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TRACER LEAK TESTING OF THE CONTROLLED-RELEASE TEST CELL AT THE GROUNDWATER REMEDIATION FIELD LABORATORY, DOVER AIR FORCE BASE, DELAWARE

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14. ABSTRACT

A two-stage dual-tracer leak test was performed on the test cell at the Groundwater Remediation Field Laboratory at Dover Air Force Base, Delaware to quantify the leakage across the cell and determine the exchange rate between system gas and the atmosphere. Ambient air containing helium and sulfur hexafluoride (SF_6) at known concentrations was injected into the cell at a flow rate of 1.4 scfm. Vapor was extracted from the cell at the same flow rate while monitored for helium and SF_6 concentrations until steady state was achieved. The data showed 53.3 and 64.9 percent leakage for the helium and SF_6 tracers, respectively. Tracer data from soil gas from the 45 soil-gas monitoring probes in the cell, and 4 additional soil-gas probes inserted between the two cell walls showed that the cell wall was leaking on the north end. An average leakage or dilution factor of 40.4 percent was calculated for the south plenum. Results from Stage 2, a tracer bleed-off test, showed a first order decrease in the concentrations of both tracers. The exchange rate was determined to be once in approximately 10.2 days.

15. SUBJECT TERMS

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Final Report

TRACER LEAK TESTING OF THE CONTROLLED-RELEASE TEST CELL AT THE GROUNDWATER REMEDIATION FIELD LABORATORY, DOVER AIR FORCE BASE, DELAWARE

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PREFACE

This report was prepared by Battelle, 505 King Avenue, Columbus, Ohio 43201-2693, U.S. Air Force Contract No. F08637-95-D-6004, for the Armstrong Laboratory Environics Directorate (AL/EQ), Suite 2, 139 Barnes Drive, Tyndall Air Force Base, Florida 32404-5319.

This final report describes the methods used, measurements made, and the results of a two-stage dual-tracer test conducted to assess the leakage from a controlled release test cell at the Groundwater Remediation Field Laboratory at Dover Air Force Base, Delaware.

The work was performed between May 1997 and June 1997. The AL/EQ project officer was Ms. Catherine Vogel.

EXECUTIVE SUMMARY

A two-stage dual-tracer leak test was performed on the test cell at the Groundwater Remediation Field Laboratory at Dover Air Force Base, Delaware to quantify the leakage across the cell and determine the exchange rate between the system gas and the atmosphere. During Stage 1, ambient air containing helium and sulfur hexafluoride (SF_6) at known concentrations was injected into the vent wells at one end of the cell at a flowrate of 1.4 scfm. Vapor was extracted from the opposite end of the cell at the same flowrate while monitoring for helium and SF_6 concentrations. The injection process continued until the tracer concentrations in the extracted gas reached steady state. The data showed 53.3 and 64.9 percent leakage for the helium and SF_6 tracers, respectively.

Tracer concentrations also were monitored in the soil gas collected from the 45 soil-gas monitoring probes and 4 additional soil-gas probes that were inserted on the north end of the test cell between the two cell walls. The data showed that the cell wall was leaking on the north end and it indicated more leakage in the northwest corner. An average leakage or dilution factor of 40.4 percent was calculated for the south plenum based on the tracer concentrations in soil gas from the monitoring probes adjacent to this plenum. This represented 68 percent of the total cell leakage. Based on this result, an average of 18.8 percent dilution or 32 percent of the total leakage occurred over the remainder of the test cell and bioventing system.

Stage 2 included a tracer bleed-off test that was conducted to determine the rate at which the system gas was exchanged with the atmosphere during operation of the bioventing system. Once Stage 1 was completed, the aboveground bioventing system was reconnected to the vent wells and the system was operated recirculating air at 1.4 scfm. Soil-gas samples were collected over a period of 5 days and analyzed for helium and SF_6. The data showed a first-order decrease in the concentrations of both tracers. The exchange rate was determined to be once in approximately 9.8 days.

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LIST OF ABBREVIATIONS

AFB	Air Force Base
bgs	below ground surface
ECD	electron capture detector
GC	gas chromatograph
GRFL	Groundwater Remediation Field Laboratory
NS	not sampled
PCE	perchloroethylene
PVC	polyvinyl chloride
TCE	trichloroethylene

Final Report

on

Tracer Leak Testing of the Controlled Release Test Cell at the Groundwater Remediation Field Laboratory, Dover Air Force Base, Delaware

July 2, 1997

1.0 INTRODUCTION

A co-oxidative bioventing study has been underway at the Groundwater Remediation Field Laboratory (GRFL) at Dover Air Force Base (AFB) since June of 1996. The study is being conducted in a controlled release test cell that was designed to be hydraulically contained. The walls of the cell were constructed by driving interlocking sections of sheet pile into a clay layer located approximately 35 to 40 feet below ground surface (bgs). The joints between the sections of sheet pile were jetted clean and sealed with a hardening grout. An inner and an outer wall were installed to allow monitoring and control of any potential release of introduced contaminants from the test cell.

In May 1996, the water table in the test cell was raised to 7 feet bgs and the cell was allowed to equilibrate. Approximately 85 gallons of an aged JP-4 jet fuel, trichloroethylene (TCE), perchloroethylene (PCE), chlorobenzene, toluene, and xylene mixture was introduced into the capillary fringe in the north half of the test cell, and smeared between 5 and 9 feet bgs by lowering the water table during injection.

A closed loop recirculating bioventing system was installed. The system consists of two vent wells placed in gravel plenums at both the north and south ends of the test cell, an extraction blower, a CO_2 scrubber, an injection blower, and a pressure swing O_2 generator. The system has been operating since June 1996 on a semi-continuous basis. The system has been turned off on four occasions for up to two weeks to conduct in situ respiration tests.

Over the operational period, the concentrations of contaminants in the soil gas and soil samples have decreased significantly. Unexpectedly, the oxygen utilization rates measured during the respiration tests did not account for the mass of contaminant that was removed. This suggested that the cell and/or bioventing system may have been leaking.

A leak test of the test cell and bioventing system was conducted in March 1997. Air was injected into, or extracted from, the vent wells and/or monitoring points while flow was measured at other points around the cell. The results from these tests indicated that there was significant leakage occurring in the cell. Because the leak test did not reproduce the flow properties of the cell and bioventing system during system operation, it was not possible to extrapolate the results from this test to

quantify the leakage during system operation. A two-part tracer test was conducted to quantify the leakage properties of the test cell. The objective of this test was to determine the leakage factor in the cell under operating conditions and to evaluate the loss of tracer during system operation. This report contains the results from this tracer test.

2.0 METHODS

The cell leak test was conducted in two stages. The first stage consisted of continuous injection of a known concentration of two tracer gases, helium and sulfur hexaflouride (SF_6). The effluent concentrations of each tracer gas were monitored until steady state was achieved. The difference between the influent and effluent concentrations was used to determine the cell leakage factor. Once steady state was achieved, the second stage of the test began and included a tracer bleed-off test. This involved turning off the helium and SF_6 injection, then operating the bioventing system while monitoring the disappearance of the tracers from the test cell. The data from this test was used to determine the rate of exchange between the soil gas in the cell and the atmosphere. The following descriptions provide details of the methods used for conducting each test.

2.1 STAGE 1: CONTINUOUS TRACER INJECTION

Two blowers were used in this test, one for injection into, and the other for extraction from, the test cell (Figure 1). The exhaust side of the injection blower was fitted with a flow meter and a sampling port. The intake side of the blower was connected to a 2-inch by 5-foot polyvinyl chloride (PVC) manifold with a helium and SF_6 introduction port located approximately 6 inches downstream of the open end of the manifold where ambient air was introduced. This arrangement allowed sweeping and mixing of the tracer gases prior to entry into the injection blower. Injection flowrates were controlled by adjusting a flow control valve on the inlet of the blower.

Helium and SF_6 delivery lines were plumbed into the manifold on the intake side of the injection blower. The delivery lines were fitted with a mass flow meter and a flow control valve, and the lines were connected to dual-stage regulators. The regulator on the helium line was connected to a bank of twelve helium tanks. The regulator on the SF_6 line was connected to a 39 ft^3 cylinder of 1036 ppm SF_6.

The extraction blower was fitted with a flow control valve on the intake side. The exhaust side of the blower was fitted with a flow meter and sampling port. The extracted gas was routed through activated carbon canisters and discharged to the atmosphere.

Four soil-gas sampling probes were installed to a depth of 5 feet between the two sheet pile walls on the north end of the test cell. Two probes were installed on the north side of the cell and were designated as MP-N1 and MP-N2. The other two probes were installed on the east and west sides of the test cell and were designated as MP-E3 and MP-W4, respectively. The purpose of these soil-gas probes was to monitor the soil gas outside the inner test cell wall.

A tracer recovery test was conducted around the two blowers prior to injecting into the test cell. The exhaust line from the injection blower was directly plumbed to the intake side of the extraction blower. The blowers were turned on and the flowrate on the extraction blower was set at 1.4 scfm, the same as the flowrate during operation of the bioventing system. The flowrate on the injection blower was adjusted to 1.33 scfm. The helium flowrate was set at 1.69 L/min (0.06 scfm) and the SF_6 flowrate was set at 40.6 mL/min (0.0014 scfm), for a total injection flowrate of 1.4 scfm. The total injection and extraction flowrates were set equal so that changes in tracer concentrations between the injected and extracted gas could be used to calculate the leakage across the cell. Once the blower and tracer gas

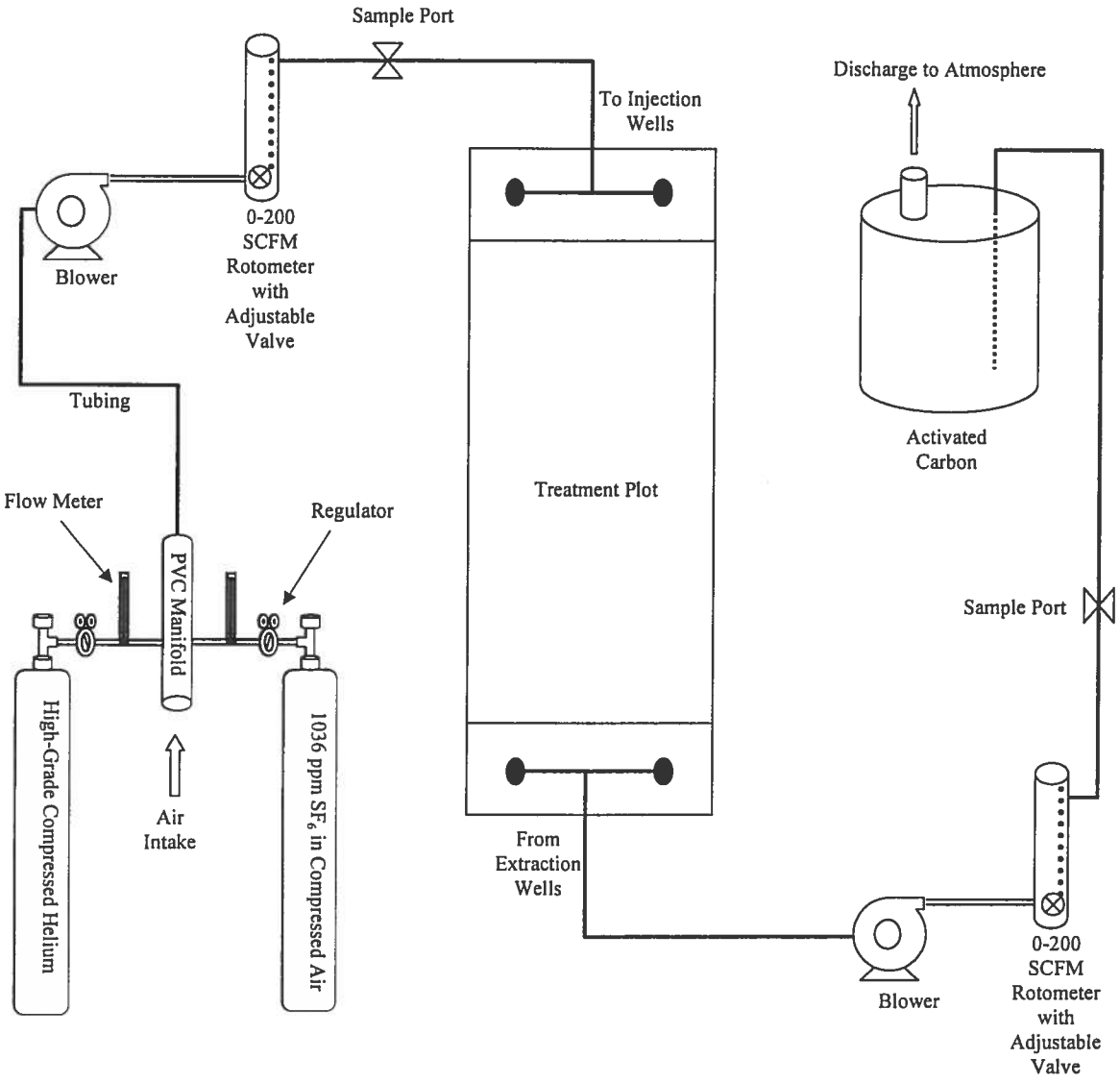


Figure 1. Schematic of the Air Injection and Extraction Setup Used During Stage 1.

flowrates were set, the system was allowed to run for approximately one hour before samples of the injection and extraction gases were collected and analyzed for helium and SF_6.

Following completion of the tracer recovery test, the injection blower was plumbed to the vent wells on the north end of the cell and the extraction blower was plumbed to the vent wells on the south end of the cell. The two blowers were turned on and the flowrates set as described above.

Samples of the injected gas, extracted gas, and soil gas from the soil-gas monitoring points were collected and analyzed for helium and SF_6 (see Section 2.3). This was done until the system came to steady state. Steady state was defined as the time when three successive extraction samples collected over a minimum of 6 hours fell within 5% of each other.

2.2 STAGE 2: TRACER BLEED OFF

Once steady state was verified according to the definition above, the injection and extraction blowers were turned off and the valves on the vent wells were closed. Helium and SF_6 were introduced into the aboveground components of the bioventing system to eliminate the interference from a slug of ambient air in the closed system. The injection blower and associated helium and SF_6 lines were connected to the south end of the system and 1.4 scfm of the gas mixture was injected. The effluent gas at the north end of the system was monitored for helium concentration to determine when the system was at equilibrium. Once the aboveground components were flushed, the vent wells were reconnected to the recirculating bioventing system and the system was put into standard operation, recirculating air at 1.4 scfm.

Periodic soil-gas samples were collected from the soil-gas monitoring points and from the injected and extracted air. All samples were analyzed for helium and SF_6 concentrations (see Section 2.3). The test lasted for five days.

2.3 ANALYTICAL METHODS

Samples of the injected air, soil gas, and extracted air were collected and analyzed for helium and SF_6 concentrations. Helium was measured at the test cell with a Marks helium detector. Injection and extraction gas samples were collected in Tedlar™ soil-gas sampling bags, then the meter was connected to the bag to draw the required volume for analysis. Soil-gas helium concentrations were measured by purging the soil-gas sampling lines, then hooking the helium detector directly to the line.

