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Nuclear Operations

10CFR50.73

May 3, 1991
NRC-91-0054

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

Reference: Fermi 2
NRC Docket No. 50-341
NRC License No. NPF-43

Subject: Licensee Event Report (LER) No. 90-013-01

Please find enclosed LER No. 90-013-01, dated May 3, 1991, for a reportable event that occurred on December 28, 1990. A copy of this LER is also being sent to the Regional Administrator, USNRC Region III.

If you have any questions, please contact Patricia Anthony, Compliance Engineer, at (313) 586-1617.

Sincerely,

Enclosure: NRC Forms 366, 366A

cc: A. B. Davis
J. R. Eckert
R. W. DeFayette
W. G. Rogers
J. F. Stang

Wayne County Emergency
Management Division

IE22 1/1

NRC Form 366 (9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES 8/31/88

LICENSEE EVENT REPORT (LER)

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TITLE (4): Inadequate Control During the Primary Containment Air Grab Sampling Process

EVENT DATE (5) MONTH	DAY	YEAR	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	REPORT DATE (7) MONTH	DAY	YEAR	OTHER FACILITIES INVOLVED (8) FACILITY NAMES	DOCKET NUMBER(S)
1 2	2 8	9 0	9 0	0 1 3	0 1	0 5	0 3	9 1		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): 4
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) Inadequate Administrative Controls
	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	
Patricia Anthony, Compliance Engineer	3 1 3	5 8 6 - 1 6 1 7

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)	X NO				

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

Review determined that primary containment atmosphere sampl ng practices could potentially compromise primary containment integrity. The need for isolation of the sampling line in the event of a Loss of Coolant Accident was not identified in the procedure.

The root cause was a lack of proper administrative controls. The technician or the operator could have manually isolated the sample lines in 60 seconds which is the time allowed by Technical Specifications. Corrective action was to add sample suction and return taps down stream of automatic containment isolation valves.

During a test in March of 1991, it was determined that portable grab sampling hardware could have compromised the quality of the containment air sample by using an oversized sample pump which caused backflow through the system piping and, thereby, diluting the sample. The root cause was a lack of proper administrative controls over sample hardware and its application.

Since the containment atmosphere was monitored during releases, there has been no unmonitored release to the environment. In November 1990, on the suspicion that diluted samples could be obtained, the portable sample rig's vacuum pump was downsized. The sample location change assures that the sample obtained is valid.

Initial Conditions on December 28, 1990:

Operational Conditions: 4 (Cold Shutdown)
Reactor Power Level: 0
Reactor Pressure: 0 psig
Reactor Temperature: Approximately 155°F

Initial Conditions on March 31, 1991:

Operational Conditions: 4 (Cold Shutdown)
Reactor Power Level: 0 psig
Reactor Pressure: 0 psig
Reactor Temperature: 158°F

Description of Event:

During an industry Operating Experience review, it was determined that Fermi 2 primary containment atmosphere sampling procedures did not contain appropriate administrative controls for sampling the primary containment. The Fermi 2 design utilizes Primary Containment Atmosphere Monitoring System (PCAMS)[IK] piping to provide the primary containment grab sample for radiation protection and chemistry analyses. The frequency of grab sampling varies from three times per week to as much as three times per day. The primary containment grab sample had been obtained by connecting a portable sampling rig to two normally locked closed valves in the PCAMS hydrogen/oxygen monitoring subsystem (H21P282 and H21P283) (Figure A). The locked closed valves contain a lockwire seal attached to each valve. The hydrogen/oxygen monitoring [IK] subsystem is a qualified and closed loop system outside the primary containment with normally open remote manual containment isolation valves [ISV] operated from the control room. To obtain the grab sample, the normally locked closed suction valve [SMV], T5000F047A(B), and return valve [V], T5000F090A(B), were opened and remained open while the sample was drawn. To open the locked closed valves, the technician informed the main control room operator that a primary containment grab sample was to be obtained. At the sample location, the technician broke the valve seal and proceeded with the sampling. The sampling process typically took approximately

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

15 minutes (based on technician interviews) during which the technician remained at the sample rig. After sampling, the valves were closed and relocked. This was the only location where primary containment atmospheric samples were taken during normal plant operation.

Fermi 2 Technical Specification (TS) 3.6.1.1 requires that primary containment integrity be restored within 1 hour if it is breeched or the reactor be shutdown within an additional 12 hours. During sampling, the valves were opened for considerably less than 1 hour as noted above. The technician performing the sampling remained at the sample rig throughout the sampling period and could respond by promptly closing the sample valves, if a condition developed that warranted it. The control room operator, aware that the valves were open, could also have remotely isolated the containment isolation valves in the potential leakage pathway, if necessary.

