GPU Service

TECHNICAL DATA REPORT

TDR NO. 162	REVISION NO. 1
PROJECT NO. 021	PAGE 1 OF 12
PROJECT: TMI-2 CONTAINMENT ASSESSMENT PROGRAM	DEPARTMENT/SECTION 323
	RELEASE DATE _____ REVISION DATE _____

DOCUMENT TITLE: Post Accident Sampling and Hazardous Gas Analysis of TMI-2 Reactor Building Atmosphere For Support of Reactor Building Entry

ORIGINATOR SIGNATURE	DATE	APPROVAL(S) SIGNATURE.	DATE
James W. Langenbach	9/18/80	K. W. [illegible]	9/24/80
		APPROVAL FOR EXTERNAL DISTRIBUTION	DATE
		K. W. [illegible]	9/24/80

*	DISTRIBUTION
	R. F. Wilson R. W. Keaten D. K. Croneberger M. P. Morrell J. W. Langenbach T. C. Menzel J. C. DeVine B. D. Elam P. Stoner R. Witzke E. G. Wallace External J. T. Collins

ABSTRACT:

Subsequent to the gas samples taken as discussed in Revision 0 of TDR 112, additional samples of the TMI-2 Reactor Building Atmosphere were taken to determine the makeup of the reactor building atmosphere in support of the Reactor Building Entry Program.

In order to obtain representative samples, they were drawn from the reactor building through penetration R-626 as described herein. The results are as follows:

Oxygen - Average Concentration	= 12.9%
Hydrogen - Average Concentration	= 0.7%
Relative Humidity	= 90%
Carbon Dioxide	= N.D. to .013%
Carbon Monoxide	= N.D.
Ozone	= N.D. to .1 ppm
Hydrogen Sulfide	= N.D. to 2.5 ppm
Kr-85 Concentration	= 0.94 μCi/ml
Particulate Average Concentration	= Cs 134/137 1 x 10^{-8} μCi/ml
Average Gross Alpha Activity	= 2 x 10^{-10} μCi/ml

*COVER PAGE ONLY

GPU Service	TDR NO. 162
TITLE TMI-2 Containment Assessment Program	PAGE 1 OF 12

REV	SUMMARY OF CHANGE	APPROVAL	DATE
1	Corrected typo Page 12 of 12 Sample No. 37669, was: Gross γ $1.97E^{-10}$ to: Gross α $1.97E^{-10}$ was: Gross $\beta\gamma$ $1.3E^{-8}$ to: Gross $\beta\gamma$ $1.3E^{-8}$ Sample No. 36652, was: Gross γ $4.02E^{-11}$ to: Gross α $4.02E^{-11}$ was: Gross $\beta\gamma$ $6.69E^{-9}$ to: Gross $\beta\gamma$ $6.69E^{-9}$	J W Langenbach	9/26/80

The detailed sample results are shown in Tables 1, 2 and 3. The information gathered from these samples confirmed the relative accuracy of the samples gathered through the HPR 227 sample system as modified, and provided a sound basis for the next step in the containment assessment program - Reactor Building Entry.

Table of Contents

1.0 Introduction

Experiments were performed on April 3, 1980 and April 14, 1980 to confirm levels of oxygen, hydrogen, krypton and particulate concentrations measured with HPR 227 and to determine if there were toxic gases present. The results of the experiments verified the readings taken using the HPR 227 sample system and confirmed, as predicted by chemical theory, that the presence of airborne concentrations of hazardous or toxic gases is neglible.

The measurements of reactor building atmosphere were made through penetration R-626 by inserting sampling equipment into the penetration glove box and drawing samples from the reactor building through 3/8" tubing and discharging into a sample bag. All gas samples were measured by analyzing the gases inside of the sample bag while in the glove box.

The instrument preparation and measurements were performed by the following people:

GPU: Jim Langenbach
Pam Stoner
Russ Witzke
Bechtel:
Ed Walker
Rad Services:
Mike Pavelek
Ralph Jacobs
Babcock & Wilcox:
Lee Porter

2.0 Sample Techniques

2.1 Gas samples were taken on April 3, 1980 and April 14, 1980 using the glass tube indicator method of analysis to measure relative humidity and

concentrations of ozone, carbon dioxide, carbon monoxide and hydrogen sulfide.