SF_6 concentrations were measured in gas samples collected in 10 mL disposable syringes. Samples of injected and extracted gas were collected from sampling ports shown in Figure 1. Soil-gas samples were collected from the soil-gas sampling lines following purging. SF_6 was quantified using a Hewlett Packard 6890 gas chromatograph (GC) equipped with a gas sample injection loop, a 6-inch-long by 1/8-inch-diameter stainless steel column packed with Haysep A (80/100 mesh) (Alltech Chromatography), and an electron capture detector (ECD). The GC was calibrated by injecting gas samples with known SF_6 concentrations and calculating a response factor based on the resulting area counts. The temperature program was isothermal at 80°C and nitrogen served as the carrier and makeup gas. SF_6 concentrations were calculated by multiplying the resulting area counts by the response factor determined during calibration.

3.0 RESULTS AND DISCUSSION

The layout of the test cell is shown in Figure 2. The tri-level soil-gas points (6 foot, 10 foot, and 14 foot bgs) inside the cell are shown and labeled as A through O. The four soil-gas probes inserted between the cell walls are shown and labeled as N1, N2, E3, and W4. The results discussed below are based on the analytical results from gas samples collected around the injection system and from the locations indicated in Figure 2.

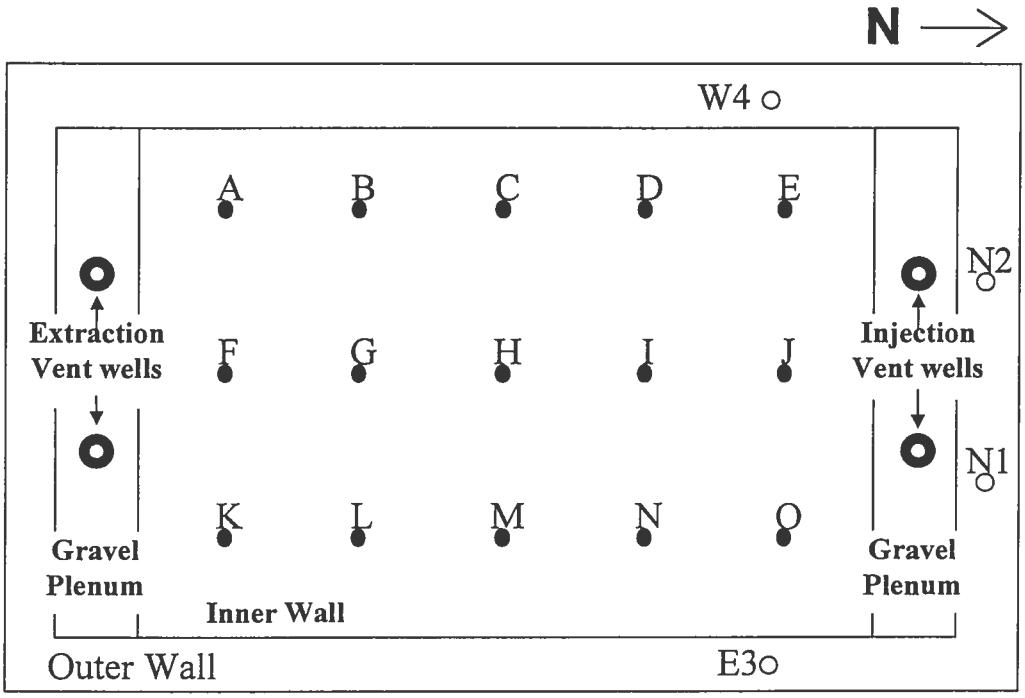


Figure 2. Layout of the Test Cell at the GRFL at Dover AFB During the Dual-Tracer Leak Test.

3.1 STAGE 1: CONTINUOUS TRACER INJECTION

The helium and SF_6 concentrations in the injection air were measured at 6.2 percent and 1,030 ppb, respectively. This was determined to be close enough to the targeted values of 6 percent for the helium and 1,000 ppb for the SF_6 to require no further adjustment. The helium and SF_6 concentrations in the extraction gas were 6 percent and 944 ppb, respectively. This represented recoveries of 96.8 and 91.7 percent of the injected helium and SF_6, respectively. These values were used in subsequent leakage factor concentrations (see Equation 1).

The blowers were plumbed to the vent wells as described previously, and the helium, SF_6, air injection, and total extraction rates were set. Figure 3 shows the flowrates over the duration of Stage 1. Overall, the flowrates remained constant except at 22 hours when the SF_6 and total extraction flowrates dropped. These flowrates were adjusted back to the target rates and remained constant for the remainder of the test.

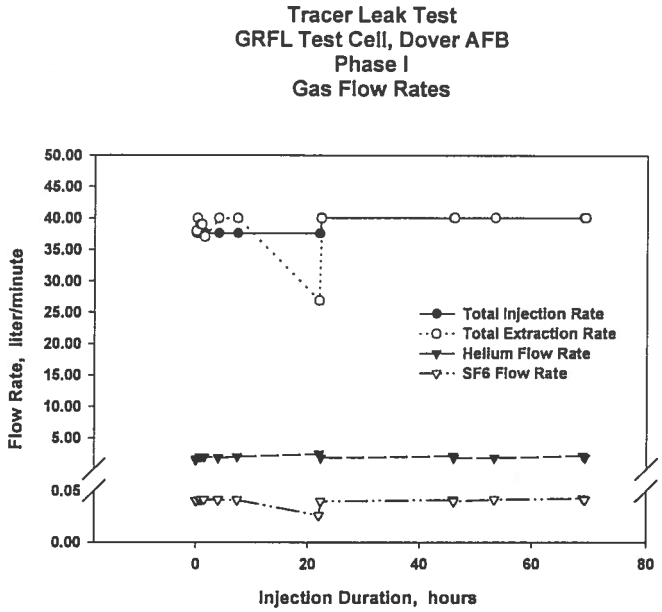
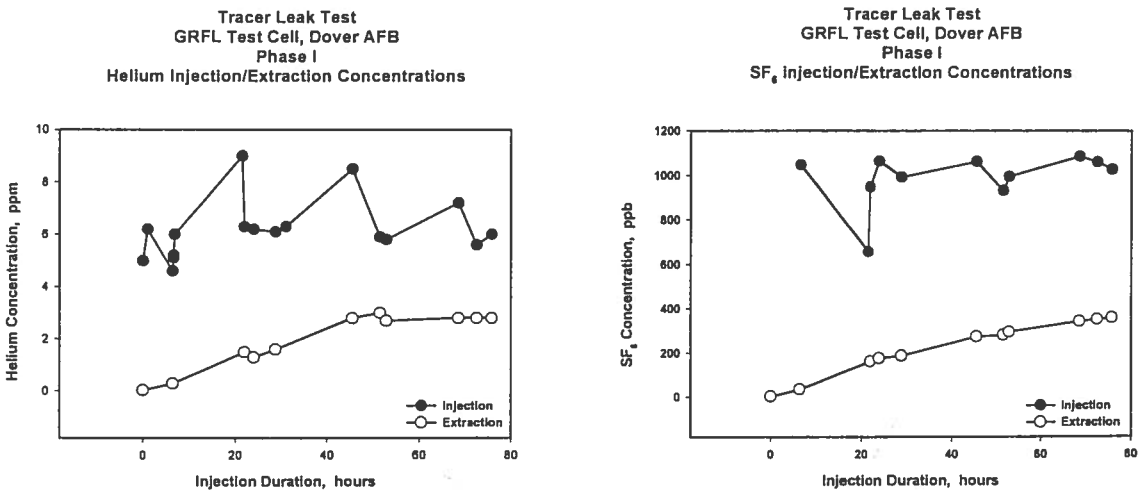


Figure 3. Flowrates of the Individual Gas Streams During Stage 1 of the Dual-Tracer Leak Test Conducted at the GRFL at Dover AFB.

Figures 4(a) and (b) show the injection and extraction concentrations for helium and SF_6, respectively. The helium flowrate tended to increase overnight when the temperature cooled down. The flowrate was adjusted and monitored during the day to ensure that the desired influent concentration was maintained. Although the fluctuations in concentration were noticeable in the influent, the effect was dampened out through the cell and was not observed in the extracted gas.



(a) (b)

Figure 4. Injection and Extraction Concentrations of (a) Helium and (b) SF_6.

The helium data show that steady state was achieved after approximately 44.5 hours, while the SF_6 data indicated steady state after approximately 68.5 hours. The steady-state concentrations were 2.8 percent and 331 ppb for helium and SF_6, respectively. These values were used to determine a cell leakage factor as follows:

$$\frac{\text{Tracer Concentration}_{rec} - \text{Tracer Concentration}_{ext}}{\text{Tracer Concentration}_{rec}} \times 100\,p \qquad (1)$$

where: $\text{Tracer Concentration}_{rec}$ = the concentration of helium or SF_6 measured during the recovery test
$\text{Tracer Concentration}_{ext}$ = the concentration of helium or SF_6 in the extracted air.

The resulting leakage factors were calculated at 53.3 and 64.9 percent for helium and SF_6, respectively, for an average leakage factor of 59.1 percent. The higher leakage factor determined using the SF_6 data may be indicative of the partitioning nature of this tracer.

The data from the soil-gas probes inserted between the two sheet pile walls indicated that there was significant leakage occurring on the north end of the cell. This is the pressurized end of the cell and it was anticipated that if the tracers were leaking, they would be detected in this vicinity. Table 1 lists the helium and SF_6 concentrations measured in soil-gas samples collected from the four probes during the injection of the tracers. The data show that both tracers were detected in all four probes. The concentrations were significantly higher in the samples collected from MP-N2 and MP-W4. These probes were located at the north end of the test cell on the west side. Although the data verified that the cell was leaking through the cell wall and that the leakage may have been greater in the northwest section of the cell, it was not possible to pinpoint or to quantify the leakage.

For the most part, both tracers were evenly distributed at the injection concentration throughout the plot, except for at the 14-foot depth at MP-K, L, and M where the concentrations of both tracers were significantly lower than their injection concentrations. This indicated either that there was potential leakage on the southeast corner of the cell or that the soils in this area of the cell may have been less permeable than the rest of the cell and had not reached equilibrium. The data plots in the Appendix show that the tracer concentrations at these locations remained constant or increased before decreasing during Stage 2, indicating that the latter was the case.

The leakage in the south plenum was estimated by calculating the gas flowrate from the cell into the south plenum using the following equation.

$$Q_{cell} = Q_{ext} \frac{C_{ext}}{C_{avg}} \qquad (2)$$

where: Q_{cell} = gas flowrate from the cell (scfm)
Q_{ext} = extraction flowrate = 1.4 scfm
C_{ext} = concentration of tracer in extracted gas = 2.8% helium, 331 ppb SF_6
C_{avg} = average tracer concentration between MPs A, F, and K = 4.1% helium, 649 ppb SF_6.

TABLE 1. HELIUM AND SF_6 CONCENTRATIONS IN GAS SAMPLES COLLECTED FROM THE FOUR SOIL-GAS MONITORING PROBES INSERTED BETWEEN THE CELL WALLS

Location	Time (hr)	Helium Concentration (%)	SF_6 Concentration (ppb)
MP-N1	19	0.03	NS
	43	0.13	NS
	67	0.28	24
	90	0.33	47
MP-N2	19	0.8	115
	25	0.71	181
	43	0.86	316
	67	1.4	479
	90	1.5	598
MP-E3	19	0.02	NS
	43	0.05	NS
	67	0.18	41
	90	0.15	NS
MP-W4	19	0.11	2
	43	0.28	NS
	67	0.34	68
	90	0.57	133

NS = Not sampled.

Substituting the measured values into equation 2 resulted in a calculated gas flowrate from the cell of 0.96 and 0.71 scfm for helium and SF_6, respectively. Based on a total extraction flowrate of 1.4 scfm, the dilution in the south plenum was 31.4 and 49.3 percent for helium and SF_6, respectively, for an average dilution rate of 40.4 percent.

Leakage factors for the north plenum and the cell between the plenums were calculated using the overall cell leakage factors and the leakage factors for the south plenum. The results were 21.9 and 15.6 percent for helium and SF_6, respectively, for an average leakage of 18.8 percent.

The results calculated above indicate that on average, approximately 68 percent of the total leakage occurred in the south plenum. The remaining 32 percent of the total leakage occurred to the north of the south plenum. Based on the tracer measurement in the soil gas from the soil-gas probes, it appears that a large percentage of this leakage may have occurred in the northwest corner of the test cell.

3.2 STAGE 2: TRACER BLEED OFF

The objective of Stage 2 was to monitor the bleed off of the two tracers from the test cell during operation of the aboveground bioventing system. The helium and SF_6 data collected from each of the 45 soil-gas monitoring points can be found in the Appendix. The data were plotted to illustrate the

change in concentration over time for each monitoring point and the resulting graphs also can be found in the Appendix.

An average concentration was calculated for the 45 soil-gas monitoring points for each of the sampling events in Stage 2. The resulting average concentrations are plotted as symbols in Figure 5. The data show that the decreases in the helium and SF_6 concentrations followed a first-order decay. Non-linear regression analyses performed on the helium and SF_6 data resulted in Equations 3 and 4, respectively. The fit of these equations are shown as the lines in Figure 5.

$$He = 5.8e^{-0.02(t)} \tag{3}$$

$$SF_6 = 1210.2e^{-0.02(t)} \tag{4}$$

where: He = helium concentration, %
SF_6 = SF_6 concentration, ppb
t = time, hours

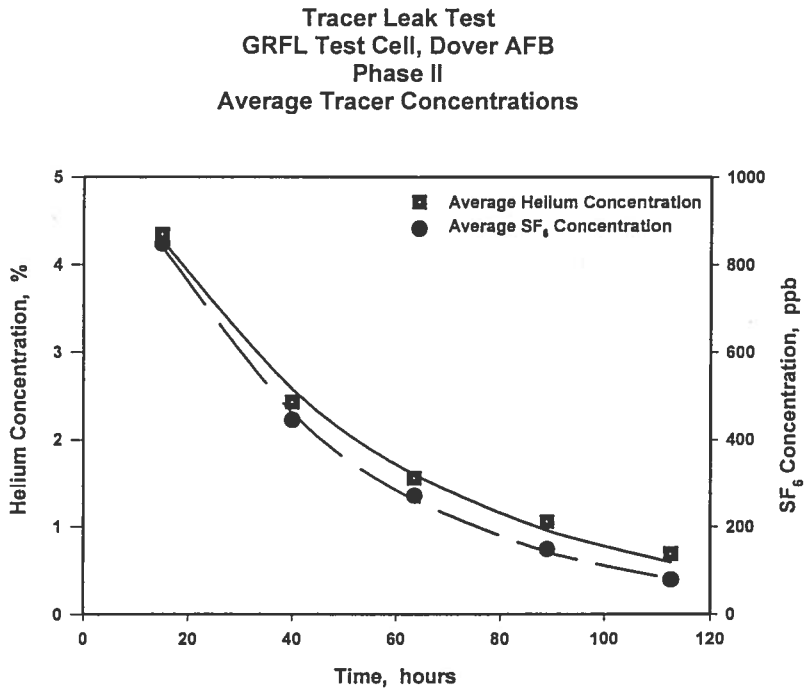


Figure 5. Averaged Helium and SF_6 Concentrations in the Test Cell at Dover Air Force Base During Stage 2 of the Cell Leak Test. (Time 0 indicates the start of Stage 2).