In order to resolve another question raised in the same time period concerning whether samples obtained were representative, a plant specific Sequence of Events (SOE 91-01) test was performed in March of 1991. Based upon review and analysis in April, it was determined that Fermi 2 procedures did not contain appropriate administrative controls for primary containment atmosphere sampling hardware and its application.

As shown in Figure A, the sample rig's 4 SCFM vacuum pump was placed in series with the H_2/O_2 system's 1.5 SCFM sample pump. Also, as evident in Figure A, the Division I H_2/O_2 system's 1.5 SCFM sample pump is in parallel with the Radiation Monitor's 2 SCFM sample pump.

The sampling configuration provided too much flow for the in-series 1.5 SCFM H_2/O_2 sample pump. The excess flow then backflowed through the H_2/O_2 sensor and caused high O_2 alarms. If the sample was being taken from Division I and the radiation monitor was in service, the backflow was diverted through the radiation monitor's 2 SCFM pump, and the grab sample rig saw little or no reactor building air. However, if the sample was taken from Division II or Division I without the radiation monitor skid in operation, the sample was diluted by reactor building air. The sample rig has a very low flow sample criteria of 1 liter/min. Investigation determined that additional pump flow was sometimes obtained from the opening of the suction valve of the rig's 4 SCFM vacuum pump to reactor building atmosphere.

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Until September of 1988, the radiation and chemistry samples were obtained by Plant Chemistry alone. Plant Chemistry analyzed for both oxygen and radiation concentrations. After September of 1988, the samples were taken by two separate plant organizations; Radiation Protection and Chemistry. When they separately began taking their own samples, the testing for O_2 did not occur with the sample taken by Radiation Protection.

While containment samples were being taken from the PCAMS by Radiation Protection, the PCAMS Hi-Hi O_2 alarms came in. The SOE test further confirmed that both the H_2 and O_2 sensors and the radiation sensor on the radiation monitor skid H21-P284 were being exposed to reactor building air. Since the sampling took only about 10-15 minutes, the amount of time the PCAMS and PCRMS were out of service was well under the Limiting Conditions for Operation per TS 3/4.3.7.5 of 7 days and TS 3/4.4.3.1a of 30 days (without samples, shutdown in 12 hours).

It therefore can be postulated that from September 1988 until November 1, 1990, it was likely that some diluted primary containment samples were obtained using the then existing sample rig and its procedure. Since the discharge path for the containment vent and purge is monitored, it is also known that no unmonitored radiation release or release in excess of that allowed by Technical Specification was made.

Cause of Event:

The cause of both concerns was a lack of proper administrative controls in the sampling procedures used for collecting the primary containment atmosphere sample. The controls established for the sampling evolution did not cover all appropriate aspects, based on the opening of the primary containment during sampling and sample hardware compatability. No review (formal or informal) of the potential impact of temporary hardware such as sampling rigs was performed.

Although a technician was at the sampling rig during the time period the manual valves were open and the sample was being drawn, the procedure did not require him to close the manual valves in the event

of a Design Basis Accident (DBA)/Loss of Coolant Accident (LOCA) or if the sampling rig became dislodged from the sample taps. Operating procedures did not require a control room operator to manually isolate the affected primary containment hydrogen/oxygen monitoring division by closing the applicable air operated containment isolation valves. Also, no Limiting Condition for Operation action statement was formally entered during the sampling period.

The existing design was reviewed to determine if it is in compliance with the requirements of TS 3.6.1.1 on primary containment integrity and TS 3.11.2.8 on primary containment sampling and analyzing prior to and during venting and purging of the primary containment. The PCAMS design was found acceptable to meet the requirements of TS 3.6.1.1 and 3.11.2.8 individually. However, it was not recognized that the portable sample rig, being an unqualified rig, could potentially compromise the primary containment integrity requirements of TS 3.6.1.1. Adequate administrative controls in sampling and operating procedures would have ensured the valves would be immediately shut should an accident occur.

The use of a sample pump that was sized/rated much larger than of the series system pump was not recognized as a sample rig hardware application deficiency. The original PCAMS design had a 10 SCFM pump which was changed out in November 1985 to the existing 1.5 SCFM pump via a design change, (EDP 1422). Inadequate review of plant sampling procedures and hardware failed to recognize the impact of this design change.

Additionally, the group taking samples changed in September of 1988. Plant Chemistry took samples for both chemical properties and radiation until September. While they took samples, the O_2 level provided an indication of having obtained an adequate sample. In September of 1988, Radiation Protection began taking their own samples. From that point forward, suspect samples were possible if either the PCRMS was out of service or the samples were obtained from Division II which does not have the PCRMS 2 SCFM sample pump.

The PCAMS hi-hi O_2 alarm which resulted during sampling went unrecognized as evidence that PCAMS was experiencing backflow and, therefore, did not fulfill its design function. Based on interviews, the operators thought that the sample return location was upstream of the H_2/O_2 sensors and therefore the alarm was an expected result of the sampling process.