In order to take these samples a fifteen foot length of 3/8" tubing was installed three feet into the TMI-2 reactor building through penetration R-626 using a telescoping tube (See Figure 1 for sketch). The sample line was attached to the suction of a Bendix BDX55HD air sampling pump which discharged into a 1000 cc poly bag at a rate of 3200 cc/min.

The sample pump was allowed to run for 10 minutes to assure that equilibrium was reached in the line. The collection bag was then connected to the sample pump discharge, filled, and flushed three times before samples were withdrawn. The ends of the glass tube indicators were broken open and samples were drawn through the glass tube indicators using a Bendix Gastec detector tube sampler withdrawing the sample from the collection bag.

The sample results are shown in the Tables and discussed below.

Relative Humidity Water vapor in the atmosphere was measured at 8.0 mg/l from the sample pump discharge with the desiccant removed from the line. This converts to a relative humidity of 90% and was as expected.

Carbon Dioxide (CO_2) The indication that there was little or no CO_2 present was expected. The most probable source of CO_2 in the TMI-2 reactor building would be the result of combustion of hydrocarbons. There has been no evidence of a fire during the accident, other than

the hydrogen burn which would not generate carbon dioxide. The hydrogen burn also precluded the possibility of combustion after it occurred on March 28, 1979 since it reduced the oxygen levels to the point where there was insufficient oxygen to support combustion.

Ozone (O_3) The indication that there was no detectable ozone in the atmosphere was expected. The presence of hydrogen in the atmosphere would scavenge any ozone.

Hydrogen Sulfide (H_2S) There is no known source for H_2S, however, it was measured as a precaution. The results confirmed the expectation that none would be found.

Carbon Monoxide (CO) There was no carbon monoxide expected to be detected, however, the initial indications on the Gastec glass sample tube were that, CO was present in concentrations greater than 10,000 ppm. The results of this test were suspect due to the lack of CO_2, since CO will combine with the oxygen present and in time form CO_2. Further investigation of the results revealed that the chemicals in the sample tube reacted with the hydrogen in the atmosphere and invalidated the results. In order to provide positive assurance that this was indeed the case, the sample procedure was repeated on April 14, 1980 using a MSA gas sampler and CO gas sample tube which would not react with the hydrogen or any other anticipated contaminant. The results confirmed that there was in fact no detectable level of CO in the Reactor Building atmosphere.

2.2 Particulate samples were drawn from the reactor building at the same time that the gas samples were being drawn.

A Bendix BDX 55HD air sampling pump and tubing in a configuration similar to that used for drawing the reactor building gas samples was used. A particulate sample medium was affixed to the inlet of the sample pump suction tubing and inserted into containment using a telescoping tube. The sample pump was then turned on and run for 119 min. at a rate of 2000 cc/minute. The unit rotometer was calibrated prior to use, with the sample head and tubing, to assure the flow rate was accurate. The rotometer flow rate reading was visually verified during the sampling duration. The results of the sample indicate an average concentration of 1×10^{-8} μCi/cc CS-137 which was the predominant isotope. Gross Alpha Activity was also measured as 2×10^{-10} μCi/cc.

2.3 A 6cc vial of gas, collected from the sample pump discharge was analyzed for Kr-85 (Sample #36,620) and indicated a concentration of 0.94 μCi/ml. The vial was sealed after the pump had discharged into it for a period of 2 minutes and was sent to the lab for analysis.

2.4 Hydrogen and oxygen were analyzed using Edmont Combustible Gas Oxygen Monitor Model 60-400 which was placed in the R-626 penetration glove box. The O_2 combustible detector was inserted into the bag on the discharge of the BDX55 HD sample pump used for drawing the gas samples from the reactor building, as discussed earlier. The pump discharge was connected to an inline filter (desiccant) to remove moisture from

the samples. The results are shown in Table 2. The average concentrations of 12.9% oxygen and 0.7% hydrogen compare favorably to the measurements taken using the HPR 227 sample rig as modified. Two of the six samples taken (the last two taken) had the filter (desiccant) removed from the sample line to provide a comparison to the other sample data. The results compared well.

3.0 Conclusions

The results of these experiments indicate that there are no toxic gases present in the TMI-2 reactor building which would preclude entry into the building prior to atmosphere cleanup.

The oxygen deficient atmosphere is hazardous but will still sustain life but precludes routine entry. Krypton-85 concentrations are hazardous and also preclude routine entry.

The gaseous (Kr-85) and particulate sample results show good agreement with the most recent sample results from HPR-227.

The hydrogen concentration (0.7%) is well below the flammability limit of 4%.