In order to estimate the atmosphere exchange rate for the test cell and bioventing system, the above equations were used to calculate the length of time that would be required to reduce the concentration of each tracer by 99%. The results showed that it would take 9.5 and 10.1 days for this reduction in the helium and SF_6 concentrations, respectively.

4.0 SUMMARY

The dual-tracer leak test was useful for quantifying the vadose zone leakage of the test cell at the GRFL at Dover AFB. The leakage factors calculated from the difference between the total recoverable concentrations of helium and SF_6 during Stage 1 of this test were 53.3 and 64.9 percent, for an average of 59.1 percent. Tracer concentrations in soil gas collected from between the cell walls showed that the north end of the test cell leaked, with greater leakage apparent toward the northwest corner.

An average dilution factor for the south plenum of 40.4% was calculated using the average concentrations at the soil-gas monitoring points closest to the south end of the test cell and the extraction rate and tracer concentrations. The dilution for the remaining sections of the test cell was calculated to be 18.8 percent. This suggested that up to 68 percent of the total cell leakage occurred in the south plenum and up to 32 percent occurred around the rest of the cell.

The results from Stage 2 of this test showed that the gas in the system was exchanged with the atmosphere approximately every 9.8 days. Both the helium and SF_6 data were in agreement with this observation.

Appendix

Tabulated Tracer Data
and Tracer Concentration Graphs

MP-A 6'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 9:45	18.25	0.27	10
5/19/97 15:30	24.00	1.3	155
5/20/97 8:42	41.20	2.7	521
5/21/97 9:10	65.67	6.2	931
5/22/97 15:16	95.77	3.6	1054
5/23/97 7:26	111.93	5.4	1097
5/24/97 9:06	137.60	1.9	193
5/25/97 8:38	161.13	2	236
5/26/97 9:22	185.87	1.1	119
5/27/97 8:40	209.17	0.59	49

MP-A 10'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 9:45	18.25	0.05	
5/19/97 15:30	24.00	0.55	0
5/20/97 8:40	41.17	1.8	233
5/21/97 9:08	65.63	4.6	640
5/22/97 15:18	95.80	5.3	897
5/23/97 7:28	111.97	4.9	995
5/24/97 9:08	137.63	3.2	849
5/25/97 8:40	161.17	2.2	513
5/26/97 9:24	185.90	1.3	244
5/27/97 8:42	209.20	0.96	119

MP-A 14'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 9:45	18.25	0	
5/19/97 15:30	24.00	0.01	
5/20/97 8:40	41.17	0.66	8
5/21/97 9:06	65.60	3	318
5/22/97 9:00	89.50	4	717
5/22/97 15:20	95.83	4	768
5/23/97 7:30	112.00	6.5	769
5/24/97 9:09	137.65	5	826
5/25/97 8:42	161.20	2.8	550
5/26/97 9:26	185.93	2.2	312
5/27/97 8:44	209.23	1	174

MP-B 6'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 10:00	18.50	0.85	139
5/19/97 15:45	24.25	2.3	603
5/20/97 8:58	41.47	3.8	1058
5/21/97 9:42	66.20	4	
5/22/97 15:34	96.07	4.9	1067
5/23/97 7:42	112.20	4.9	1050
5/24/97 9:28	137.97	1.9	348
5/25/97 8:54	161.40	1.3	194
5/26/97 9:40	186.17	0.82	95
5/27/97 8:52	209.37	0.43	42

MP-B 10'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 10:00	18.50	0.23	0
5/19/97 15:45	24.25	0.94	10
5/20/97 8:56	41.43	3	711
5/21/97 9:42	66.20	5	
5/22/97 15:36	96.10	5.7	1043
5/23/97 7:44	112.23	6.1	1089
5/24/97 9:30	138.00	3.2	511
5/25/97 8:56	161.43	1.6	299
5/26/97 9:42	186.20	1.1	143
5/27/97 8:54	209.40	0.74	63

MP-B 14'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 10:00	18.50	0	
5/19/97 15:45	24.25	0.06	
5/20/97 8:54	41.40	1.6	35
5/21/97 9:26	65.93	3.8	549
5/22/97 9:06	89.60	5.3	839
5/22/97 15:38	96.13	3.6	573
5/23/97 7:46	112.27	4.6	404
5/24/97 9:32	138.03	3.8	450
5/25/97 8:58	161.47	2.1	259
5/26/97 9:44	186.23	1.9	144
5/27/97 8:56	209.43	1.3	124

MP-C 6'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 10:50	19.33	1.1	640
5/19/97 16:15	24.75	4.4	
5/20/97 9:15	41.75	8.2	1062
5/21/97 9:50	66.33	4.4	
5/22/97 16:30	97.00	4.7	1111
5/23/97 7:58	112.47	4.9	930
5/24/97 9:44	138.23	2.4	340
5/25/97 9:10	161.67	0.89	161
5/26/97 9:54	186.40	0.22	75
5/27/97 9:04	209.57	0.36	34

MP-C 10'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 10:50	19.33	0.99	11
5/19/97 16:15	24.75	1.7	
5/20/97 9:13	41.72	4.5	951
5/21/97 9:53	66.38	4.3	
5/22/97 16:32	97.03	5.2	1058
5/23/97 8:00	112.50	5.2	1083
5/24/97 9:46	138.27	1.9	374
5/25/97 9:12	161.70	1.2	206
5/26/97 9:56	186.43	0.87	101
5/27/97 9:06	209.60	0.49	44

MP-C 14'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 10:50	19.33	0.06	
5/19/97 16:05	24.58	0.31	
5/20/97 9:11	41.68	1.5	223
5/21/97 9:34	66.07	4.6	757
5/22/97 16:34	97.07	5.4	974
5/23/97 8:02	112.53	5	1026
5/24/97 9:48	138.30	2.4	680
5/25/97 9:14	161.73	2	367
5/26/97 9:58	186.47	1.1	192
5/27/97 9:08	209.63	0.73	93

MP-D 6'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 11:58	20.47	2.5	190
5/19/97 16:35	25.08	2.7	
5/20/97 9:32	42.03	5.6	920
5/21/97 10:02	66.53	5.3	
5/22/97 16:30	97.00	6.4	1106
5/23/97 8:50	113.33	3.3	446
5/24/97 10:02	138.53	1	302
5/25/97 9:26	161.93	0.82	152
5/26/97 10:06	186.60	0.56	68
5/27/97 9:14	209.73	0.35	27

MP-D 10'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 11:55	20.42	1.2	247
5/19/97 16:30	25.00	2.2	
5/20/97 9:30	42.00	5.4	1056
5/21/97 10:04	66.57	4.1	
5/22/97 16:32	97.03	5.6	1062
5/23/97 8:52	113.37	4.7	928
5/24/97 10:04	138.57	1.6	349
5/25/97 9:28	161.97	1	176
5/26/97 10:08	186.63	0.72	85
5/27/97 9:16	209.77	0.45	36

MP-D 14'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 11:50	20.33	0.17	5
5/19/97 16:20	24.83	1.1	
5/20/97 9:28	41.97	3.7	583
5/21/97 9:40	66.17	4.8	882
5/22/97 16:34	97.07	5.1	1038
5/23/97 8:54	113.40	5.4	1063
5/24/97 10:06	138.60	2.9	492
5/25/97 9:30	162.00	1.5	268
5/26/97 10:10	186.67	1	134
5/27/97 9:18	209.80	0.62	60

MP-E 6'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/18/97 18:40	3.17	1	62
5/19/97 12:07	20.62	4.5	757
5/19/97 17:05	25.58	5.8	
5/20/97 9:52	42.37	7.2	694
5/21/97 10:18	66.80	6.8	
5/22/97 14:56	95.43	5.7	1051
5/23/97 9:04	113.57	2	373
5/24/97 10:18	138.80	1.2	228
5/25/97 9:40	162.17	0.7	126
5/26/97 10:18	186.80	0.32	54
5/27/97 9:26	209.93	0.31	22

MP-E 10'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/18/97 19:20	3.83	0.13	5
5/19/97 12:04	20.57	1.8	747
5/19/97 17:00	25.50	3.5	
5/20/97 9:50	42.33	6.2	833
5/21/97 10:20	66.83	5.2	
5/21/97 14:42	71.20	5.7	1059
5/22/97 14:57	95.45	5.5	1055
5/23/97 9:06	113.60	2.3	372
5/24/97 10:20	138.83	1.5	247
5/25/97 9:42	162.20	0.79	132
5/26/97 10:20	186.83	0.85	55
5/27/97 9:27	209.95	0.38	21

MP-E 14'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 12:02	20.53	0.9	28
5/19/97 16:45	25.25	1.3	
5/20/97 9:48	42.30	5.3	708
5/21/97 10:22	66.87	3.7	
5/22/97 14:59	95.48	5.4	1060
5/23/97 9:08	113.63	4.5	915
5/24/97 10:22	138.87	2.4	394
5/25/97 9:44	162.23	1.1	215
5/26/97 10:22	186.87	0.83	105
5/27/97 9:28	209.97	0.99	45

MP-F 6'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 9:45	18.25	0.3	2
5/19/97 15:35	24.08	0.98	91
5/20/97 8:48	41.30	1.7	401
5/21/97 9:16	65.77	5	617
5/22/97 9:00	89.50	4.7	646
5/22/97 15:20	95.83	3.7	473
5/23/97 7:32	112.03	3.7	248
5/24/97 9:12	137.70	2.3	459
5/25/97 8:44	161.23	1.3	275
5/26/97 9:30	186.00	1	130
5/27/97 8:44	209.23	0.57	47

MP-F 10'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 9:45	18.25	0.03	
5/19/97 15:35	24.08	0.19	
5/20/97 8:46	41.27	1.9	41
5/21/97 9:14	65.73	4.1	422
5/22/97 15:22	95.87	4.2	852
5/23/97 7:34	112.07	5.5	968
5/24/97 9:14	137.73	3.8	1003
5/25/97 8:46	161.27	2.7	669
5/26/97 9:32	186.03	1.6	315
5/27/97 8:46	209.27	1	150

MP-F 14'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 9:45	18.25	0.01	
5/19/97 15:35	24.08	0	
5/20/97 8:45	41.25	0.6	2
5/21/97 9:12	65.70	3.2	351
5/22/97 9:02	89.53	4.7	796
5/22/97 15:24	95.90	3.3	187
5/23/97 7:36	112.10	5.9	940
5/24/97 9:15	137.75	4.8	1018
5/25/97 8:48	161.30	3.5	601
5/26/97 9:34	186.07	2.1	298
5/27/97 8:48	209.30	1.2	154

MP-G 6'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 10:00	18.50	0.96	244
5/19/97 15:50	24.33	2.2	696
5/20/97 9:04	41.57	6.1	
5/21/97 9:44	66.23	5.1	
5/22/97 15:40	96.17	5.2	1070
5/23/97 7:48	112.30	5.9	1079
5/24/97 9:34	138.07	2.5	346
5/25/97 9:00	161.50	1.3	188
5/26/97 9:46	186.27	0.78	96
5/27/97 8:56	209.43	0.47	40

MP-G 10'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 10:10	18.67	0.27	0
5/19/97 15:50	24.33	0.58	
5/20/97 9:02	41.53	4	733
5/21/97 9:44	66.23	3.3	
5/22/97 15:42	96.20	4.3	1049
5/23/97 7:50	112.33	5	1101
5/24/97 9:36	138.10	3.2	504
5/25/97 9:02	161.53	2.1	277
5/26/97 9:48	186.30	1.1	131
5/27/97 8:58	209.47	0.73	56

MP-G 14'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 10:10	18.67	0.01	
5/19/97 15:50	24.33	0.09	
5/20/97 9:00	41.50	1.6	6.8
5/21/97 9:27	65.95	4.1	695
5/22/97 9:08	89.63	5.1	910
5/22/97 15:44	96.23	4	938
5/23/97 7:52	112.37	6	1008
5/24/97 9:38	138.13	3.8	882
5/25/97 9:04	161.57	2.4	420
5/26/97 9:50	186.33	2.1	221
5/27/97 9:00	209.50	0.99	119

MP-H 6'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 10:52	19.37	1.8	781
5/19/97 16:20	24.83	4.3	891
5/20/97 9:21	41.85	6.7	1088
5/21/97 9:56	66.43	4	
5/22/97 16:38	97.13	5.3	1101
5/23/97 8:04	112.57	5.2	912
5/24/97 9:50	138.33	1.6	328
5/25/97 9:16	161.77	1.1	152
5/26/97 9:58	186.47	0.68	79
5/27/97 9:08	209.63	0.39	32

MP-H 10'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 10:52	19.37	0.97	34
5/19/97 16:10	24.67	1.3	341
5/20/97 9:19	41.82	5	975
5/21/97 9:58	66.47	4.8	
5/22/97 16:40	97.17	5.8	1068
5/23/97 8:06	112.60	5.4	1084
5/24/97 9:52	138.37	2.1	374
5/25/97 9:18	161.80	1.4	195
5/26/97 10:00	186.50	1.1	100
5/27/97 9:10	209.67	0.53	42

MP-H 14'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 10:52	19.37	0.12	
5/19/97 16:10	24.67	0.44	
5/20/97 9:19	41.82	2.4	290
5/21/97 9:36	66.10	5.1	878
5/22/97 16:42	97.20	5.2	1043
5/23/97 8:08	112.63	5.1	1071
5/24/97 9:54	138.40	2.7	620
5/25/97 9:20	161.83	1.9	338
5/26/97 10:02	186.53	1.1	161
5/27/97 9:12	209.70	0.69	75

MP-I 6'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 11:59	20.48	1.6	870
5/19/97 16:35	25.08	2.8	
5/20/97 9:38	42.13	7.2	1083
5/21/97 10:10	66.67	5.1	
5/22/97 16:38	97.13	4.8	1110
5/23/97 8:56	113.43	3	458
5/24/97 10:08	138.63	1.2	303
5/25/97 9:30	162.00	0.9	138
5/26/97 10:10	186.67	0.64	66
5/27/97 9:18	209.80	0.33	25

MP-I 10'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 11:57	20.45	1.3	607
5/19/97 16:30	25.00	3.5	752
5/20/97 9:36	42.10	4.8	1090
5/21/97 10:12	66.70	4.4	
5/22/97 16:40	97.17	4.9	1120
5/23/97 8:58	113.47	4.3	671
5/24/97 10:10	138.67	1.6	319
5/25/97 9:32	162.03	0.97	151
5/26/97 10:12	186.70	0.84	73
5/27/97 9:20	209.83	0.42	31

MP-I 14'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 11:50	20.33	0.64	26
5/19/97 16:20	24.83	1.4	
5/20/97 9:34	42.07	3.9	757
5/21/97 9:40	66.17	3.2	985
5/22/97 16:42	97.20	5.5	1068
5/23/97 9:00	113.50	4.9	1008
5/24/97 10:12	138.70	2.5	377
5/25/97 9:34	162.07	1.5	210
5/26/97 10:14	186.73	1	105
5/27/97 9:22	209.87	0.62	43

MP-J 6'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/18/97 18:40	3.17	1.6	254
5/19/97 12:07	20.62	5.2	957
5/19/97 17:08	25.63	6.2	1048
5/20/97 9:56	42.43	7.3	775
5/21/97 10:24	66.90	5.1	
5/22/97 15:00	95.50	5.5	1046
5/23/97 9:10	113.67	2.1	366
5/24/97 10:22	138.87	1.1	231
5/25/97 9:44	162.23	0.75	126
5/26/97 10:22	186.87	0.61	53
5/27/97 9:28	209.97	0.27	23