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Proper administrative controls in the sampling and operating procedures would have limited the likelihood of the PCAMS and PCRMS potentially not fulfilling their design bases during sampling and provided assurance that a proper sample was being obtained.

Safety Analysis of Event:

In the event of a DBA/LOCA, while sampling the primary containment atmosphere using the original sampling taps, there could potentially be two openings in the PCAMS piping. A 1 inch opening at the sample suction point and a 3/8 inch opening at the sample return point could occur should the sampling rig become dislodged (refer to Figure A). Flow through the 3/8 inch line would be negligible due to line size, check valves located on the discharge side of the hydrogen/oxygen skid, fittings and other components in its flow path. Therefore, only the 1 inch opening in the primary containment boundary at the sample suction point could cause significant leakage to secondary containment. A calculation was performed to determine the effects of the 1 inch opening in primary containment discharging to the secondary containment environment and subsequently to the site boundary. The calculation shows that with primary containment at a postulated DBA/LOCA value of 56.5 psig, a flow of 99 cfm of steam could occur until the line was isolated. This exceeds the limit when it is compared with the design basis leakage reported in the Technical Specification bases of 0.75 La (0.767 cfm at 56.5 psig containment pressure).

Two scenarios for manual action were evaluated. A one minute response time for local technician action is consistent with the following:

1) The sample suction and sample return valves are in close proximity to the rig and are readily accessible for manual action to close. Therefore, these valves could be closed by the technician within 1 minute.

2) Per Technical Specifications, a maximum isolation time of 60 seconds is allowed for valve operability requirements for systems with similar functions as the PCAMS. Per the basis for Technical Specification Section 3/4.6.3, containment isolation within the time limits specified for those isolation valves designed to close

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LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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automatically ensures that the release of radioactive material to the environment will be consistent with the assumptions used in the analyses for a LOCA. Thus, the 60 second technician action timeframe for closure of the manual valves is consistent with the 60 seconds for automatic isolation requirements.

3) Per UFSAR, Section 6.2.4.3, isolation valves must be closed before significant amounts of fission products are released from the reactor core during the DBA. Because the amount of radioactive material in the reactor coolant is small, a sufficient limitation of fission product release will be accomplished if the isolation valves are closed before fuel damage is assumed to occur.

The source term in this situation would be due to the primary coolant activity at the maximum Technical Specification values. These assumptions are similar to those for a primary coolant instrument line break. The instrument line break analysis is bounding for this event since it assumes 25,000 pounds of reactor coolant are released directly into secondary containment over a period of 5 hours. The release at the 1 inch opening of the sample suction point is 16.2 pounds of reactor coolant over a one minute period. The calculated offsite dose for the instrument line break is a small fraction of 10CFR100 per Section 15.2.3.5 of Fermi 2 Safety Evaluation Report (NUREG-0798). Therefore, the offsite and main control room dose increase due to the one minute long sampling rig leakage pathway during a postulated LOCA would also be small. In the case where the local technician fails to take any actions, the control room operator can close the valves. The release would be dependent on the time it would take for the operator to isolate the lines.

In addition, a very conservative dose calculation was performed using the Regulatory Guide 1.3 methodology to evaluate the potential consequences of a worst case core damage scenario during sampling if the lines were not promptly isolated (i.e., within timeframe of automatic containment isolation). The limits of 10CFR100, General Design Criteria 19 and NUREG-0800, Section 6.4 could be exceeded using these very conservative assumptions.

Based upon the results of SOE 91-01, there were two configurations in which a diluted sample of primary containment atmosphere could have been obtained.

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During the SOE test, it was shown that for samples taken from Division II of PCAMS and from Division I without PCRMS in operation, a dilution effect began to take place within seconds of the start of the sample pump.

The Division I PCAMS is the preferred location of obtaining drywell samples. It is usually lined up to sample the drywell to support radiation detection for the leak detection function of PCRMS. If the PCRMS was on-line, it would have diverted the reverse flow of reactor building air and a valid grab sample could have been obtained from the sample rig.

Typical noble gas concentrations in the primary containment atmosphere are either below or slightly above detectable levels. This is due to the fact that there has been minimal drywell leakage from primary systems and that there has been no leakage from the fuel. Since the technicians typically found concentrations below detectable levels, the dilution was not readily evident.

It can be concluded that the quality of some samples may not have been adequate. However, there were no adverse consequences since the vent and purge paths are equipped with on-line radiation monitoring sensors. Had these sensors shown excessive radiation being discharged, then alarms would have alerted the operator and appropriate isolations would have been initiated.

