WOLF CREEK
NUCLEAR OPERATING CORPORATION

John A. Bailey
Vice President
Operations

July 13, 1992

NO 92-0193

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Station P1-137
Washington, D. C. 20555

Subject: Docket No. 50-482: Licensee Event Report 92-006-00

Gentlemen:

The attached Licensee Event Report (LER) is being submitted as a voluntary report.

Very truly yours,

John A. Bailey

John A. Bailey
Vice President
Operations

JAB/aem

Attachment

cc: A. T. Howell (NRC), w/a
J. L. Milhoan (NRC), w/a
G. A. Pick (NRC), w/a
W. D. Reckley (NRC), w/a

IE22 1/1

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Wolf Creek Generating Station	0 5 0 0 0 4 8 2	1 OF 0 9

TITLE (4) Binding And Slippage Between Reactor Coolant System Crossover Leg Saddles And Thrust Block Causes Unusual Noise

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 2	2 8	9 2	9 2	- 0 0 6 -	0 0	0 7	1 3	9 2		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): 3

POWER LEVEL (10): 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

[ ] 20.402(b)	[ ] 20.405(c)	[ ] 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)	[X] 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)	Voluntary
[ ] 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 (AREA CODE)
Steve G. Wideman - Supervisor Licensing	3 1 6 3 6 4 - 8 8 3 1

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

SUPPLEMENTAL REPORT EXPECTED (14)

[ ] YES (If yes, complete EXPECTED SUBMISSION DATE) [X] NO

EXPECTED SUBMISSION DATE (15): MONTH | DAY | YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On February 28, 1992, with the unit in Mode 3, Hot Standby, the Control Room received alarms on the Loose Parts and Vibration Monitoring System and the Seismic Instrumentation system. Three inspection personnel inside the Containment Building standing on the Reactor Cavity Seal Ring heard an unusual noise and felt the seal ring vibrate. An extensive walkdown of the Reactor Coolant System (RCS), connecting systems and the Containment Building did not identify any evidence of RCS leakage or other significant damage.

An evaluation of data from this event and data from similar events in January and March 1992, identified that the noise was generated as the result of thermal binding and subsequent slippage between the RCS crossover leg saddles and thrust blocks. The shims on the reactor coolant pump (RCP) and steam generator crossover legs lower horizontal and the RCP vertical restraints were reworked to maintain minimum clearance at normal operating temperature. Additional monitoring of the RCS for thermal expansion and proper clearance between the crossover leg saddles and thrust block will be performed.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
Wolf Creek Generating Station	0 5 0 0 0 4 8 2	9 2	- 0 0 6 -	0 0	0 2 OF 0 9

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

INTRODUCTION

On February 28, 1992, at 0154 CST, with the unit in Mode 3, Hot Standby, the Control Room [NA] received alarms on the Loose Parts and Vibration Monitoring System (LPVMS) [II] and the Seismic Instrumentation System [IN]. Three inspection personnel inside the Containment Building [NH] standing on the Reactor Cavity Seal Ring heard an unusual noise and felt the seal ring vibrate. An extensive walkdown of the Reactor Coolant System (RCS) [AB], connecting systems and the Containment Building did not identify any evidence of RCS leakage or other significant damage. An evaluation of data from this event and data from similar events in January and March 1992, identified that the noise was generated as a result of thermal binding and subsequent slippage between the RCS crossover leg saddles and thrust blocks. Subsequent evaluation indicates that the binding of the RCS crossover legs at the thrust blocks imposed acceptable loads and stresses on the RCS and the stresses were within the applicable American Society of Mechanical Engineers (ASME) code allowables. This event is being reported as a voluntary Licensee Event Report (LER).

DESCRIPTION OF EVENT

On February 28, 1992, at 0035 CST, during a routine reactor coolant pressure boundary inspection, a leak was identified from a canopy seal weld on a spare capped head penetration. The plant was in Mode 3, Hot Standby, making preparations for going to Mode 2, Start-up. Reactor Coolant System temperature and pressure had been stable at approximately 537 degrees Fahrenheit (F) and 2235 pounds per square inch gage (psig) for four hours. No RCS or containment parameters were changing. Safety Injection accumulator check valve testing had been completed for more than nine hours and all accumulator isolation valves had been open for 13 hours. Technical Specification 3.4.6.2.a requires RCS leakage be limited to no pressure boundary leakage. As a conservative measure, Control Room operators entered Technical Specification 3.4.6.2.a Action Statement which requires the plant be placed in Cold Shutdown within 30 hours.