MP-J 10'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/18/97 19:00	3.50	0.39	43
5/19/97 12:05	20.58	3.4	648
5/19/97 17:00	25.50	3.8	
5/20/97 9:54	42.40	4.1	934
5/21/97 10:26	66.93	4.6	
5/22/97 15:02	95.53	5	1041
5/23/97 9:12	113.70	2.7	366
5/24/97 10:24	138.90	1.2	231
5/25/97 9:46	162.27	0.91	126
5/26/97 10:24	186.90	0.54	54
5/27/97 9:29	209.98	0.35	22

MP-J 14'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/18/97 19:00	3.50	0.05	7
5/19/97 12:03	20.55	1.1	514
5/19/97 16:45	25.25	2.6	
5/20/97 9:52	42.37	5.7	1015
5/21/97 10:28	66.97	4.7	
5/21/97 14:44	71.23	4.6	1052
5/22/97 15:04	95.57	8.2	1040
5/23/97 9:14	113.73	2.9	363
5/24/97 10:26	138.93	1.8	241
5/25/97 9:48	162.30	0.98	128
5/26/97 10:26	186.93	0.68	56
5/27/97 9:30	210.00	0.36	23

MP-K 6'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 9:45	18.25	0.19	
5/19/97 15:40	24.17	0.91	65
5/20/97 8:52	41.37	3.7	822
5/21/97 9:24	65.90	5.5	946
5/22/97 15:26	95.93	4.9	1068
5/23/97 7:38	112.13	2.8	1060
5/24/97 9:23	137.88	1.9	429
5/25/97 8:50	161.33	1.7	264
5/26/97 9:36	186.10	0.77	123
5/27/97 8:48	209.30	0.46	52

MP-K 10'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 9:45	18.25	0	
5/19/97 15:40	24.17	0.05	
5/20/97 8:50	41.33	1.4	0
5/21/97 9:22	65.87	4	87
5/22/97 9:04	89.57	4.9	383
5/22/97 15:28	95.97	4.2	466
5/23/97 7:40	112.17	5	649
5/24/97 9:24	137.90	4.5	832
5/25/97 8:52	161.37	2.4	866
5/26/97 9:38	186.13	1.4	600
5/27/97 8:50	209.33	1.1	351

MP-K 14'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 9:45	18.25	0.01	
5/19/97 15:40	24.17	0	
5/20/97 8:49	41.32	0.31	
5/21/97 9:20	65.83	1.4	45
5/22/97 9:06	89.60	2.7	193
5/22/97 15:30	96.00	1.7	73
5/23/97 7:42	112.20	3	64
5/24/97 9:26	137.93	2.5	199
5/25/97 8:54	161.40	2.6	220
5/26/97 9:40	186.17	2.3	159
5/27/97 8:52	209.37	2.1	211

MP-L 6'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 10:15	18.75	0.7	64
5/19/97 15:50	24.33	2.5	
5/20/97 9:10	41.67	2.9	607
5/21/97 9:48	66.30	4.6	
5/22/97 15:46	96.27	4.8	1049
5/23/97 7:52	112.37	5.5	1086
5/24/97 9:40	138.17	2.4	361
5/25/97 9:04	161.57	1.2	193
5/26/97 9:50	186.33	0.82	100
5/27/97 9:00	209.50	0.43	42

MP-L 10'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 10:15	18.75	0.18	0
5/19/97 15:50	24.33	0.8	2
5/20/97 9:08	41.63	2.7	415
5/21/97 9:46	66.27	4	
5/22/97 9:10	89.67	4.7	966
5/22/97 15:48	96.30	4.5	8
5/23/97 7:54	112.40	4.1	1050
5/24/97 9:42	138.20	3.5	726
5/25/97 9:06	161.60	2	399
5/26/97 9:52	186.37	1.2	186
5/27/97 9:02	209.53	0.74	85

MP-L 14'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 10:15	18.75	0	
5/19/97 15:50	24.33	0.01	
5/20/97 9:06	41.60	0.42	
5/21/97 9:29	65.98	2.1	58
5/22/97 9:12	89.70	2	99
5/22/97 15:50	96.33	1.7	76
5/23/97 7:56	112.43	2.9	122
5/24/97 9:44	138.23	2.7	290
5/25/97 9:08	161.63	3.1	442
5/26/97 9:54	186.40	2.9	549
5/27/97 9:04	209.57	2.7	533

MP-M 6'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 10:54	19.40	1.8	570
5/19/97 16:20	24.83	3.3	
5/20/97 9:26	41.93	5.6	1124
5/21/97 9:58	66.47	4.4	
5/22/97 16:44	97.23	5.9	1109
5/23/97 8:10	112.67	4.6	978
5/24/97 9:56	138.43	1.8	328
5/25/97 9:20	161.83	1	162
5/26/97 10:02	186.53	0.69	78
5/27/97 9:12	209.70	0.41	32

MP-M 10'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 10:54	19.40	0.58	11
5/19/97 16:10	24.67	1.4	
5/20/97 9:24	41.90	4.2	902
5/21/97 10:00	66.50	4.5	
5/22/97 16:46	97.27	5.9	1056
5/23/97 8:12	112.70	3.2	1088
5/24/97 9:58	138.47	2.2	428
5/25/97 9:22	161.87	1.8	237
5/26/97 10:04	186.57	0.96	118
5/27/97 9:14	209.73	0.59	46

MP-M 14'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 10:54	19.40	0.03	
5/19/97 16:10	24.67	0.13	
5/20/97 9:22	41.87	1.2	45
5/21/97 9:38	66.13	2.4	507
5/22/97 16:48	97.30	4.3	669
5/23/97 8:14	112.73	4.3	808
5/24/97 10:00	138.50	3.3	755
5/25/97 9:24	161.90	2.5	543
5/26/97 10:06	186.60	1.7	344
5/27/97 9:14	209.73	1.2	191

MP-N 6'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 12:00	20.50	2.7	857
5/19/97 16:40	25.17	4.4	
5/20/97 9:42	42.20	6.8	1076
5/21/97 10:14	66.73	6.9	
5/21/97 14:40	71.17	5.7	1094
5/22/97 16:46	97.27	6.5	1126
5/23/97 9:00	113.50	3.3	462
5/24/97 10:12	138.70	1.5	300
5/25/97 9:34	162.07	0.81	145
5/26/97 10:14	186.73	0.61	68
5/27/97 9:22	209.87	0.34	27

MP-N 10'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 11:58	20.47	1.3	403
5/19/97 16:28	24.97	2.7	
5/20/97 9:40	42.17	5.4	1106
5/21/97 10:16	66.77	5.6	
5/22/97 16:48	97.30	5.1	1117
5/23/97 9:02	113.53	5.3	828
5/24/97 10:14	138.73	1.7	333
5/25/97 9:36	162.10	1	159
5/26/97 10:16	186.77	0.72	77
5/27/97 9:24	209.90	0.42	31

MP-N 14'

Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 11:50	20.33	0.54	11
5/19/97 16:25	24.92	1.5	
5/20/97 9:38	42.13	3.6	730
5/21/97 10:18	66.80	4.6	
5/22/97 16:50	97.33	5.1	1058
5/23/97 9:04	113.57	6	1078
5/24/97 10:16	138.77	2.8	437
5/25/97 9:38	162.13	1.5	244
5/26/97 10:18	186.80	0.97	121
5/27/97 9:26	209.93	0.65	51

MP-O 6'

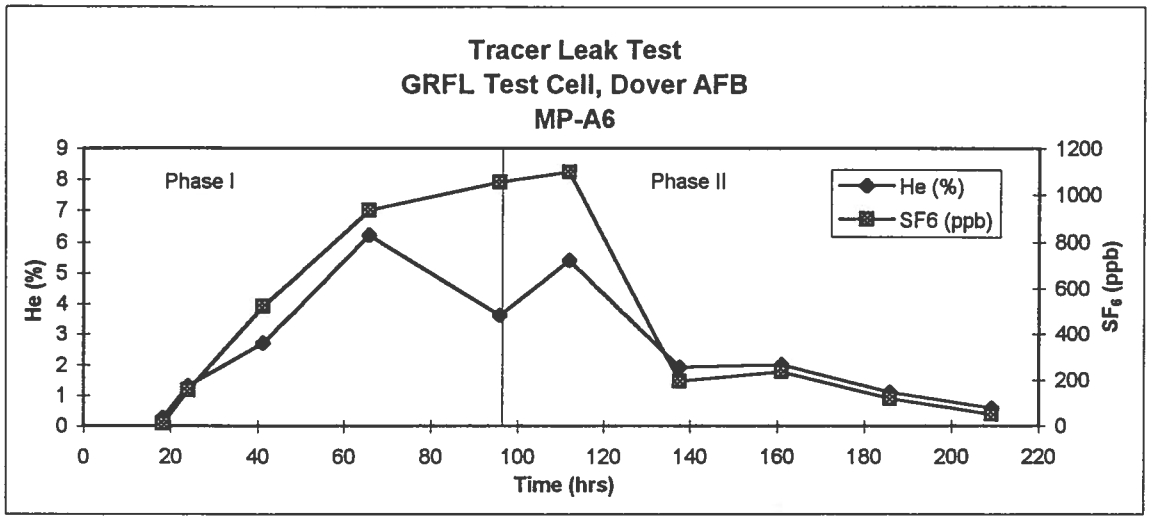
Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/18/97 18:40	3.17	1.3	28
5/19/97 12:08	20.63	4	1163
5/19/97 16:52	25.37	4.4	
5/20/97 10:04	42.57	7.2	714
5/21/97 10:30	67.00	5	
5/22/97 15:06	95.60	4.8	1050
5/23/97 9:20	113.83	2.1	365
5/24/97 10:28	138.97	1.2	224
5/25/97 9:48	162.30	0.75	125
5/26/97 10:26	186.93	0.51	54
5/27/97 9:30	210.00	0.26	21

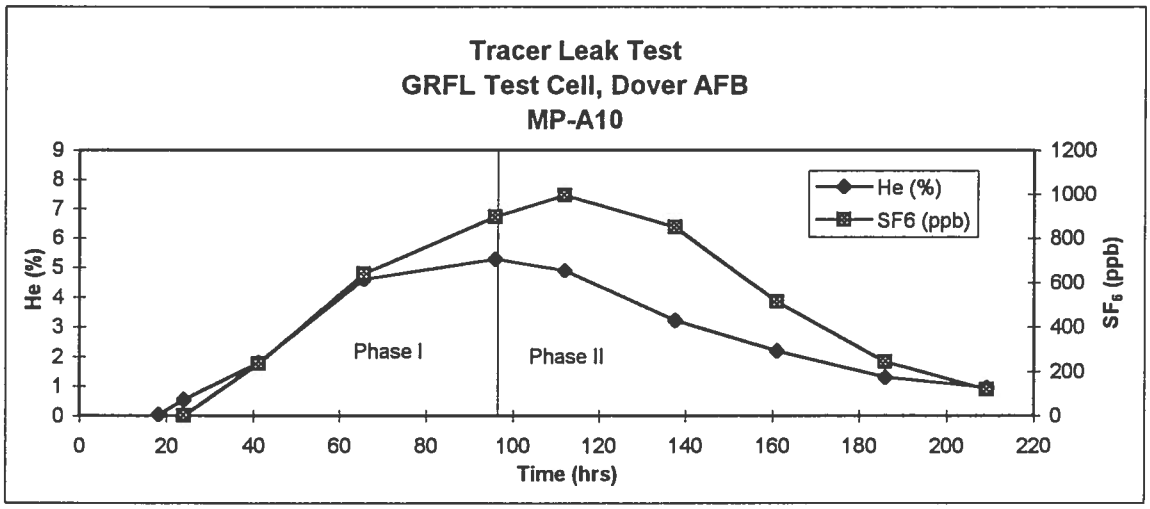
MP-O 10'

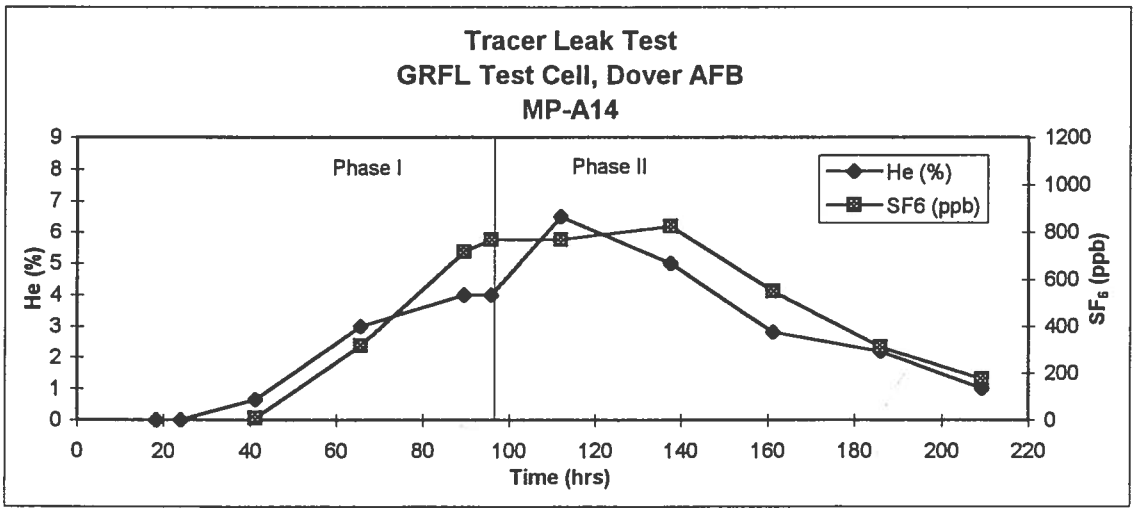
Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 12:06	20.60	1.9	730
5/19/97 16:50	25.33	2.7	
5/20/97 10:02	42.53	5.8	846
5/21/97 10:32	67.03	4.8	
5/22/97 15:08	95.63	4.7	1054
5/23/97 9:22	113.87	2.2	378
5/24/97 10:30	139.00	1.3	246
5/25/97 9:50	162.33	0.91	131
5/26/97 10:28	186.97	0.61	58
5/27/97 9:31	210.02	0.29	23