Corrective Actions:

Based on the review, it was concluded that relying on administrative controls using the original sample taps located on primary containment hydrogen/oxygen monitoring system piping (H21P282 and H21P283) (Figure A) for the manual grab sample was not optimal. Therefore, corrective action was taken to add new sample taps to the PCRMS system (H21P284) (Figure B) between the existing inlet and outlet automatic containment isolation valves. Thus, if grab sampling is in progress, the sampling rig will be automatically isolated should a DBA/LOCA occur.

EDP-11974 added one sample suction tap (T5001F465) [SMV] and two sample return taps (T5001F466 and T5001F467) [V] to the primary containment radiation monitoring skid H21P284 (Figure B) which has redundant automatic containment isolation valves [ISV]. Procedures NPP-67.000.501 and NPP-78.000.069 have been revised to obtain primary containment atmosphere samples using the added sample taps on the PCRMS skid H21P284.

The corrective actions for the hardware sample dilution concern was to downsize the sample rig's vacuum pump and the subsequent change of the primary sample location per EDP 11977. These are sufficient to assure that existing samples being obtained are now valid. Radiation Protection technicians will be informed of the results of the Sequence of Events test and contents of this LER.

Previous Similar Events:

LER 87-052-00, "Potential for Degrading Primary Containment Integrity Through a Radiation Monitoring Skid", described a violation of primary containment integrity involving modification work.

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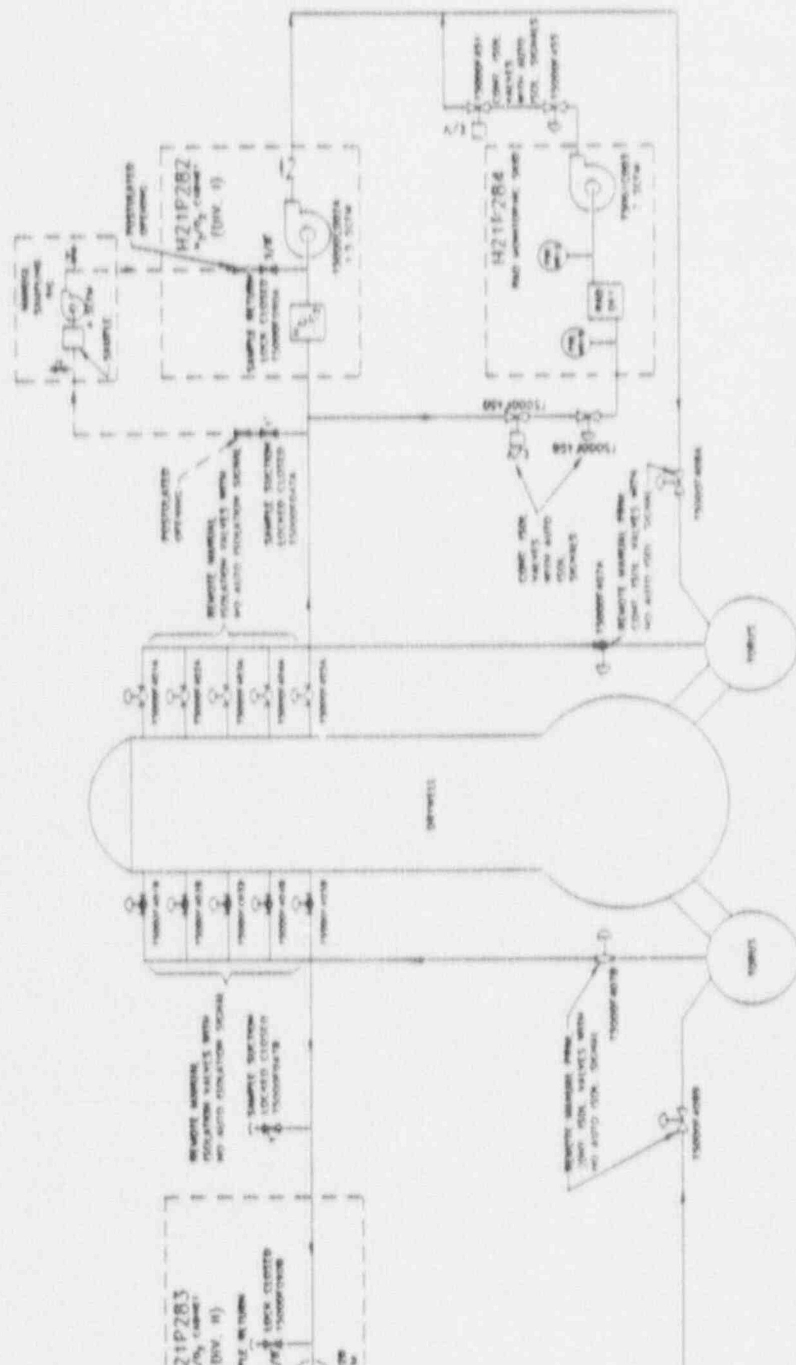

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