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July 13, 1992

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Subject: McGuire Nuclear Station Unit 1
Docket No. 50-369
Licensee Event Report 369/91-07, Revision 1

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a) (1) and (d), attached is Licensee Event Report 369/91-07, Revision 1, concerning Train B of the Residual Heat Removal System being inoperable. This report is being submitted in accordance with 10 CFR 50.73 (a) (2) (i). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

T.C. McMeekin

TLP/bcb

Attachment

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IE22 1/1

LICENSEE EVENT REPORT (LER)

FACILITY NAME(1)	DOCKET NUMBER(2)	PAGE(3)
McGuire Nuclear Station, Unit 1	05000	1 OF 11

TITLE(4) Train B Of The Residual Heat Removal System Was Inoprable Due To Inappropriate Actions And An Unknown Possible Installation Deficiency

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)
										05000
05	20	91	91	07	01	06	18	91		05000

OPERATING MODE(9)	1	THIS REPORT IS SUBMITTED PURSUANT TO REQUIREMENTS OF 10CFR (Check one or more of the following)(11)									
POWER LEVEL(10)	100%		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)		OTHER (Specify in Abstract below and in Text)		
			20.405(a)(1)(iii)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)(A)				
			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	
Terry L. Pedersen, Manager, Safety Review Group	704	875-4487

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)		EXPECTED SUBMISSION DATE(15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	NO				

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

On May 19, 1991 at approximately 1100, while Unit 1 was in Mode 1 (100 percent power), the action statement of Technical Specification 3/4.5.2 was exceeded without appropriate compensatory action. Valve 1ND-67B (Residual Heat Removal System Pump 1B and Heat Exchanger 1B Miniflow) had been inoperable for more than 72 hours without the knowledge of Operations (OPS) Control Room personnel. A work request was written on May 16, 1991 due to wires being pulled out of pressure switch 1NDPG5050 (Residual Heat Removal Pump 1B Miniflow) while test equipment was removed at the conclusion of periodic test PT/1/A/4204/01B (Residual Heat Removal Pump 1B Performance Test). It was not recognized by Performance (PRF) personnel at the time that this affected the operation of valve 1ND-67B. Valve 1ND-67B would not automatically open as required when ND Pump 1B was manually started on May 21, 1991. The separated wires were subsequently repaired under work request 1449770PS. The Residual Heat Removal (ND) system was returned to operable status on May 21, 1991 at 0550. This event is assigned causes of Inappropriate Actions, and an Unknown.

EVALUATION:

Background

The ND system [EIIS:BP] functions during normal operating conditions to remove heat energy from the Reactor Core [EIIS:RCT] during plant cooldown and refueling operations and in support of the Emergency Core Cooling System (ECCS) during mitigation of Small Break and Large Break Loss Of Coolant Accidents (LOCA).

The ND system contains two parallel paths sharing a common inlet from the Reactor Coolant [EIIS:AB] (NC) system for residual heat removal during normal operating conditions. Each flow path contains a residual heat removal pump [EIIS:P], heat exchanger [EIIS:HX] and the associated piping, valves [EIIS:V], and instrumentation for operational control.

During Mode 1 operation, the ND system is not in service but is aligned in readiness for operation as a part of the ECCS.

The ND system pumps 1A and 1B actuate on a Safety Injection (SI) signal and deliver borated water from the Refueling Water Storage Tank (FWST) [EIIS:TK] to the NC system. The injected water offsets NC system inventory loss due to LOCAs. The injection boron provides an additional negative reactivity to maintain the Reactor subcritical following a LOCA.