4.0 Recommendations

Entry into the TMI-2 reactor building prior to atmosphere cleanup is practical, however, entries should be limited to data gathering and emergencies, due to the dose contribution from the 1μCi/ml concentration of Kr-85 and the hazard posed by the oxygen deficient atmosphere.

5.0 References

1. TDR 112 Rev. 0.

2. R.L. Witzke Memo 4/15/80 to J. Langenbach

3. M. Pavlek Memo 4/4/80 to B.D. Elam

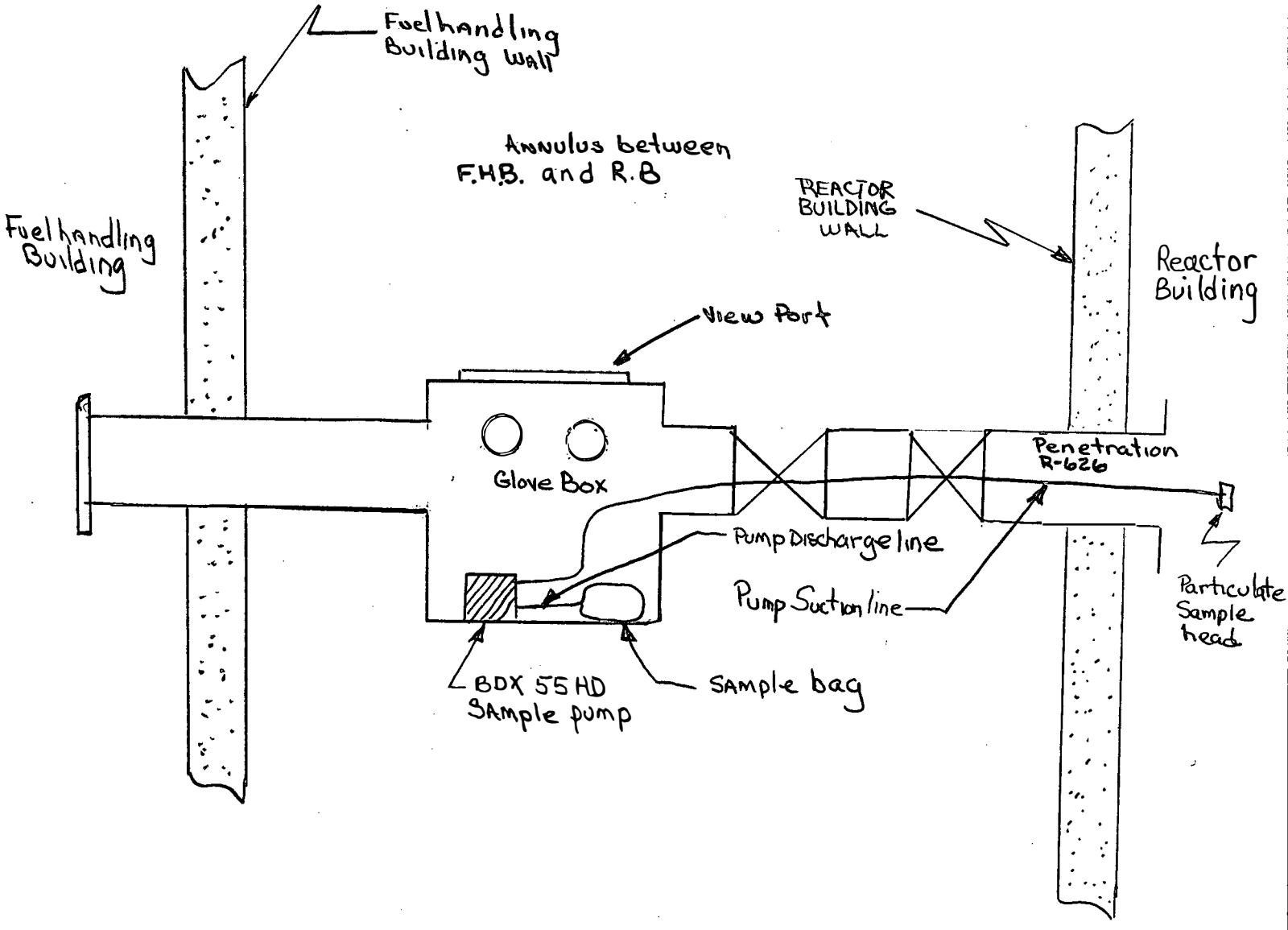
4. TMI Sample No. 37667

5. TMI Sample No. 37669

6. TMI Sample No. 36652

APPENDIX A

Figure 1



APPENDIX B

TABLE 1

GPU SERVICE CORPORATION

Industrial Hygiene Field Sampling Record

Plant: Met-Ed, TMI, Unit #2 Date: 4-3 and 4-80

Area or Unit: Reactor Building, Containment By: R. L. Witzke

Material(s): Carbon Monoxide, Ozone, Hydrogen Sulfide, Carbon Monoxide

Operating Comditions: -0.5 psig Instrument: Bendix/Gastec
Detector Tubes
MSA Detector Tubes