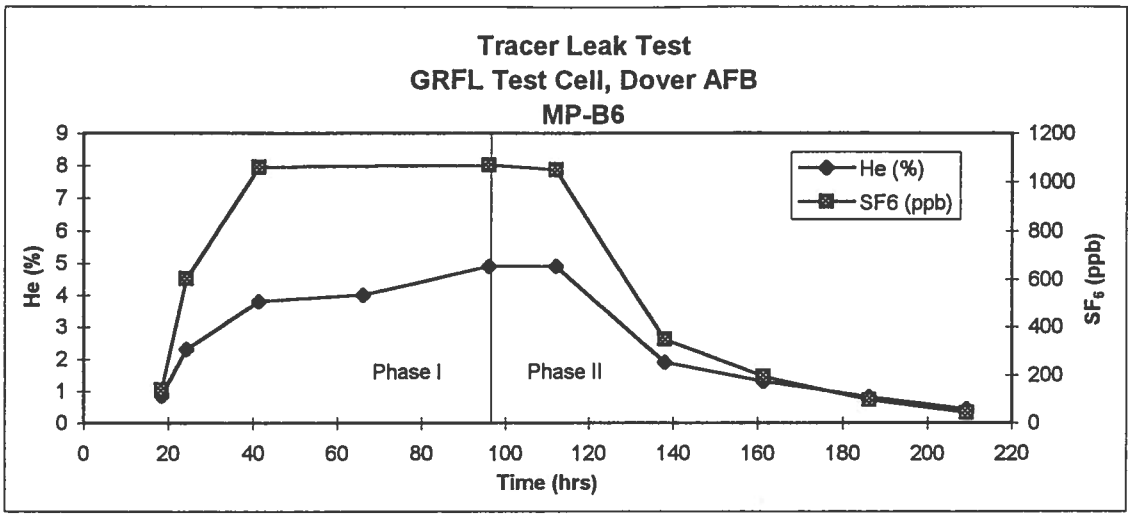
MP-O 14'

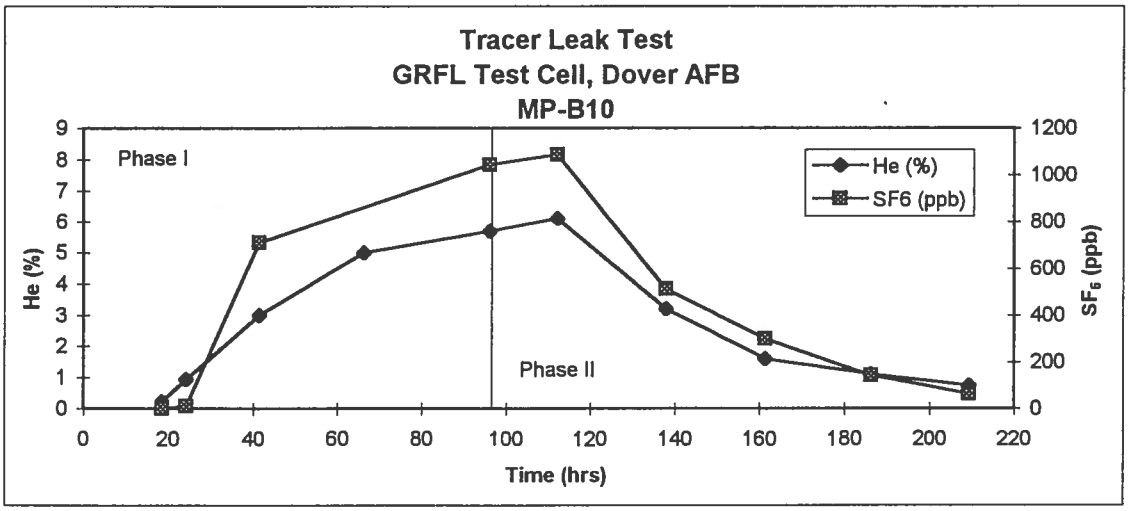
Date & Time	Elasped Time	He (%)	SF6 (ppb)
5/18/97 15:30	0.00		
5/19/97 12:03	20.55	1.6	183
5/19/97 16:50	25.33	2.4	
5/20/97 10:00	42.50	5.6	931
5/21/97 10:34	67.07	4.1	
5/22/97 15:10	95.67	5.5	1075
5/23/97 9:24	113.90	4	607
5/24/97 10:32	139.03	1.7	315
5/25/97 9:52	162.37	1	153
5/26/97 10:30	187.00	0.73	73
5/27/97 9:32	210.03	0.53	30

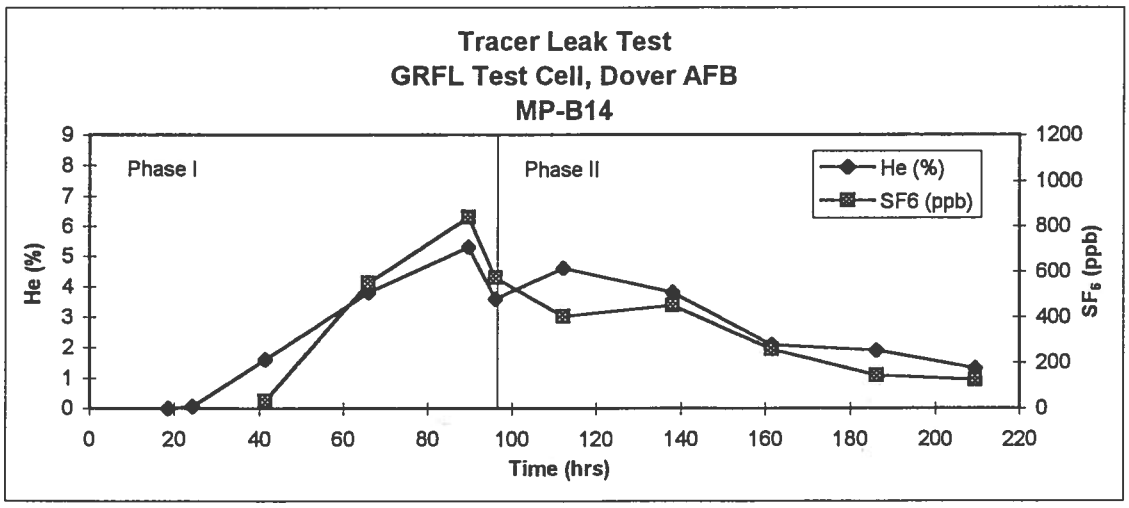

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-A6
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF6 (ppb)
Time (hrs)

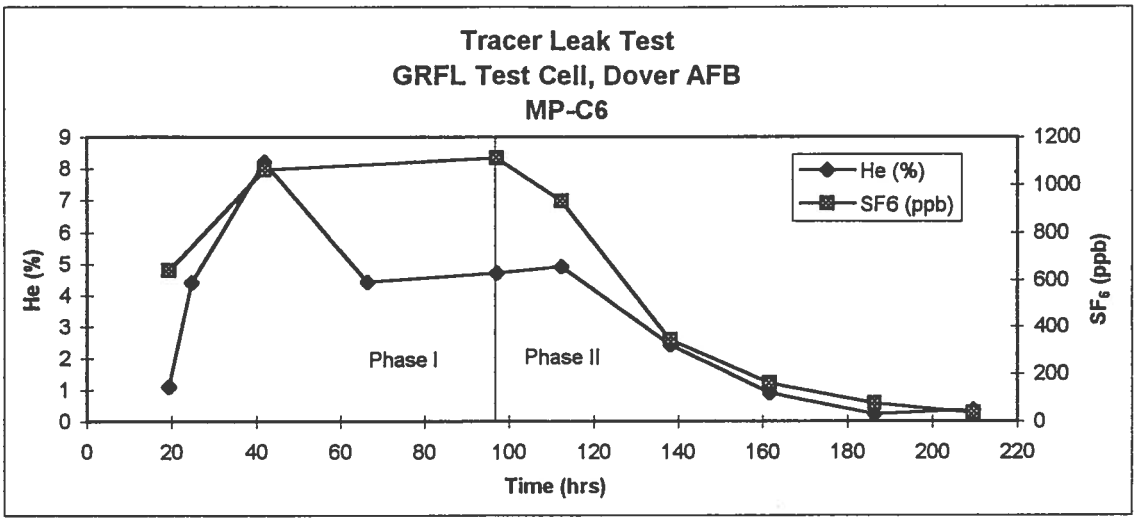

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-A10
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF6 (ppb)
Time (hrs)

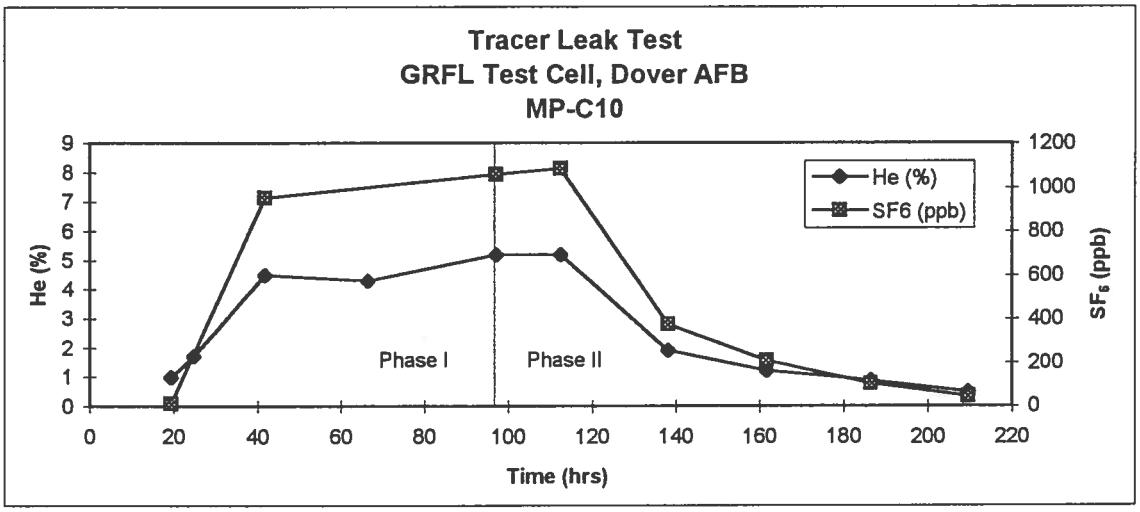

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-A14
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF6 (ppb)
Time (hrs)

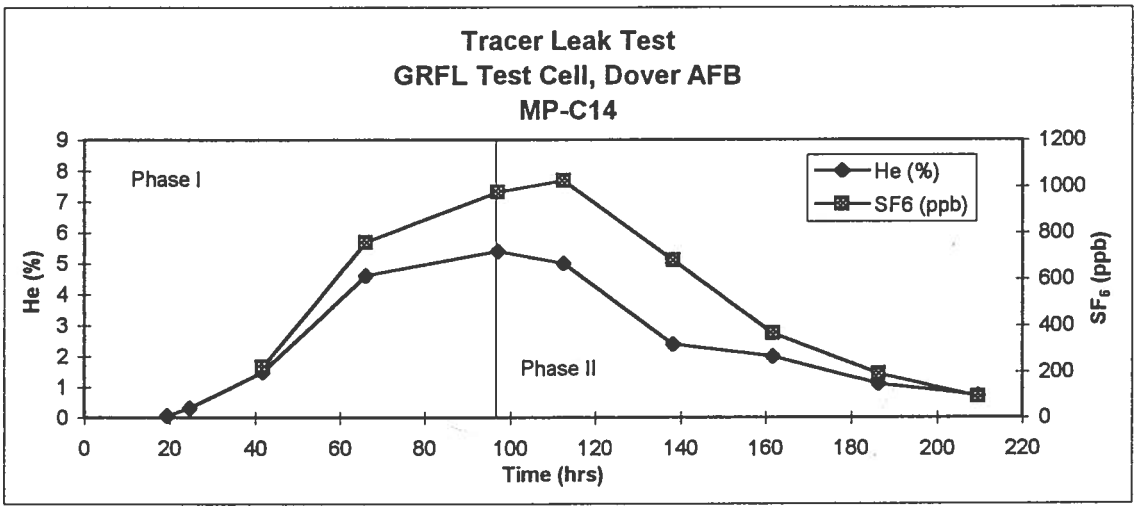

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-B6
He (%)
SF6 (ppb)
Phase I
Phase II
Time (hrs)
SF6 (ppb)

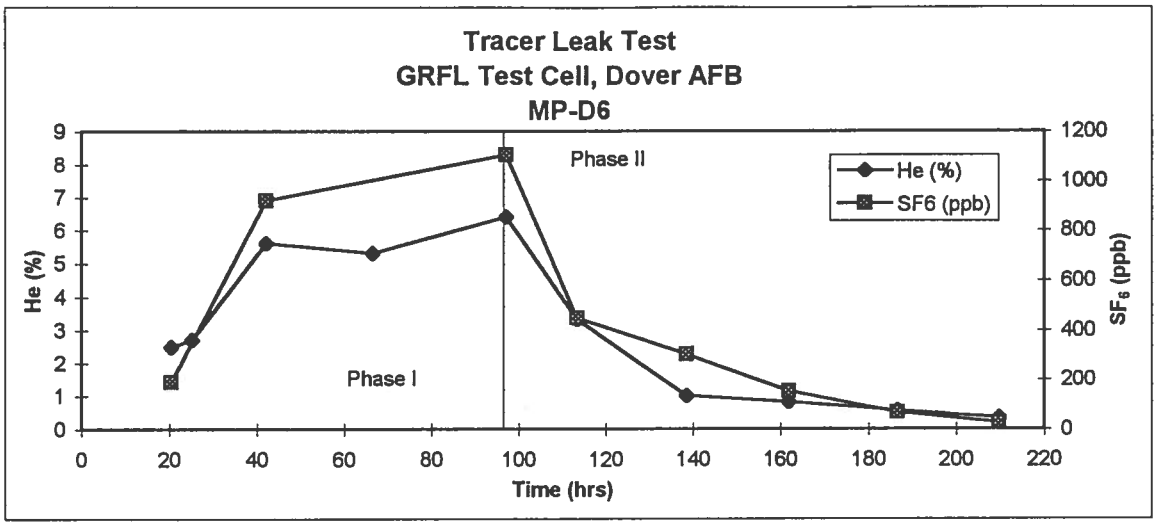

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-B10
Phase I
He (%)
SF6 (ppb)
Phase II
Time (hrs)
SF6 (ppb)

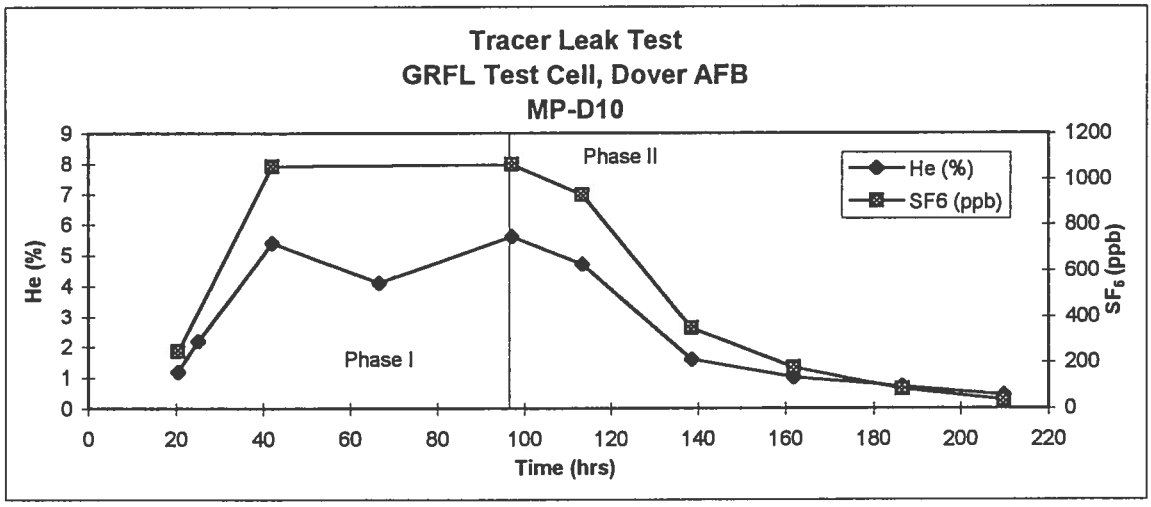

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-B14
Phase I
Phase II
He (%)
SF6 (ppb)
Time (hrs)
SF6 (ppb)