At 0152 CST, the Control Room received Annunciator 98C "R Spectrum OBE Exceeded," Annunciator 98E "Seismic Recorder On," and Annunciator 79F "Loose Parts Monitor Alarm." At approximately the same time, three inspection personnel inside the Containment Building reported to the Control Room a loud noise and vibration of the Reactor Cavity Seal Ring.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
Wolf Creek Generating Station	0 5 0 0 0 4 8 2	9 2	- 0 0 6 -	0 0	0 3 OF 0 9

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

As a result of the event, the Director Plant Operations initiated an Incident Investigation Team (IIT) to investigate and evaluate the event. Plant conditions were maintained until the IIT had performed an initial investigation. An extensive walkdown of the RCS including the Emergency Core Cooling System identified no evidence of leakage or damage. The IIT initial evaluation included a review of the Control Room logs and plant parameters, interviews with on-shift operators and a review of significant modification's made during the fifth refueling outage. Additionally, the IIT took measurements of the cavity seal ring for comparison of the hot position to the cold position. The LPVMS audio tape was reviewed by Reactor Engineering personnel and then transmitted to a contractor for analysis. Control Room operators performed surveillance test procedure STS BB-004, "RCS Water Inventory Balance" and determined that leakage rates had not increased.

Communication with NRC Region IV was initiated and a letter was submitted confirming the actions being taken by Wolf Creek Nuclear Operating Corporation (WCNOC) prior to restart of the plant. It was subsequently determined that the leakage from the canopy seal weld was not pressure boundary leakage and Technical Specification 3.4.6.2.a was exited. On February 28, 1992, after an initial investigation into the noise it was determined that a plant cooldown was required to repair the leak on a canopy seal weld.

The IIT began looking for past events which may have produced similar reported effects. The initial screening criteria consisted of a "Seismic Recorder On" alarm and any report of an unusual noise or movement/vibration. This search identified two potential events, one on January 9, 1992, and another on May 10, 1990, that may have been similar to the February 28, 1992 event.

EVALUATION OF PREVIOUS EVENTS

An evaluation of the three events which resulted in a seismic recorder activating and a report of an unusual noise was performed. These events consisted of the potential May 10, 1990 and the January 9, 1992 events, and the initiating February 28, 1992 event. Based on this evaluation, the May 10, 1990 event was shown not to be similar to the other two events.

May 10, 1990

During this period, the plant was returning to power operation following the fourth refueling outage. A review of the Control Room logs indicate that the "Seismic Recorder On" alarm was received and floor motion was "felt" by the Control Room operators. This was the original screening criteria established to find past events. These same logs indicated that the plant had entered Mode 3, Hot Standby, at 1510 CDT the previous day and that by 2025 CDT they were holding at approximately 450 degrees F and 900 psig. The most recent series of check valve testing had been completed two hours prior to the event. By 2330 CDT, approximately one hour and 45 minutes before the event, RCS pressure was greater than 950 psig and the accumulator isolation valves were open. At 0016 CDT on May 10, a seismic alarm was received and an operator was dispatched to investigate the situation. For the next 17 hours, Control Room operators continued the RCS heat-up and using system operating procedure SYS EP-201, "RCS Isolation Check Valve Leak Test," continued to leak test check valves. Results Engineering personnel continued measuring check valve leakage in accordance with surveillance test procedure STS PE-019E, "Seating Accumulator Safety Injection Line Check Valves Using Test Line Valves". All check valve leakage rates were found to satisfy the acceptance criteria.

January 9, 1992

During this period, the plant was in the process of heating up following the fifth refueling outage in preparation for returning to power operation. A review of Control Room logs and the process computer archives indicated two significant alarms were received on or about 0306 CST. They were the "Seismic Recorder On" and the "R Spectrum OBE Exceeded" alarms. The LPVMS was already in the alarm condition and had been for several hours. Nothing was heard or felt by Control Room operators but Security personnel did report a loud thud and shake at the 2047 feet elevation of the Auxiliary Building just outside the Personnel Hatch. The plant was in Mode 3, Hot Standby, at approximately 512 degrees F and 1830 psig on a 20 degrees F per hour heat-up rate with check valve testing still in progress. The piping upstream of the safety injection (SI) pump check valves (EP-V010, 20, 30 and 40) [BQ-V] was depressurized at 0304 CST. The test line isolation valve (EM HV-8823) was reclosed at 0314 CST, allowing the line to begin repressurization. All four of these valves exhibited no leakage at this pressure. All check valve leakage rates were found to satisfy the acceptance criteria. The accumulator isolation valves were open during this evolution. Control Room logs indicate that the seismic analyzer located on the containment basemat, (2000 feet elevation), just outside the containment wall, captured an event on the 32 hertz (Hz) channel in the east to west direction. Plant heat-up continued during the Control Room investigation and was stabilized at approximately 538 degrees F at 0445 CST. A review of the plant process computer archives data indicated that all other pertinent plant parameters were stable and in their normal ranges.