Isolation valves [EIIS:ISV] 1ND-67B and 1ND-68A (ND Pump 1A Miniflow) [EIIS:FCV] are located in the ND Pump miniflow recirculation lines. The purpose of these safety related, normally closed, motor operated valves [EIIS:20] is to protect the ND pumps from cavitation at low flow conditions during either residual heat removal or ECCS operation. Each of these valves will open automatically if the associated ND pump starts and flow, as measured off pump discharge by instrument loops [EIIS:FIS] 5040 (ND system Train A) and 5050 (ND system Train B), is less than 750 gallons per minute (gpm). Valves 1ND-67B or 1ND-68A will close automatically if flow exceeds 1400 gpm or the associated pump stops. The associated miniflow valve closes when the pump stops to prevent back flow through the miniflow line of an inoperative ND pump.

If one of these valves is incapable of opening or closing, or fails the quarterly in-service test, the associated train of the ND system shall be declared inoperable. These valves do not have a fail safe position.

Valve status and flow indication is provided to the Operator Aid Computer (OAC).

A Nuclear Station Modification (NSM) (MG12343 for Unit 1 and MG22343 for Unit 2) is underway to add an additional miniflow line for each pump. This NSM results from NRC IE Bulletin 88-04 which concerns the potential of one ND pump to deadhead the other pump when both pumps are given an automatic safety start signal.

Technical Specifications (TSs) 3.5.2 and 3.5.3 specify the requirements for operation of the ND pumps with respect to their ECCS function. Both pumps are required to be operable in Modes 1, 2 (Startup), and 3 (Hot Standby). During operation in Modes 1, 2, or 3, when one train of ECCS becomes inoperable, the inoperable train must be returned to operable status within 72 hours, or the Unit must be shutdown to Mode 3 within the next six hours and Mode 4 (Hot Shutdown) within the following six hours.

Periodically, Performance Tests (PTs) are run to verify the operational readiness of ND pumps 1A and 1B. This is implemented as directed by procedures PT/1/A/4204/01A (Residual Heat Removal Pump 1A Performance Test) and PT/1/A/4204/01B (Residual Heat Removal Pump 1B Performance Test). These PTs may be run in any Mode.

Description of Event

On May 16, 1991, while Unit 1 was operating in Mode 1, procedure PT/1/A/4204/01B was scheduled to be performed. Performance (PRF) Technicians A and B were assigned the task of performing the test. At approximately 0800, PRF Technicians A and B began preparing to implement the test. At approximately 0900, they gathered the necessary equipment, notified appropriate personnel that procedure PT/1/A/4204/01B would be run later that morning, and proceeded to the ND Pump 1b Room Access Hallway located on the 695' elevation in the Auxiliary Building [EIIS:NF]

PRF Technicians A and B began connecting temporary test instrumentation as directed by the procedure to supplement existing plant installed instrumentation. Steps 12.1 through 12.6 of procedure PT/1/A/4204/01B required test instrumentation to be installed at several locations. One of these locations was at pressure switch [EIIS:FIS] 1NDPG5050 (Pressure switch 1NDPG5050 is a combination pressure indicating gauge and switch mounted in the same housing). (See Figure 1, page 10 of 10.) PRF Technician A placed a plastic bag under pressure switch 1NDPG5050 to catch any potentially-contaminated water that leaked out of the tee fitting in the pressure switch supply line when it was opened for the temporary test instrumentation to be connected. The plastic bag was held open with duct tape. The duct tape was fastened to the supply line tubing [EIIS:TBG] of pressure switch 1NDPG5050 and to a short section of liquid tight flexible metal conduit [EIIS:CND] which originated in a nearby junction box [EIIS:JBX] and terminated in pressure switch 1NDPG5050. The test instrument was connected at the tee fitting in pressure switch 1NDPG5050 supply line. All other temporary instrumentation was connected and other prerequisites were performed as required by the procedure.