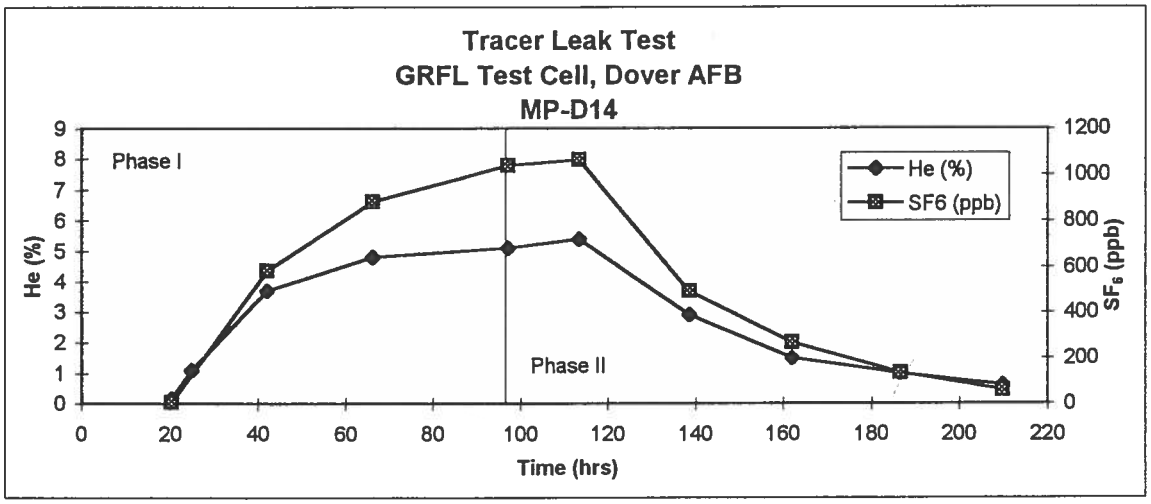

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-C6
He (%)
SF6 (ppb)
Phase I
Phase II
Time (hrs)
SF6 (ppb)

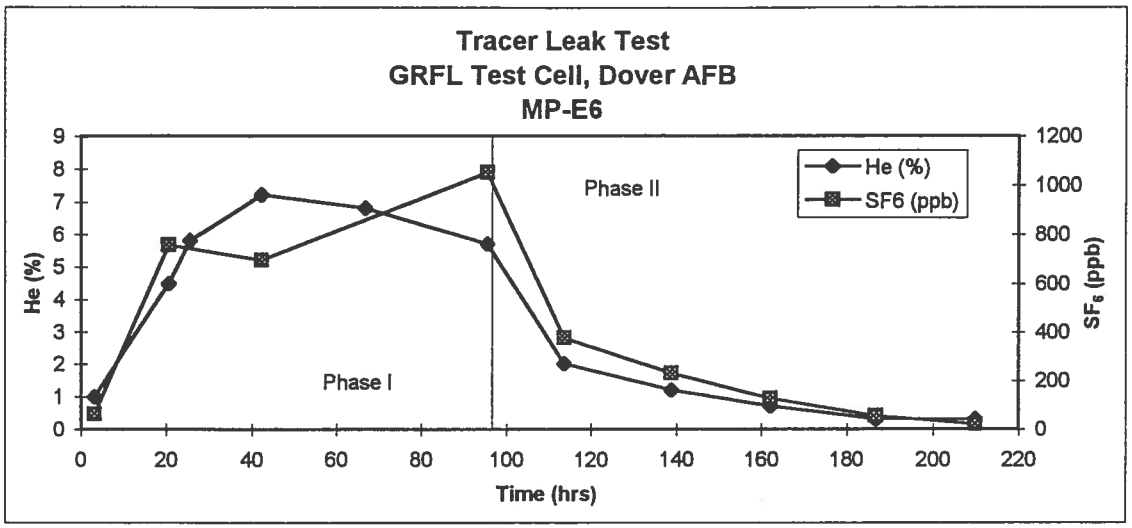

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-C10
He (%)
SF6 (ppb)
Phase I
Phase II
Time (hrs)
SF6 (ppb)

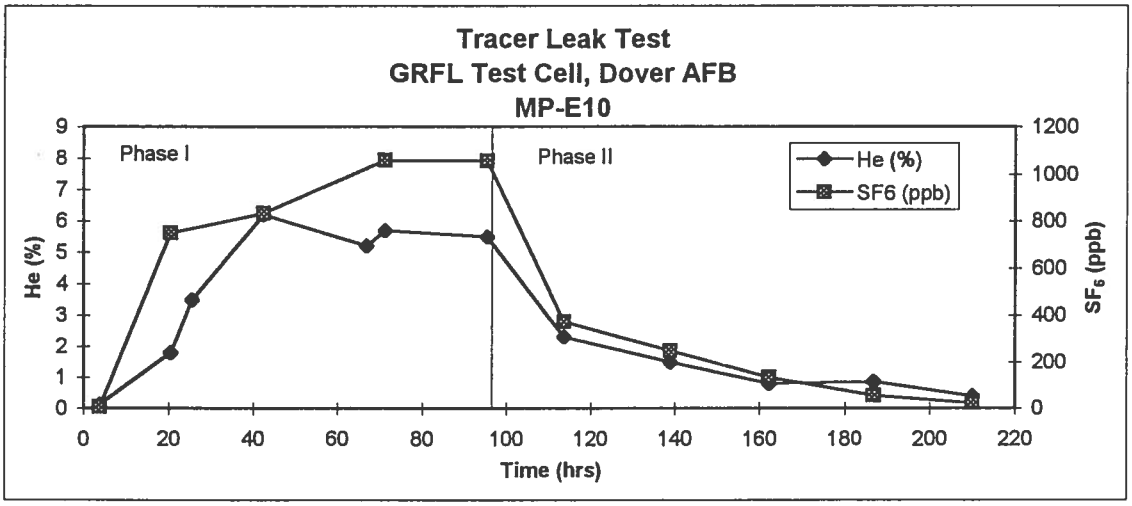

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-C14
Phase I
He (%)
SF6 (ppb)
Phase II
Time (hrs)
SF6 (ppb)

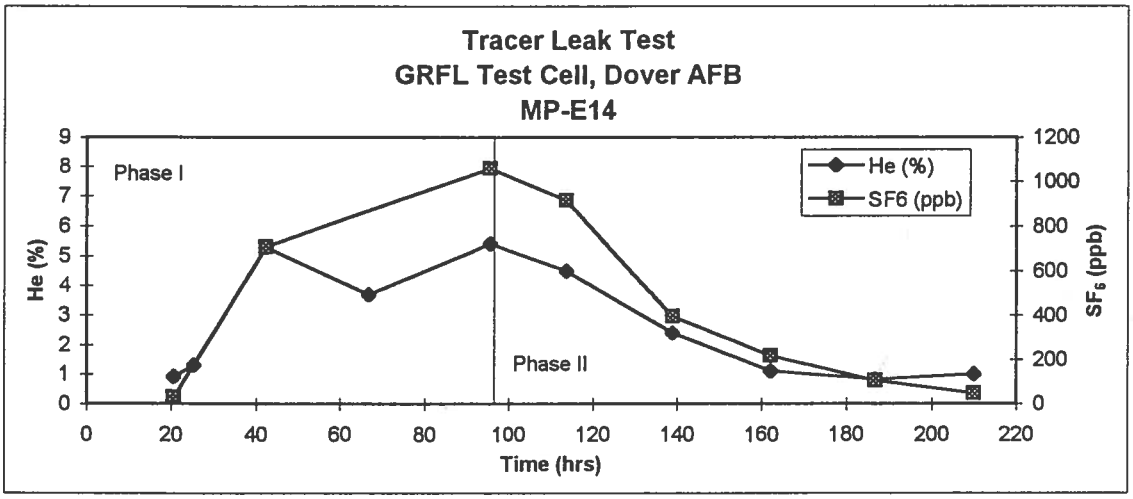

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-D6
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF6 (ppb)
Time (hrs)

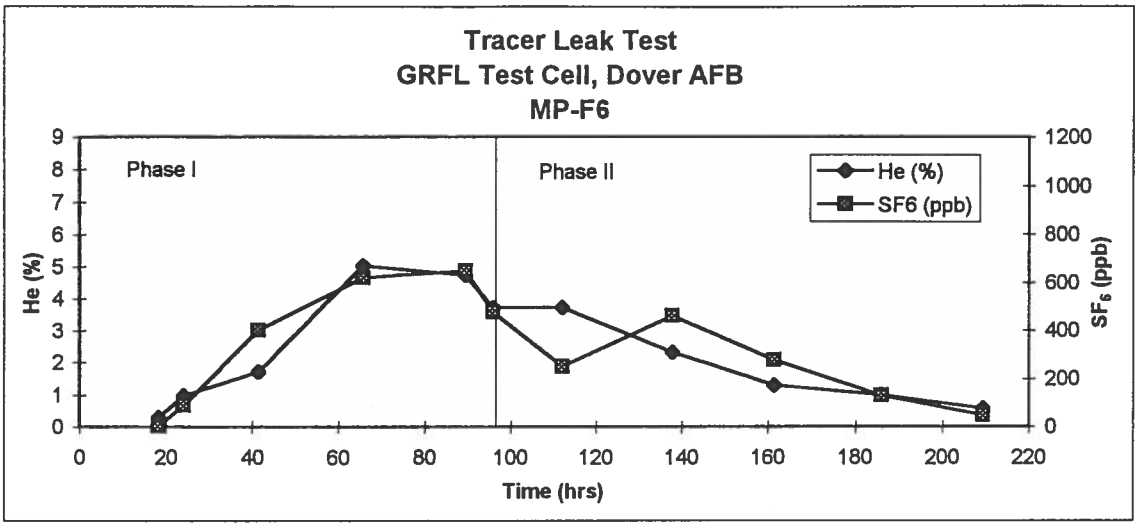

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-D10
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF6 (ppb)
Time (hrs)

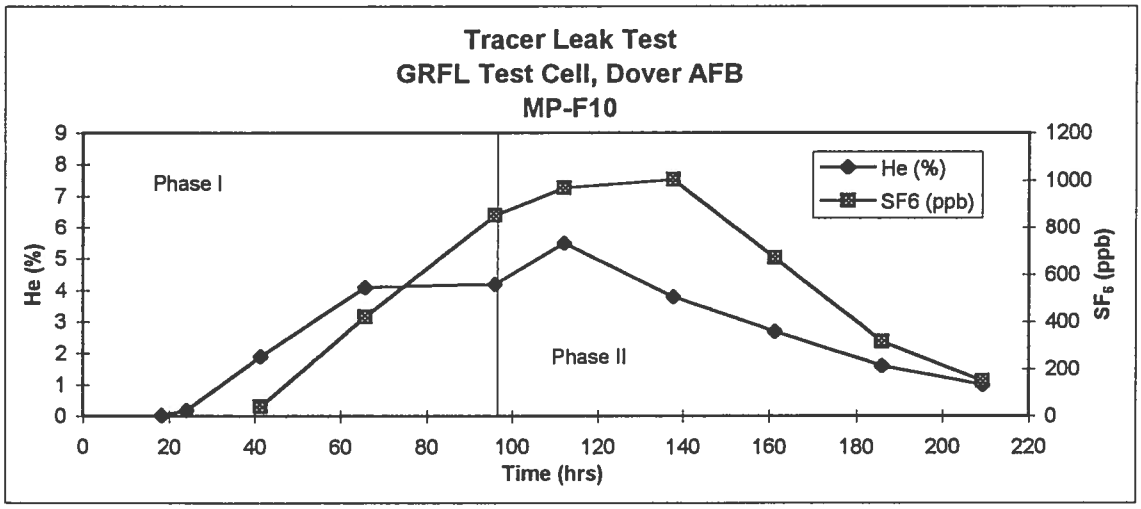

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-D14
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF6 (ppb)
Time (hrs)

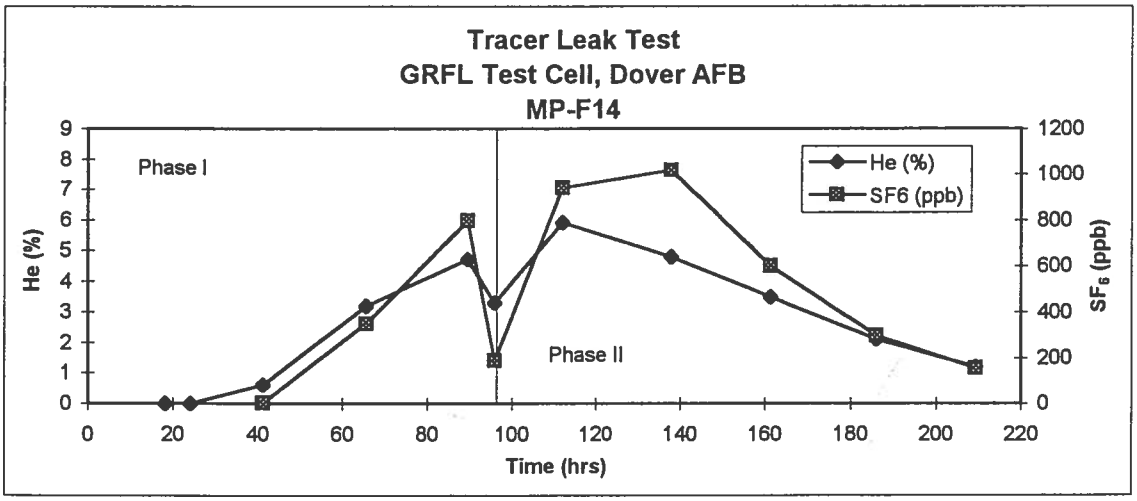

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-E6
He (%)
SF6 (ppb)
Phase I
Phase II
He (%)
SF6 (ppb)
Time (hrs)

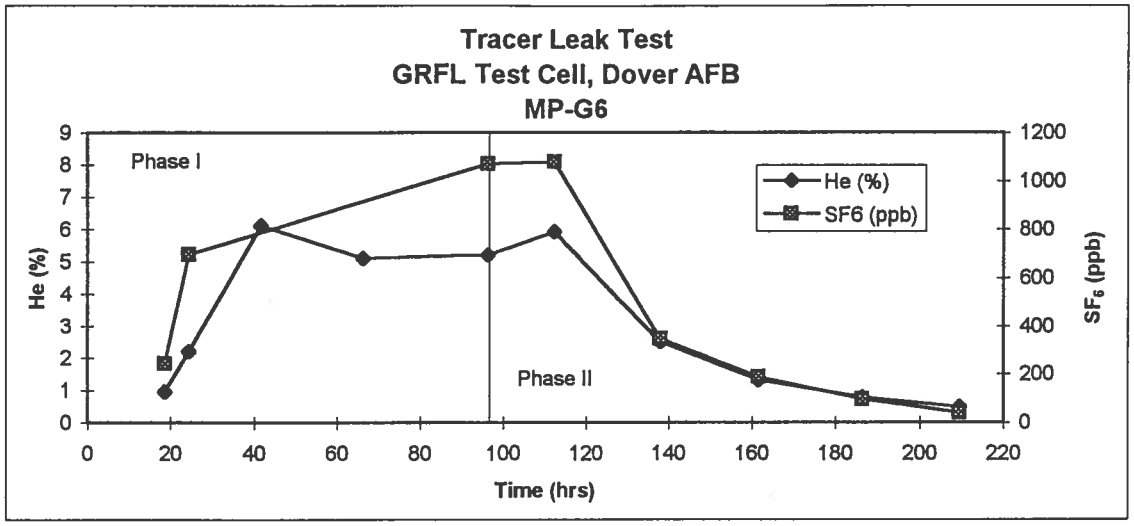

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-E10
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF6 (ppb)
Time (hrs)