Plant process computer files indicate that at the time of the event the accumulator levels were stable or increasing slightly.

During this time period the B reactor coolant pump (RCP) [AB-P] frame vibration made a shift in amplitude and phase angle. This appears to be unique to the B RCP and it appeared to occur at or about the same time and temperature as the February 1992 event.

Seismic data of this event was recorded on magnetic tape from the Seismic Instrumentation System equipment. Evaluation of this data by the vender identified a single impact, with the primary shield wall as the highest loaded section of the Containment Building.

February 28, 1992

Control Room logs indicate four alarms were received at approximately 0154 CST. The four alarms were "Seismic Recorder On," "R Spectrum OBE Exceeded," "Loose Parts Trbl," and "Process Rad Monitor Hi". Ten of the twelve LPVMS channels were in an alarm condition. The process computer archives indicate that the "Process Rad Monitor Hi" alarm came in about 30 seconds after the Seismic Instrumentation System and LPVMS alarms. Instrumentation and Controls personnel confirmed that the "Process Rad Monitor Hi" alarm was due to a spurious signal.

Reactor Coolant System temperature was 537 degrees F and pressure was 2235 psig. The temperature and pressure had been stable for several hours while testing was being performed on a main steam relief valve [SB-RV]. The testing of the relief valve had been complete for over an hour when the four alarms were received. Maximum SI accumulator level change was a decrease of 0.04 percent, (0.33 gallons), in the D accumulator. Process computer data for the time of the event shows no valve manipulations, pump starts, or other plant evolutions in progress when the noise occurred.

Process computer history for the "Seismic Recorder On" alarm indicates this alarm has never annunciated during previous check valve testing. The only valid annunciations of this alarm were during the January 9, 1992 event, the February 28, 1992 event and the plant trip on February 19, 1992. The remaining annunciations were during calibration checks and two one-second long spurious signals. The "R Spectrum OBE Exceeded" alarm annunciated during the check valve testing coming out of the fifth refueling outage and the February heatup. However, when the D SI accumulator isolation valve was manually opened the "R Spectrum OBE Exceeded" alarm did not annunciate but when the valve was electrically opened during check valve testing it set off the "Seismic Recorder On" alarm.

Vibration data for the B RCP revealed a similar situation to the January event. Frame vibration levels and phase angles changed at similar plant conditions.

ANALYSIS OF POTENTIAL SCENARIOS

Based on the evaluation of the three events and other pertinent information, three potential scenarios were postulated which may have generated the noises. These potential scenarios included a loose part impacting the reactor vessel, a thermal-hydraulic transient in the safety injection accumulator line and thermal growth of the RCS resulting in binding or interference. Analysis of the three potential scenario's were performed using the information available from the three events. From the analysis, it was believed that the noise was being generated as a result of binding during thermal growth of the RCS. In order to aid in the analysis, it was realized that a testing/monitoring program during a subsequent heat-up of the RCS was necessary.

THERMAL EXPANSION MONITORING PROGRAM

Walkdowns of the Containment Building and the RCS in addition to analysis of the RCS confirmed there was no damage to the RCS. Based on these walkdowns and analysis, it was concluded that heat-up of the RCS to normal operating temperature and pressure would pose no problems with the RCS. Temporary procedure TP-TS-72, "RCS Thermal Expansion Monitoring" was developed to prescribe the inspection methods and instrumentation to monitor thermal expansion of the RCS during a normal plant heatup. The intent of the monitoring program was to identify any evidence of binding or operational obstruction of the RCS. In conjunction with the thermal expansion monitoring program, data was taken to identify if the conditions for a thermal-hydraulic transient could exist.

The monitoring program included installing lanyards at each RCS crossover leg and on the B RCP motor to monitor movement during plant heat-up. Industry experts were brought in to measure RCS expansion during plant heat-up and compare it to the data obtained during initial start-up of the plant. Additional pressure and temperature monitoring points were added for thermal-hydraulic transient considerations especially during check valve testing. Wolf Creek Generating Station (WCGS) personnel performed walkdowns of the RCS during plant heatup to monitor snubber settings and whip restraint gaps to ensure proper pipe movement.

