire panels transferred to internal battery backup. There was no interruptions or decreases of fire protection/detection/suppression at the local fire panels.
- 31) Group 9 Isolation
- System Engineering Evaluation.
 - Upon loss of UPS1A, automatic isolation of Group 9 valves was lost. Also, loss of UPS1B resulted in loss of 2GTS-RE105, causing the radiation monitor trip contacts to close. This closed contact feeds a 15 second time delay relay in the isolation logic.

When power was restored to UPS1A, the Group 9 isolation logic was restored, causing the relay fed from the radiation monitor to time out, which resulted in the Group 9 isolation.

- 32) WCS isolation
- Operations Evaluation of Operating Procedure.
 - Root Cause under investigation by Operations Department.
- 33) Verification that EOP Actions Restored to Normal
- Attachment 14 (Alternate Control Rod Insertions) to N2-EOP-6 which installed the RPS Jumpers has a hand written double verification of their removal.
 - The ADS inhibit switch is a Control Room front panel switch on panel P601 which has been verified to be back in its normal position.
 - A Procedure Change Evaluation (PCE) will be written suggesting that all EOP-6 attachments have double verification steps after all restoration steps.
 - A second PCE will be written suggesting that the startup check list for N2-OP-101A have two additional line items.
- a) Was Nine Mile Point Two in the EOPs when it was shut down? Yes/No
- b) If a) above was yes verify that all EOP-6 related action items have been restored.

LIST OF PROTECTIVE RELAY ACTUATED ON AUGUST 13, 1991

Unit Protection Alt 1

<u>Protective Relay</u>	<u>Lockout Relay</u>	<u>Action</u>	<u>Ref. Dwg.</u>
87-2SPMX01	86-1-2SPUX01	•Initiate Turbine Trip	ESK-8SPU01
Main Transformer	86-2-2SPUX02	•Initiate Fast Transfer	ESK-8SPU02
Differential		to Reserve Station	ESK-5NPS13
Protection Relay		Transformer	ESK-5NPS14

Unit Protection Alt 2

<u>Protective Relay</u>	<u>Lockout Relay</u>	<u>Action</u>	<u>Ref. Dwg.</u>
87-2SPUX02	86-1-2SPUY01	•Initiate Turbine Trip	ESK-8SPU01
Unit Differential	86-2-2SPUY01	•Initiate Fast Transfer	ESK-8SPU03
Protection Relay		to Reserve Station	ESK-5NPS13
		Transformer	ESK-5NPS14
63-2SPMY01	86-1-2SPUY01	•Initiate Turbine Trip	ESK-8SPU03
Fault Pressure	86-2-2SPUY01	•Initiate Fast Transfer	Sh. 2
Transformer		to Reserve Station	ESK-8SPU03
		Transformer	Sh. 1
			ESK-5NPS13
			ESK-5NPS14

Unit Protection Backup

<u>Protective Relay</u>	<u>Lockout Relay</u>	<u>Action</u>	<u>Ref. Dwg.</u>
50/51N	86-1-2SPUZ01	•Initiate Turbine Trip	ESK-8SPU04
2SPMZ01	86-2-2SPUZ01	•Initiate Slow Transfer	ESK-5NPS13
Protection Relay		After 30 Sec.	ESK-5NPS14
		Block Fast Transfer	
		After 6 Cycles	

Generator Protection

<u>Protective Relay</u>	<u>Lockout Relay</u>	<u>Action</u>	<u>Ref. Dwg.</u>
Gen. Phase OC During	86-1-2SPGZ01	•Initiate Turbine Trip	ESK-8SPG01
Startup		•Initiate Slow Transfer	ESK-8SPG04
50-2SPGZ02		After 30 Sec.	ESK-5NPS13
		Block Fast Transfer	ESK-5NPS14



SCRIBA RELAYS

BUILDING #1

Panel 4-25	Loss Ground Line 20
Panel 3-1F	STA Serv. Loss of Source 1 & or #2
Panel 3-7R	Line Protection "A" Package 345 KV. Scriba - Volney #20 46TTA 20
Panel 23R	Line 23 - 67NB/L23 Inst "B" Package Nine Mile 23/DTT Xmit & Rev 30TRB - 1/L23 Trip R230 TC #2 Trip R925 TC #2
Panel 1-5R	345 NM2 - Scriba 23 Dir Trans Trip Receive "A" 30 TRA-1 L23



2ENS*SWG103

XFMR. FDR. 2EJS-X3A 103-1

Undervoltage Relay Flags in ON;