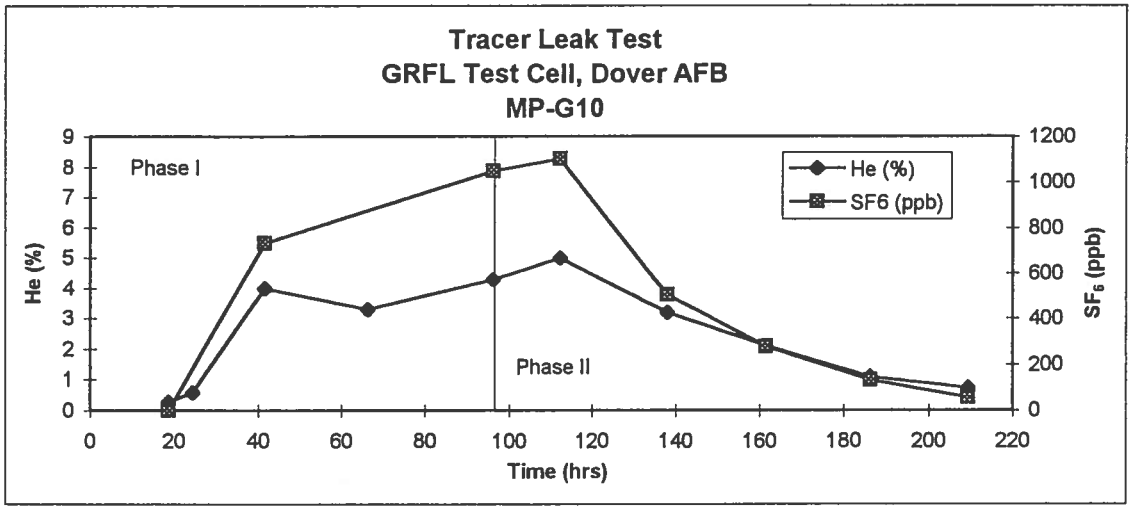

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-E14
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF6 (ppb)
Time (hrs)

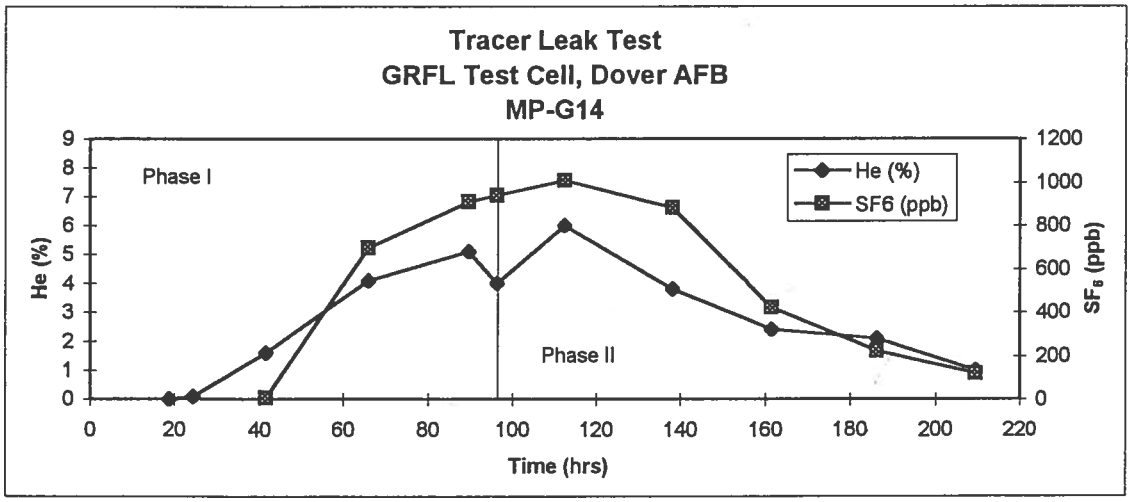

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-F6
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF6 (ppb)
Time (hrs)

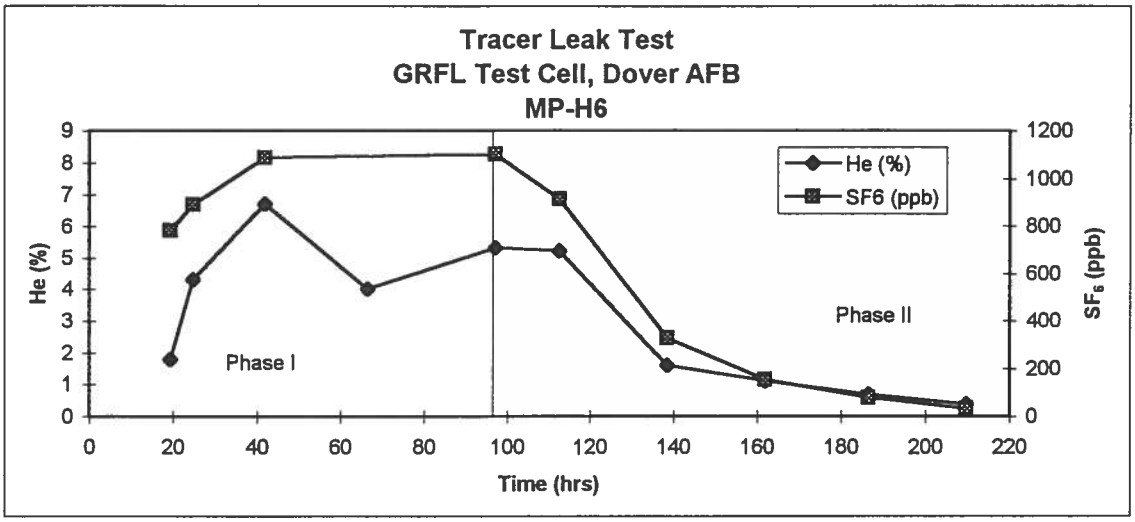

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-F10
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF6 (ppb)
Time (hrs)

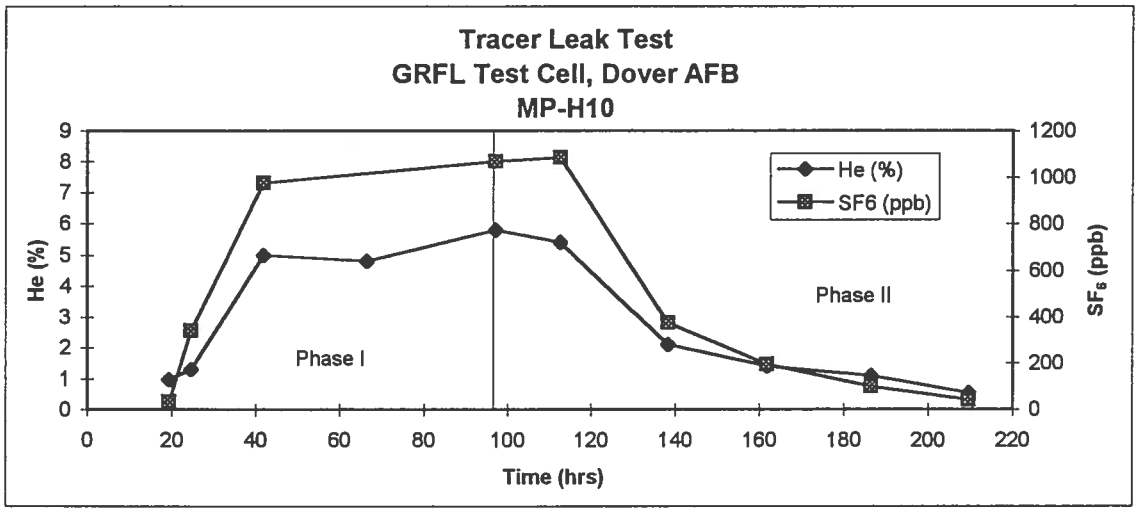

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-F14
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF6 (ppb)
Time (hrs)

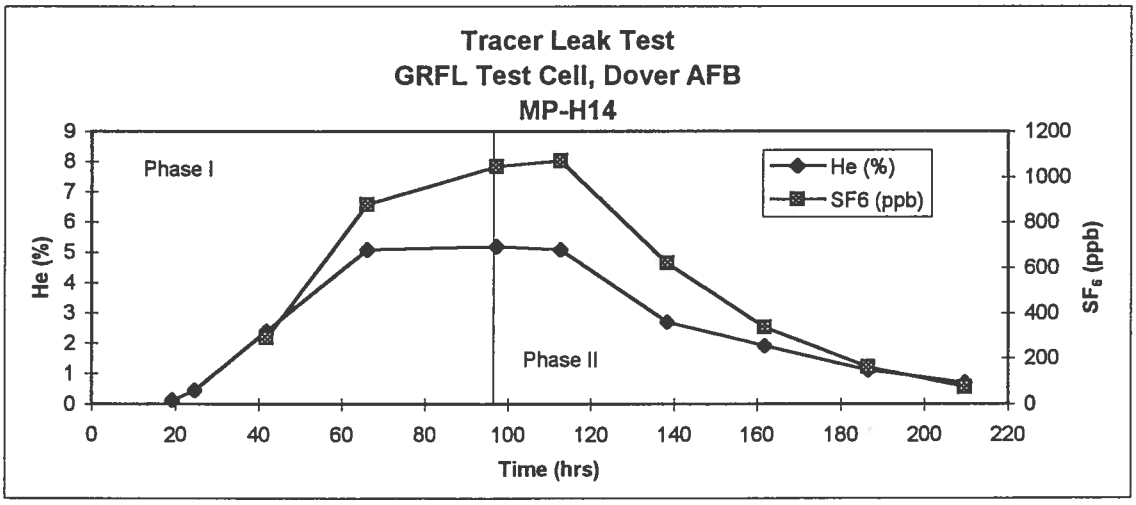

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-G6
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF6 (ppb)
Time (hrs)

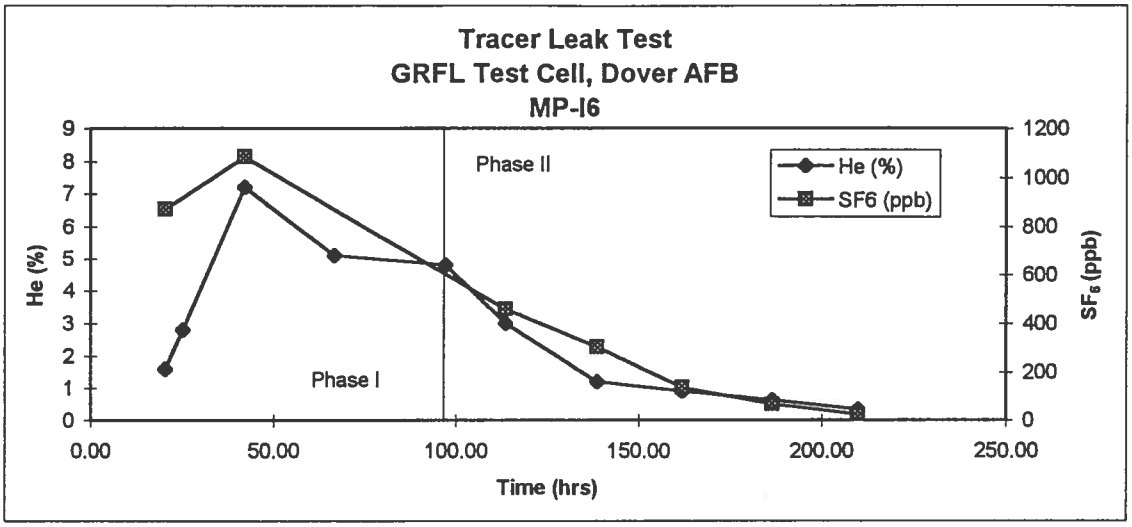

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-G10
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF6 (ppb)
Time (hrs)

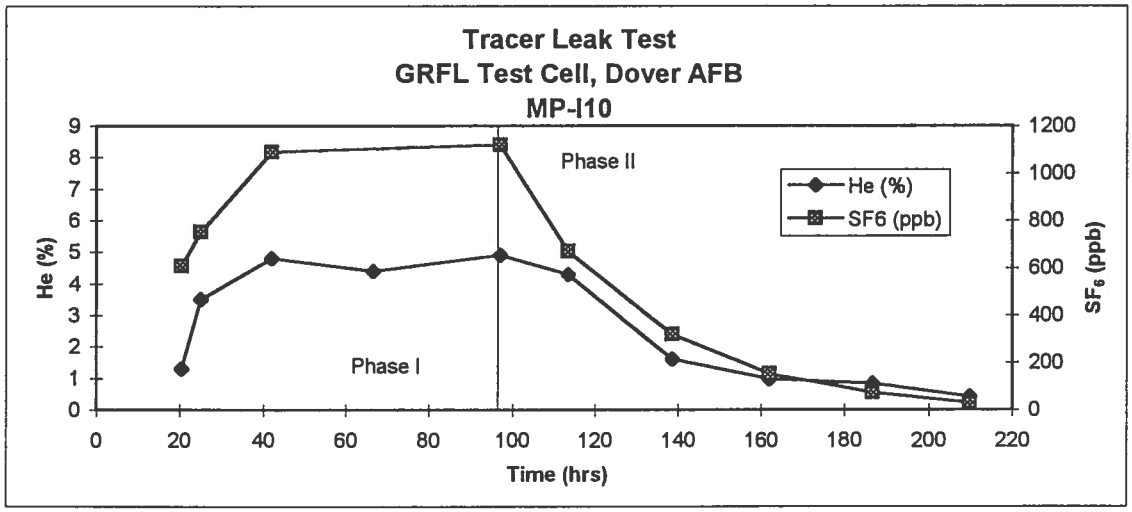

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-G14
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF6 (ppb)
Time (hrs)