A plant heat-up was conducted from March 8 through March 16, 1992 in accordance with WCGS operating procedures. As directed by procedure TP-TS-72, the heat-up was halted at various plateaus to obtain data. On March 16, 1992, at approximately 1920 CST with RCS temperature approximately 551 degrees F, a similar noise event occurred.

During walkdowns of the RCS on March 13, 1992, personnel identified that RCS loop A and C crossover vertical drop restraints had moved down approximately six inches and loop D had moved down approximately .5 inches. Review of the data and inspection of the vertical drop restraints indicate that the restraints movement was due to the relaxation of clamp springs and the misposition of clamp spacers.

RESULTS OF THERMAL EXPANSION MONITORING PROGRAM

The piping and support clearance measurements which were obtained during plant heat-up from 105 degrees F to 550 degrees F on March 8 through March 16, 1992 were compared with the design values specified in the Westinghouse Reactor Coolant Loop Thermal Expansion Test Program. This comparison indicated that the thermal expansion of RCS piping from ambient temperature to approximately 440 degrees F (at the point the crossover leg saddles came in contact with the thrust block) closely followed the expected system designed thermal growth. Binding between the crossover leg saddles and the thrust block occurred above an RCS temperature of approximately 440 degrees F due to a lack of sufficient clearances. Additionally, the binding between the crossover leg saddles and the thrust block prevented the crossover leg from moving in the out-of-plane direction. The resultant binding and the friction force between the crossover leg saddles and the thrust block is believed to have initiated gouging of the thrust block shims.

An evaluation of the loads on the crossover legs and the RCS loops was performed by the Nuclear Steam Supply System vendor to determine the effect of crossover leg binding on the system and piping integrity. The evaluation concluded that the binding of the crossover legs saddles at the thrust block imposed acceptable loads and stresses on the crossover legs and the RCS, and the stresses were within the applicable ASME code allowables.

Data collected during plant heat-up indicate that Tie Rod TR-2 for the four reactor coolant pumps were in hard contact at ambient temperature, and remained there throughout the plant heat-up. Stresses at Tie Rod TR-2 for the four reactor coolant pumps due to lack of clearance did not exceed the ASME code allowables for the tie rods. In addition, lack of clearance at the tie rods did not prohibit thermal expansion of RCS piping, or contribute to the noise events.

ROOT CAUSE AND CORRECTIVE ACTIONS

Evaluation of the data from the Thermal Expansion Monitoring Program and the four events determined that the source of the noise for the January, February and March 1992 events was thermal binding and subsequent slippage between the crossover leg saddles and the thrust block (see Figure 1). The crossover leg saddles became bound at the restraint by friction as temperature increased above 500 degrees F, restricting further free thermal expansion and resulting in [illegible] movement. Subsequently, on March 18, 1992, a plant cooldown was initiated to approximately 440 degrees F to provide clearance between the crossover leg saddles and the thrust block to allow removal of the thrust block shims.

The shims on the RCP and steam generator crossover legs lower horizontal and the RCP vertical restraints were removed and machined to maintain minimum clearance at normal operating temperature. Rework of the shims at the binding points alleviated the restriction to thermal expansion, allowing expected uniform movement.

Alarm response procedure ALR 00-098C, "R Spectrum OBE Exceed", was revised to require Control Room operators to stabilize plant conditions and obtain management concurrence before changing power level or mode upon receipt of a "R Spectrum OBE Exceeded" alarm. Additionally, procedure ALR 00-79F, "Loose Parts Mon" was revised to record the time, the channels that alarmed and the

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6): YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
Wolf Creek Generating Station	0 5 0 0 0 4 8 2	[illegible] 2	0 0 6	0 0	0 8 OF 0 9

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

tape recorder counter reading, and to not zero the counter after each activation of the alarm.

A review of the movement of the vertical drop restraints concluded that the movement of the restraints were unrelated to the binding between the crossover leg saddles and the thrust block shims. The vertical drop restraints were inspected on all four RCS loops, and the restraints for loops A and C were returned to their original position with the clamp spacers removed and with new clamp springs. An evaluation of the loop D crossover vertical drop restraint determined that the restraint was acceptable. In a subsequent heat-up to normal operating temperature, it was observed that at the vertical drop restraint tie rod was in contact with the steam generator inlet support. The interference between the tie rod and the steam generator inlet support was relieved by enlarging the notch in the inlet support.