- 1) 27BA 2ENS B24
- 2) 27BB 2ENS B24
- 3) 27BC 2ENS B24

2ENS*SWG101

XFMR. FDR. 2EJS-X1A 101-14

Undervoltage Relay Flags in ON;

- 1) 27BA 2ENS A24
- 2) 27BB 2ENS A24
- 3) 27BC 2ENS A24

2ENS*SWG102

HPCS METERING CUBICLE 102-7

Undervoltage Relay Flags in ON;

- 1) 27BA
- 2) 27BB
- 3) 27BC

2NPS-SWG002

"B" AUX. BOILER

- 1) ABM-B1B SWG-002-3
50/51-2-2ABM B51 (INST.) flag in



2CEC-PNL847
(EHC CABINET BAY E)

30 VDC PMG SUPPLY	-HIGH LIMIT -LOW LIMIT
30 VDC HOUSE POWER SUPPLY	-HIGH LIMIT -LOW LIMIT
-22VDC PMG SUPPLY	-HIGH LIMIT -LOW LIMIT
-22VDC HOUSE POWER SUPPLY	-HIGH LIMIT -LOW LIMIT (low limit not lit, WR154662)
24VDC PMG SUPPLY	-HIGH LIMIT -LOW LIMIT
24VDC HOUSE POWER SUPPLY	-HIGH LIMIT -LOW LIMIT
OSC 1 3K HZ	-HIGH LIMIT -LOW LIMIT (WR168493)
OSC 2 3K HZ	-HIGH LIMIT -LOW LIMIT
OSC 3 3K HZ	-HIGH LIMIT -LOW LIMIT
OSC 4 3K HZ	-HIGH LIMIT -LOW LIMIT

THESE ARE LIGHTS THAT ARE LIT ON THIS PANEL THAT ARE NOT
IN DURING NORMAL OPERATION.

First 4th Bus! Cust Trip

Copy to:

T. Tomlinson

C. Shawcross



1991 ESL LISTINGS PRIOR TO TRANSIENT

		INFO ONLY?
91-459	RHS B & C work WRS & EPMS	No
91-458B	SCRM "A" failed Calibration Surv	In Mode 1
91-458A	RMS-CAB180 Vent GEMS Surv	No
91-457	GTS*FN1B (GTS Train B) Unit Cooler Work (Div. II)	No
91-456	SWP*CAB146A RHS SW Effluent Loop A Rad Mon	No
91-455	SWP*CAB23A RHR SW "A" Rad Mon	No
91-452	HVC*CAB18A & C Cont Room Air Intake Rad Mon's	No
91-451	SWP*CAB146B SW Effluent Loop B Rad Mon	No
91-431	EGA-HOSE13B Connection to C2B Leaks	Yes
91-427	RMS*RE1D Rx Bldg. ARM Inop	Yes
91-420	WCS-V30A Valve Backseated to stop leak	Yes
91-407	LPM-NBE2A & B, NBV101 Loose Parts Monitor Recirc Loop Set Points too low & ground prob	No
91-374	RMS*RE111 Rx Bldg. ARM Inop	w/112 oper in Mode 1
91-361	CMS*SOV25D SOV won't open	Yes
91-359	HVC*UC107 Repairs to SWP Valve	Yes
91-345	Rx Bldg. Unit Coolers - Set Points raised	Yes
91-278	RHS*MOV40A S/D Cooling Loop "A" Inop until PMT performed	No
91-262	CPS*AOV104, 106 Hold Outs on AOVs for LLRT Failure	No
91-257	Appendix "R" Valves Surv.	Yes
91-255	Control Rod 22-47 Indication @ position 48 Inop	No

1991 ESL LISTINGS PRIOR TO TRANSIENT (cont'd)

91-214	CPS-FN1 Purge Fan Running w/ Drywell open	Yes
91-169	SLS-P1A/B Resolution to NRC in #91-12	No
91-160	OFG-FT13A & B Flow Xmttr Calib	No
91-083	HVR*UC413A & B Dampers shut as per Pr 90-09183	Yes
91-072	ICS*PCV115 Info. Only (PCV115 Failed Open)	Yes
91-068	Appendix R Valves Hold Outs	Yes
91-024	RHS*SOV36B Isolated	Yes
91-016	CMS*SOV26A & C, CMS*SOV23B Deactivated for Failed Surv.	Yes



RESULTS OF UPS FAILURE

- 1) Loss of Control Room Annunciators
- 2) Loss of Control Room Computers
- 3) Loss of Gaitronics
- 4) Loss of BOP Instrumentation
- 5) Loss of Essential Lighting
- 6) Loss of Drywell Cooling
- 7) Offgas System Isolation
- 8) Loss of Rod Position Indication
- 9) Group 9 Isolation
- 10) P603 Recorders fail as is
- 11) FWS-LV10s Lockup in open position
- 12) CWS-MOG52s (Cooling Tower Bypass Valves) went open
- 13) Loss of Radio Leaky Wire Antenna System
- 14) Feedwater and Condensate Booster Pump minimum flow valves fail open