At approximately 0920, PRF Technician B phoned OPS Control Room personnel and received permission from Senior Reactor Operator (SRO) A to proceed with the test. The test was successfully performed and no problems were noted. After the test was concluded, PRF Technicians A and B began removing the temporary instrumentation and returned all affected plant installed equipment to the as found condition. PRF Technician A removed the temporary instrument from the

tee fitting at pressure switch 1NDPG5050. At approximately 1045, PRF Technician B phoned the Control Room and informed SRO A that the test was complete and ND Pump 1B was ready to be returned to service. PRF Technicians A and B then began cleaning up the work area. At 1100, as PRF Technician A removed the plastic bag from under pressure switch 1NDPG5050, the liquid tight flexible metal conduit pulled out of the junction box connector approximately 3 inches. He noticed that the flexible conduit retainer nut was not screwed in place on the junction box connector, and that two of the wires inside the conduit had pulled apart where the wires had been joined together with crimp type butt splices. At approximately 1105, he phoned his supervisor (PRF Supervisor A), to inform him of the situation and to get advice on how to proceed. PRF Supervisor A was not available at the time. PRF Technicians A and B did not realize that pressure switch 1NDPG5050 was a nuclear safety and TS related component and that the broken wiring had just rendered ND Pump 1B technically inoperable. Therefore, PRF Technicians A and B finished cleaning up the work area and proceeded to return to the PRF office area.

Upon returning to the office, at approximately 1115, PRF Technician A found PRF Supervisor A and informed him of the broken flexible conduit connected to pressure switch 1NDPG5050. The PRF Supervisor proceeded to question PRF Technician A about the pressure switch and evaluate the significance of the broken wiring. PRF Supervisor A asked what color the cable [EIIS:CBL] was. PRF Technician A replied "Gray". PRF Supervisor A then looked up the pressure switch on flow diagram MC-1561-1.0. The flow diagram did not indicate that pressure switch 1NDPG5050 provided a signal to automatically control valve 1ND-67. Therefore, Supervisor A concluded that the purpose of pressure switch 1NDPG5050 was to provide indication only and that it did not perform any control function. He then directed PRF Technician A to write a work request to repair the cable to pressure switch 1NDPG5050.

At 1130, PRF Technician A wrote work request 89630PRF to "investigate and/or repair wiring from pressure switch 1NDPG5050 mini flow gauge B Pump". The failure description was listed as "while removing the tape from drain bag attached to pressure gauge, the wiring pulled out from cable line" and the priority was listed as "R" (Routine). PRF Supervisor A subsequently approved work request 89630PRF and directed PRF Technician A to hand carry the work request to the Maintenance Planning (PLN) Department and have it scheduled as soon as possible.

At approximately 1245, PRF Technician A delivered work request 89630PRF to the PLN Department. He wanted to discuss the broken conduit with a Planner. However, all appropriate PLN Department personnel were in a meeting at the time and were not available. He then placed a note on work request 89630PRF to call him if there were any questions and put the package in the PLN Department work request "in" box. He then went back to the Auxiliary Building to affix plant deficiency tag 003006 on pressure switch 1NDPG5050. After placing the tag, he returned to the PLN Department to check on the work request but all appropriate Planners were still unavailable. He then returned to the PRF office.

The 72 hour train operability time limit as defined by TS 3/4.5.2 for the ND system continued to approach without the inoperable component being logged in the Technical Specification Action Item Log (TSAIL) or any knowledge of the deficiency by OPS Control Room personnel. Since no personnel were aware that ND Train B was inoperable during this time period, no effort was made to repair pressure switch 1NDPG5050. Consequently, at approximately 1100 on May 19, 1991, the time limit to return ND Train B to operable status as required by TS 3/4.5.2 was exceeded without any compensatory action being implemented.