Sample No.	Time	Description	Concentration
			Carbon Dioxide %
	4-3-80		
CO_2-1	13:41	Inside R-626 glove box. Direct sample of continment	N.D. to 0.013
			Ozone ppm
O_3-1	14:08	Same as above	N.D. to 0.1
			Hydrogen Sulfide ppm
H_2S-1	14:26	Same as above	N.D. to 2.5
			Carbon Monoxide ppm
CO-1	13:58	Same as above	Void*
CO-2	14:35	Same as above	Void*
	4/14/80		Carbon Monoxide ppm
CO-3	16:17	Same as above	N.D.**
CO-4	16:34	Same as above	N.D.**

N.D. = Not Detected
*Hydrogen interference with the indicator media for the Bendix, carbon monoxide detector tube.

**MSA, Part No. 47134 carbon monoxide detector tube.

APPENDIX C

TABLE 2

GPU SERVICE CORPORATION

Industrial Hygiene Field Sampling Record

Plant: Met-Ed, TMI, Unit #2 Date: 4-3-80

Area or Unit: Reactor Building, Containment By: R. L. Witzke

Material(s): Oxygen

Operating Conditions: Instruemnt: Edmont-Wilson Model 60-400

Sample No	Time	Description	Concentration
			Oxygen %
O2-1	13:54	Inside R-626 glove box. Direct sample of containment air	12.9*
O_2-2	13:56	Same as above	12.6*
O_2-3	14:13	Same as above	12.9*
O_2-4	14:27	Same as above	13.0
O_2-5	15:10	Same as above	12.8
			Hydrogen %
H_2-1	13:54		.7%*
H_2-2	13:56		.7%*
H_2-3	14:13		.7%*
H_2-4	14:27		.7%*
H_2-5	15:10		.5%
H_2-6	15:13		.6%
		*Corrected for relative humidity at 90% = 36 mm Hg as sampled.	

Appendix D
Table 3

Metropolitan Edison Company
Three Mile Island Unit 2

Sample No.	Time/Date	Description	Results µCi/ml
37669	1907 4/15/80	Penetration R-626 Reactor Building Particulate Sample	Cs-134 $6.45E^{-10}$ Cs-137 $4.75E^{-9}$ Grossα $1.97E^{-10}$ Gross$\beta\gamma$ $1.13E^{-8}$
36652	1715 4/3/80	Penetration R-626 Reactor Building Particulate Sample	Cs-137 $1.24E^{-8}$ Grossα $4.02E^{-11}$ Gross$\beta\gamma$ $6.69E^{-9}$
36620	1519 4/3/80	Penetration R-626 Reactor Building Air Sample	Kr-85 $9.45E^{-1}$ Cs-137 $1.05E^{-5}$*
36615	1332 4/3/80	Penetration R-626 Reactor Building Air Sample	Kr-85 $5.5E^{-1}$ Cs-137 $1.11E^{-5}$*
36616	1345 4/3/80	Penetration R-626 Reactor Building Air Sample	Kr-85 $6.25E^{-1}$ Cs-137 $1.37E^{-5}$*
36617	1400 4/3/80	Penetration R-626 Reactor Building Air Sample	Kr-85 $8.86E^{-1}$
36618	1420 4/3/80	Penetration R-626 Reactor Building Air Sample	Kr-85 $6.58E^{-1}$
36619	1448 4/3/80	Penetration R-626 Reactor Building Air Sample	Kr-85 $8.9E^{-1}$

*Sample vial contaminated.

TDR 162
Rev 1

TECHNICAL DATA REPORT

	Accountable Copies
1. DDCC, Parsippany	Original
2. DDCC, TMI Site	(1)
3. GAI Proj. Mgr., R. M. Rogers	1

Information Copies

Additional information copies shall be specified by the author of the TDR.

15F