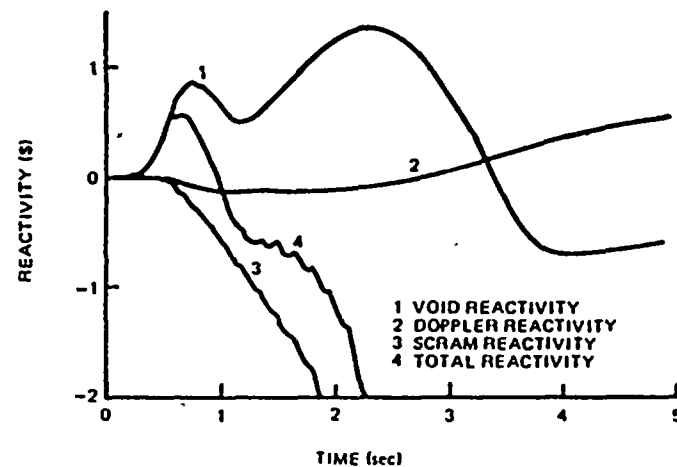
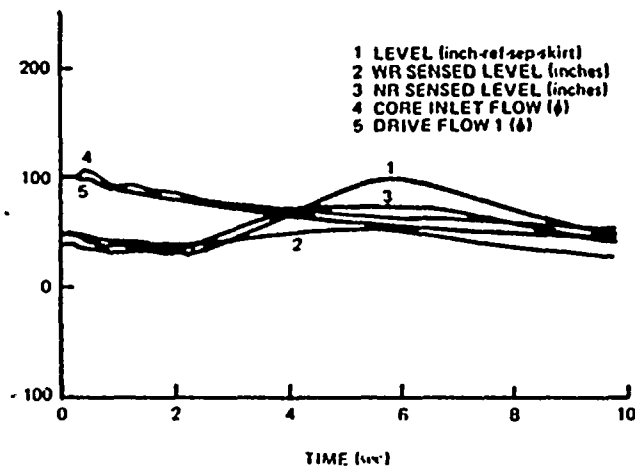
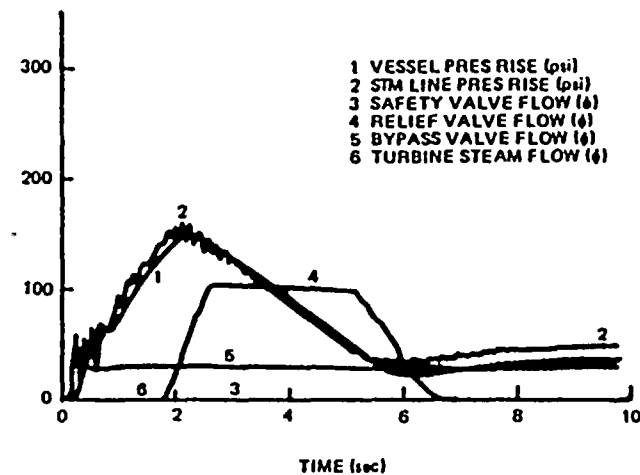
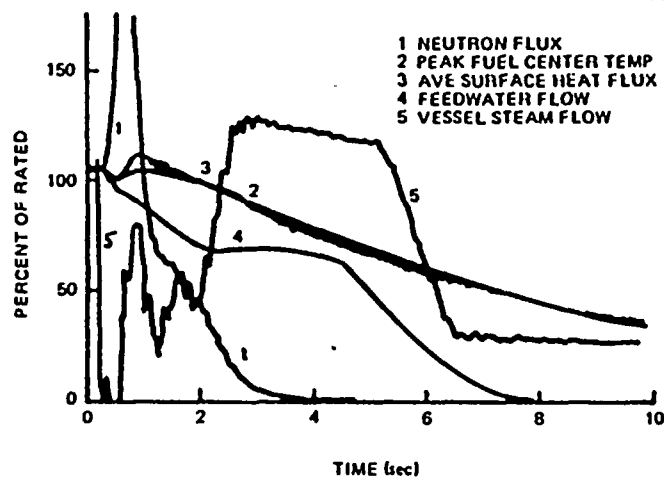


FIGURE 15.2-1

GENERATOR LOAD REJECTION
WITH BYPASS

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
FINAL SAFETY ANALYSIS REPORT