On May 20, 1991, at approximately 1300, an Instrument and Electrical (IAE) Technician requested that OPS personnel start the ND Pump 1B so that he could perform a calibration procedure on another unrelated instrument loop. OPS Control Room personnel started the ND Pump 1B as requested. At 1301, OPS Control Room personnel realized that valve 1ND-67B did not automatically open as expected. OPS Control Room personnel manually opened valve 1ND-67B and declared ND Pump 1B inoperable. An appropriate entry was immediately made in the TSAIL; however, the time declared as ND Pump 1B becoming inoperable was conservatively backed up to 0455 that morning to correspond with other ongoing Train B work. OPS Control Room personnel generated emergency (E) priority work request 1449770PS to repair valve 1ND-67B. At 1700, Planner A received work request 1449770PS and initiated action to ensure that valve 1ND-67B was promptly repaired. The wiring for pressure switch 1NDPG5050 was subsequently repaired. Valve 1ND-67B and 1B ND Pump were returned to service on May 21, 1991 at 0550. At 0730 the same day, Planner A received work request 89630PRF. He took no immediate action with this work request since he knew the needed repair activity was already underway as directed by work request 1449770PS. Later that day he informed PRF Supervisor A that pressure switch 1NDPG5050 had been repaired as directed by work request 1449770PS. Work request 89630PRF was subsequently voided.

Conclusion

This event resulted in Train B of the ND system being inoperable for more than 72 hours as allowed by TS 3/4.5.2 without appropriate compensatory action. Valve 1ND-67B was required to automatically function during the performance of procedure PT/1/A/4204/01B. The test was run without incident. Therefore, valve 1ND-67B became inoperable when the wiring separated while PT Technician A was removing the duct tape that held the plastic bag under pressure switch 1NDPG5050.

A cause of this event was an Inappropriate Action by PRF Supervisor A. Section 5.1.2 of Station Directive 2.8.2 (Operability Determination) requires station personnel to inform OPS Control Room personnel "When a system, subsystem, train, component, or device is unable to fulfill its intended function because of obvious failure, damage, or need of repair". PRF Supervisor A attempted to investigate the significance of the broken conduit to determine what action (including notifying OPS personnel) should be taken. However, PRF Supervisor A reached an incorrect conclusion based on the research he performed. Since he did not recognize the importance of pressure switch 1NDPG5050, he did not notify OPS Control Room personnel when needed.

Both PRF Technician A and Supervisor A stated that had they realized that pressure switch 1NDPG5050 performed a control function, they would have promptly notified OPS Control Room personnel. OPS Control Room personnel are aware that the operability of pressure switch 1NDPG5050 and valve 1ND-67B affects the operability of the ND system. Had OPS Control Room personnel been notified that there was a problem with the wiring on pressure switch 1NDPG5050 on May 16, 1991, it would have been repaired within TS time limits. In fact, this capability was demonstrated on Monday, May 20, 1991. Supervisor A did feel that it was important to repair all defective plant equipment, regardless of function, and subsequently directed PRF Technician A to take the work request (to repair pressure switch 1NDPG5050) to the PLN Department as soon as possible.

Another cause of this event included an Inappropriate Action due to inadequate verbal communication between PRF Supervisor A and PRF Technician A. PRF Supervisor A questioned PRF Technician A about the color of the broken cable. PRF Technician A replied "Gray". Both PRF Supervisor A and PRF Technician A were mindful that Red, Yellow, Blue, and White cables are used exclusively at McGuire Nuclear Station for nuclear safety related functions. Gray or Black cable colors are used for non-nuclear safety related applications. The cable exiting the other end of the junction box to pressure switch 1NDPG5050 was Yellow. PRF Technician A did not realize that PRF Supervisor A asked the cable color to determine whether the component was nuclear safety related or not. He thought that PRF Supervisor A wanted to know only what color the broken cable section was. PRF Supervisor A heard "Gray cable" and immediately developed a mindset that the pressure switch did not perform a nuclear safety related control function.