Additional actions as a result of WCNOC's evaluation of the noise events are planned. For the next two plant cooldowns to less than 440 degrees F on the RCS cold leg, measurements will be taken during plant heat-up of the clearances between the crossover leg saddles and thrust blocks and RCP tie rod clearances. Special test equipment will be used in conjunction with the installed Seismic Instrumentation System and LPVMS for monitoring and recording of any abnormal vibrations. Additionally, the LPVMS will be placed in the continuous record operation during the plant heat-up. These actions will be incorporated into a test procedure with the appropriate acceptance criteria.

WCNOC will evaluate the need for future monitoring at the conclusion of the second heat-up.

ADDITIONAL INFORMATION

The noise events did not result in damage to plant equipment or release of radioactivity. At no time did conditions develop that may have posed a threat to the health and safety of the public.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
Wolf Creek Generating Station	0 5 0 0 0 4 8 2	9 2	0 0 6	0 0	0 9 OF 0 9

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

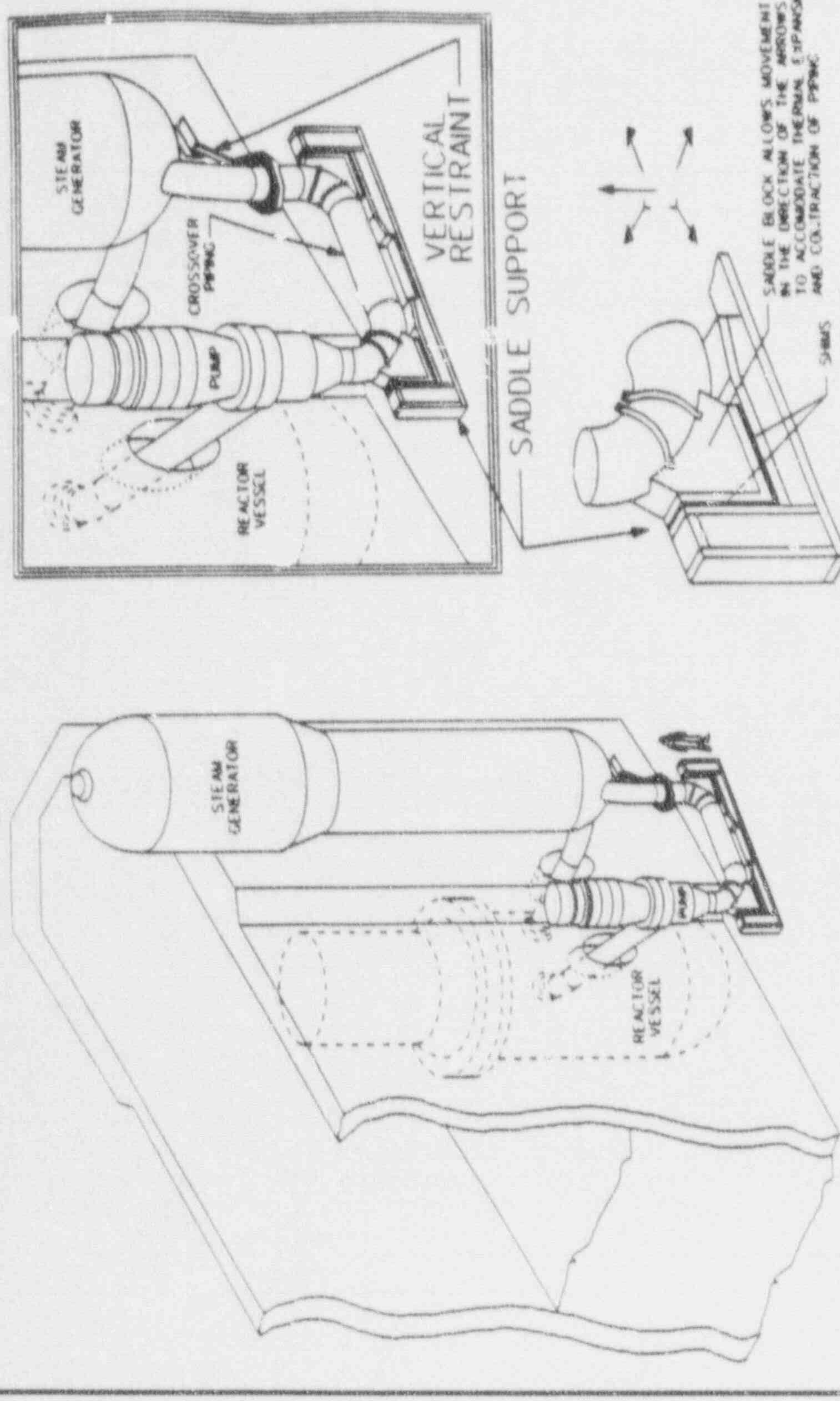

Figure 1