Another cause of this event included an Inappropriate Action due to PRF Supervisor A's misunderstanding of a design drawing which led to him taking action which was not the best alternative. After questioning PRF Technician A, PRF Supervisor A believed that pressure switch 1NDPG5050 did not perform a control function. He incorrectly confirmed this premise by reviewing the schematic representation of the pressure switch on flow diagram MC-1561-1.0. It was understood by PRF Supervisor A that it was a Design Engineering Department practice to show a dotted line between a switch and a valve that directly provides a control signal. However, according to Design Engineering personnel, this is only applicable in pneumatic control circuits. There was no dotted line on the flow diagram between pressure switch 1NDPG5050 and valve 1ND-67B. Therefore, the flow diagram did not indicate that pressure switch 1NDPG5050 provided a signal to automatically control valve 1ND-67B. This confirmed PRF Supervisor A's belief that purpose of pressure switch 1NDPG5050 was to provide indication only and did not perform any control function. However, the purpose of flow diagrams is to illustrate schematic representations of piping and related components. Flow diagrams are not intended to provide electrical interlock and control information. Pressure switch 1NDPG5050 provided an electrical interlock to electrically operated valve 1ND-67B. Consequently, the control function of pressure switch 1NDPG5050 was not shown on the flow diagram. PRF Supervisor A had this

perception because of previous experience in which he had observed dotted lines shown on flow diagrams for pneumatic control circuits.

A cause of Inappropriate Action is assigned to PRF Technician A due to inattention to detail. The Yellow cable (1ND524) and junction box are mounted at eye level (See Figure 1, page 10 of 10). PRF Technician A should have observed this during installation or removal of the plastic bag under pressure switch 1NDPG5050. Since pressure switch 1NDPG5050 was fed by a Yellow cable, Technician A should have realized that it was nuclear safety related and should have informed his supervisor.

This event is also assigned a cause of Unknown due to the separated liquid tight flexible metal conduit which originated in a nearby junction box and terminated in pressure switch 1NDPG5050. The flexible conduit pulled out of its connector at the junction box when PRF Technician A removed the plastic bag and duct tape from under pressure switch 1NDPG5050. PRF Technician A then noticed that the flexible conduit retaining nut was not screwed on the junction box connector. The retaining nut had slid down the flexible conduit. The weight of the plastic bag and its contents was negligible and should not have caused the cable to pull out of the connector. The retaining nut may have been loose or completely off prior to this event. However, no problems were noted with this particular flexible conduit section when a material condition inspection of 695' elevation of the Auxiliary building (which addressed and corrected improperly installed and broken conduit) was performed during November and December, 1990. The connector is designed to provide strain relief from external forces applied to the cable. One possible cause for this was an installation deficiency. Had the flexible conduit been properly installed, it should not have pulled apart from the force applied by PRF Technician A to the cable. A search of equipment history files revealed that the junction box wiring was last repaired in February 1986. This repair was documented on work request 122217OPS. This work request documented, among other items, the repair of a loose crimp on a butt splice connector on the wiring inside the junction box. The junction box contained wiring that was electrically continuous and did not pull apart until an external force was applied to the cable assembly. However, IAE personnel believe existing installation procedures and calibrated crimping tools are adequate.

A review of the Operating Experience Data Base for the previous 24 months prior to this incident revealed 2 incidents involving the operability of the ND system which resulted in a TS violation. LER 369/90-22 documented the potential for degraded ND injection flow during a Large Break LOCA if certain valves were open due to a Management Deficiency. LER 369/90-29 documented the potential for deadheading an ND pump due to the arrangement of the cross connecting piping. Therefore, this problem of the ND system being inoperable due to potentially deadheading the ND pumps is considered recurring.

This incident is Nuclear Plant Reliability Data System (NPRDS) reportable due to the degraded condition of pressure switch 1NDPG5050.

There were no personnel injuries, radiation overexposures, or uncontrolled releases or radioactive material as a result of this incident.

CORRECTIVE ACTIONS:

Immediate: Work request 89630PRF was written to repair pressure switch 1NDPG5050.

Subsequent:

1) The wiring and conduit feeding pressure switch 1NDGP5050 was repaired as directed by work request 1449770PS.

2) This event was reviewed with the personnel involved.

3) ND Pump 1B was successfully tested by PRF personnel on 6/6/91.

Planned:

1) PRF Test Group personnel will attend training on appropriate McGuire Nuclear Station drawings to include MCEE (Electrical Schematics) and MC-1499 (Instrument Details).

2) PRF personnel will be instructed to notify the OPS Unit Supervisor when any problems are discovered with process instrumentation so that OPS personnel are aware of the situation and an operability determination can be performed.

3) PRF Management personnel will initiate action to upgrade the labeling on flow switches 1NDPG5040, 1NDPG5050, 2NDPG5040, and 2NDPG5050. The new labels will be color coded to indicate these instruments are train related.

4) This item has been deleted on Revision 1 to this report. See page 11, Additional Information.

5) A communication package will be developed by Design Engineering personnel for all appropriate McGuire Nuclear Station Nuclear Production personnel to inform them of the practice of allowing short sections of non-color coded cable in safety related applications as described in installation specification MCS-1390.01-00-0063.

6) OPS Management personnel will revise Station Directive 3.1.5 (Operations Or Operating Instructions) to include instructions

for all station personnel to contact OPS Control Room personnel if process instrumentation is found damaged.

7. Station Management will review Station Directives and Maintenance Management Procedures which define work request priority based on operability requirements of station equipment and take appropriate action.

SAFETY ANALYSIS:

The ND system functions in conjunction with the high head portion of the ECCS to provide injection of borated water to the NC system cold legs during the injection phase following a LOCA. Should the NC system pressure fall below the ND pump shutoff head, the ND system directly injects water into the NC system. An SI signal actuates the ND pumps. During the recirculation phase, water is pumped from the Containment sump into the NC system.

The ND system pumps require protection from overheating and loss of suction flow by opening of miniflow recirculation lines that assure flow to the pump suction. Control valves 1ND-67B or 1ND-68A located in each miniflow line are automatically operated based on measurement of pump discharge flow. Setpoints are chosen to ensure that the valves open before discharge flow falls below 750 gpm and close after flow rises above 1400 gpm. Once flow is established to the NC system, the associated miniflow valve is automatically closed. Control valves 1ND-67B and 1ND-68A also may be manually cycled from the Control Room.

The worst case scenario that could potentially occur is that the ND pumps would start together due to an SI initiation and the 1B ND Pump would deadhead due to the miniflow valve (1ND-67B) remaining closed, resulting in a possible loss of a train of ND flow and possible pump damage.

The ND pumps are capable of operation under dead head conditions for approximately 10 minutes without damage. In the event that the 1B ND Pump started (either manually or automatically), OPS personnel would be able to open the associated miniflow valve within 10 minutes to mitigate any damage to the pump. The ND system meets the required design flow of 3975 gpm with one pump, supplying all required loads. Had Operator action failed to prevent damage to ND Pump 1B, the ND system would still have been able to perform its safety function since the ND Pump 1A was unaffected by this valve remaining in the closed position and would have been able to perform its safety function during the event. In addition, the other ECCS systems were operable and were available to perform their safety function in addition to the flow that would have been provided by the ND system.

The ND system was not challenged nor required to perform the safety function of the ND system under accident conditions during any of the time period when Train B was technically inoperable.

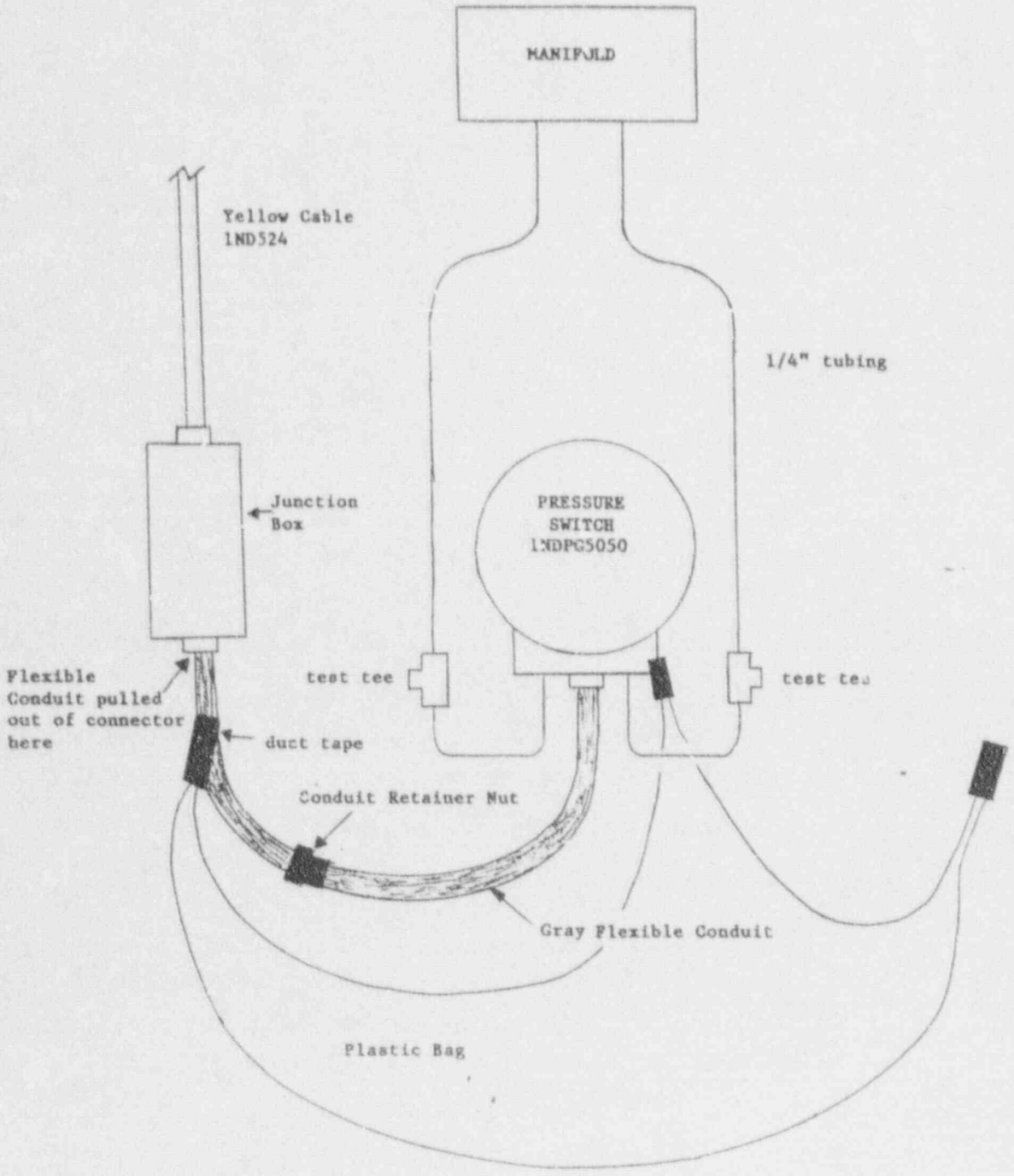
The health and safety of the public was not affected by this event.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
McGuire Nuclear Station, Unit 1	0 5 0 0 0 3 6 9	9 1	— 0 0 7	— 0 1	1 0 OF 1 1

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

FIGURE 1

EQUIPMENT ARRANGEMENT



FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
McGuire Nuclear Station, Unit 1	0 5 0 0 0 3 6 9	9 1	— 0 0 7	— 0 1	0 2 OF 0 2

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

ADDITIONAL INFORMATION

Corrective Action number four has been deleted. IAE and PRF Management personnel have determined that the intent of providing a reference list which identifies nuclear safety related process instruments is already provided by existing controlled documents.