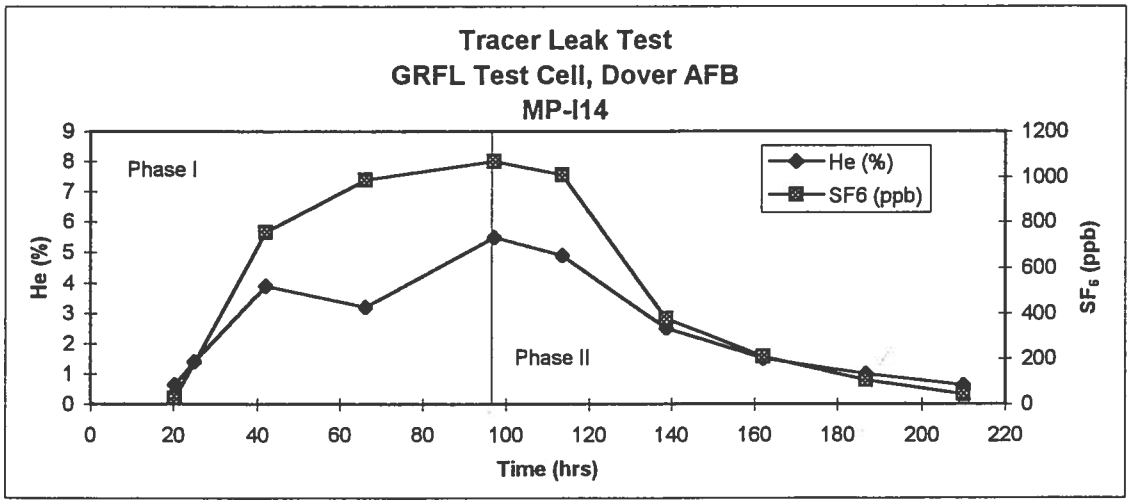

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-H6
He (%)
SF6 (ppb)
Phase I
Phase II
He (%)
SF6 (ppb)
Time (hrs)

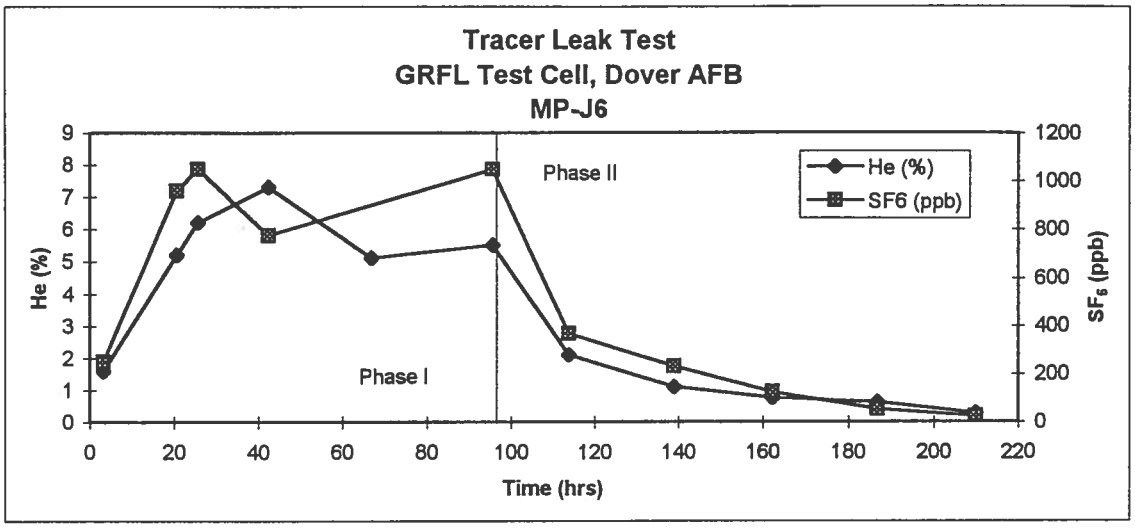

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-H10
He (%)
SF6 (ppb)
Phase I
Phase II
He (%)
SF6 (ppb)
Time (hrs)


Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-H14
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF6 (ppb)
Time (hrs)


Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-I6
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF_6 (ppb)
Time (hrs)
0.00
50.00
100.00
150.00
200.00
250.00


Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-I10
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF_6 (ppb)
Time (hrs)


Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-I14
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF_6 (ppb)
Time (hrs)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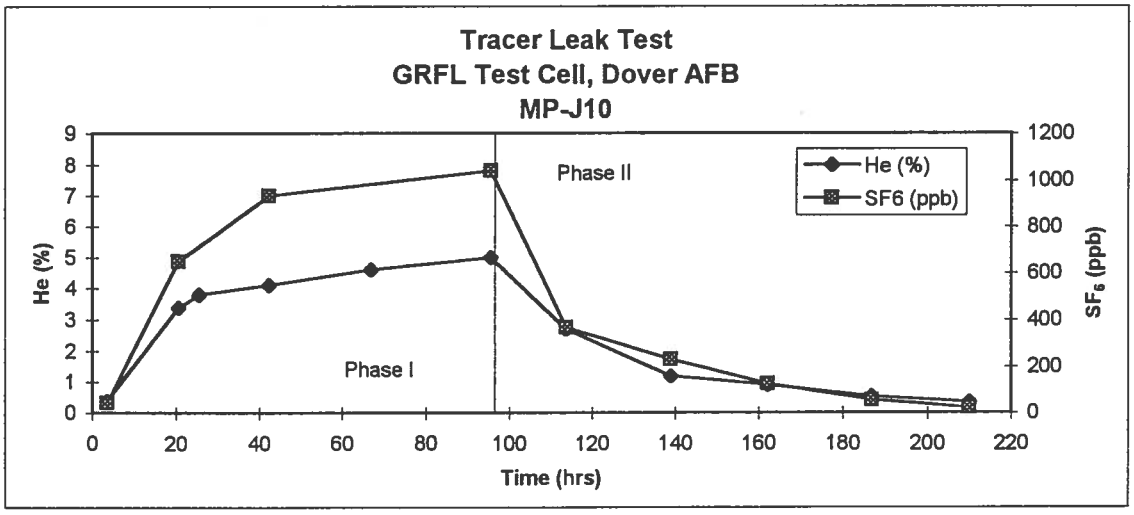
GRFL Test Cell, Dover AFB
MP-J6
He (%)
SF6 (ppb)
Phase I
Phase II
Time (hrs)
SF6 (ppb)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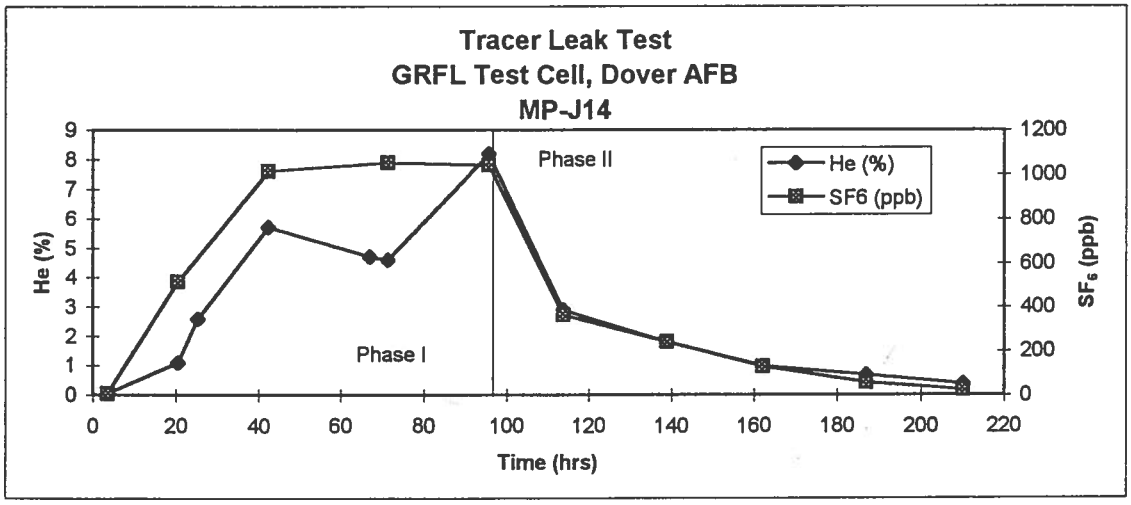
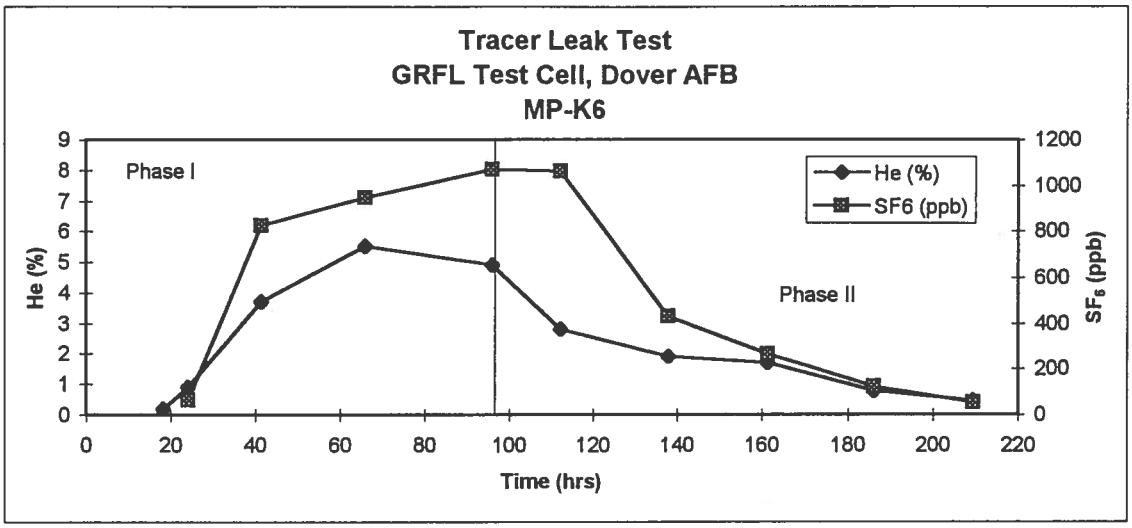
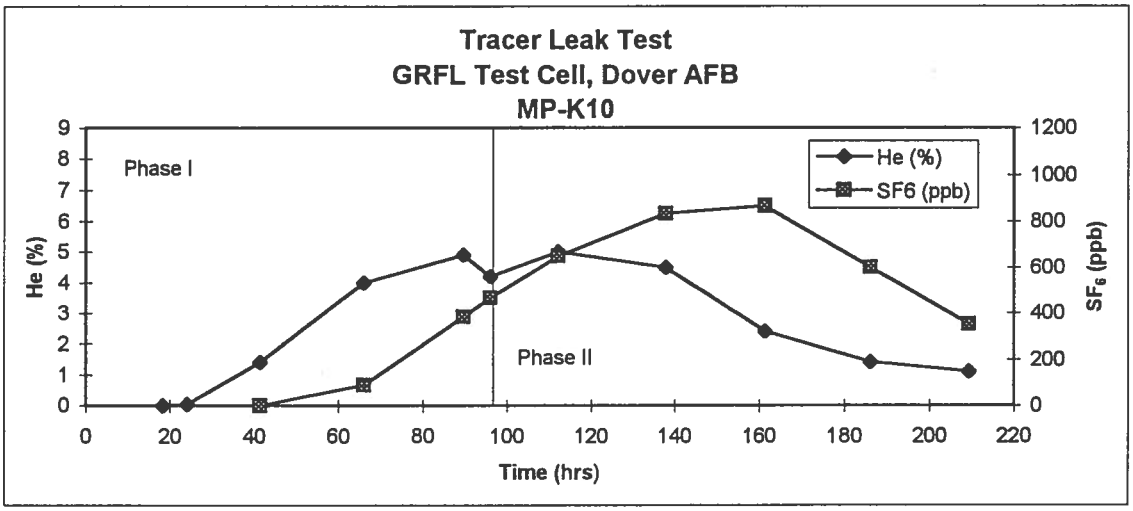
GRFL Test Cell, Dover AFB
MP-J10
He (%)
SF6 (ppb)
Phase I
Phase II
Time (hrs)
SF6 (ppb)


Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-J14
He (%)
SF6 (ppb)
Phase I
Phase II
Time (hrs)
SF6 (ppb)


Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-K6
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF6 (ppb)
Time (hrs)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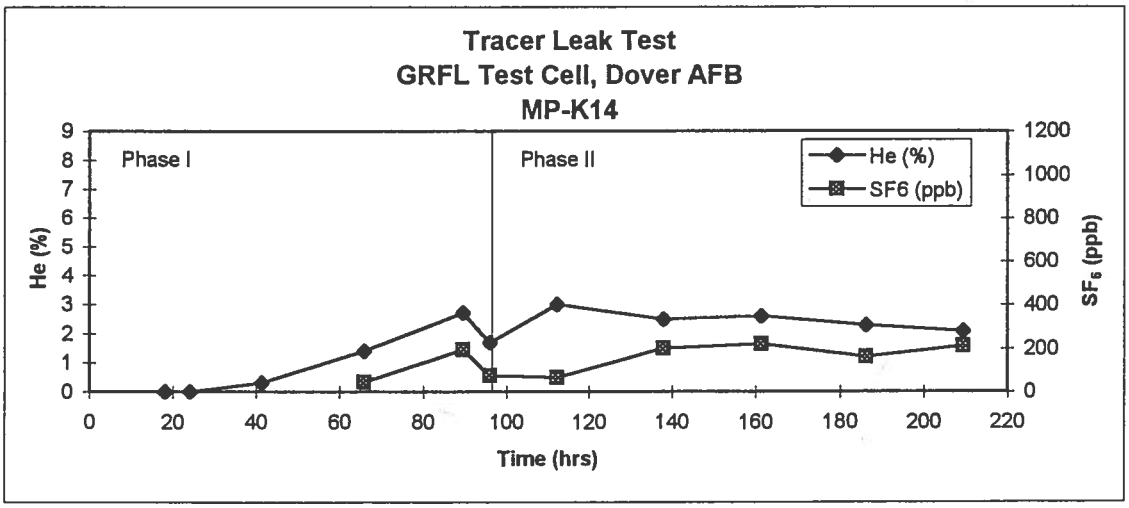
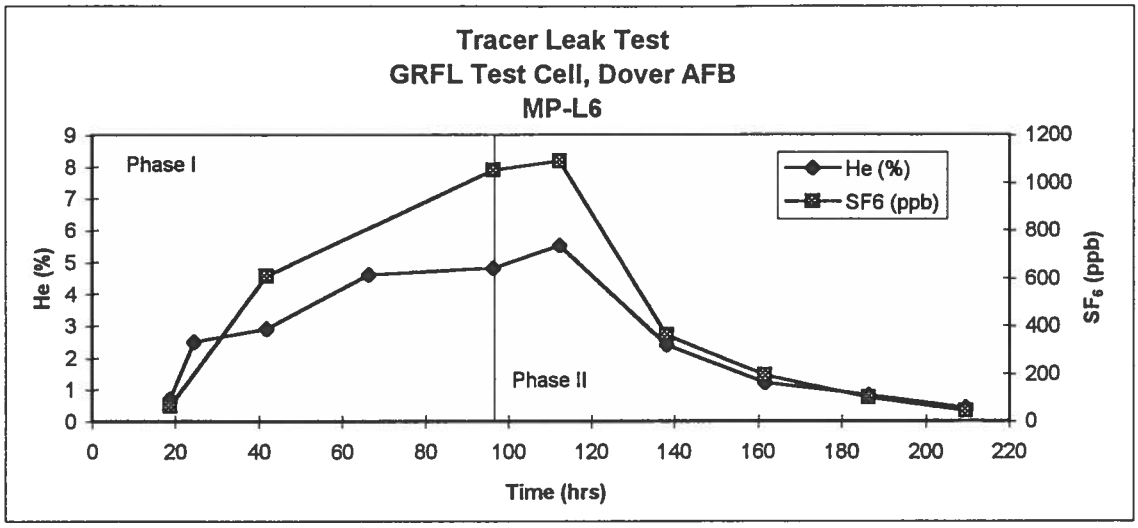
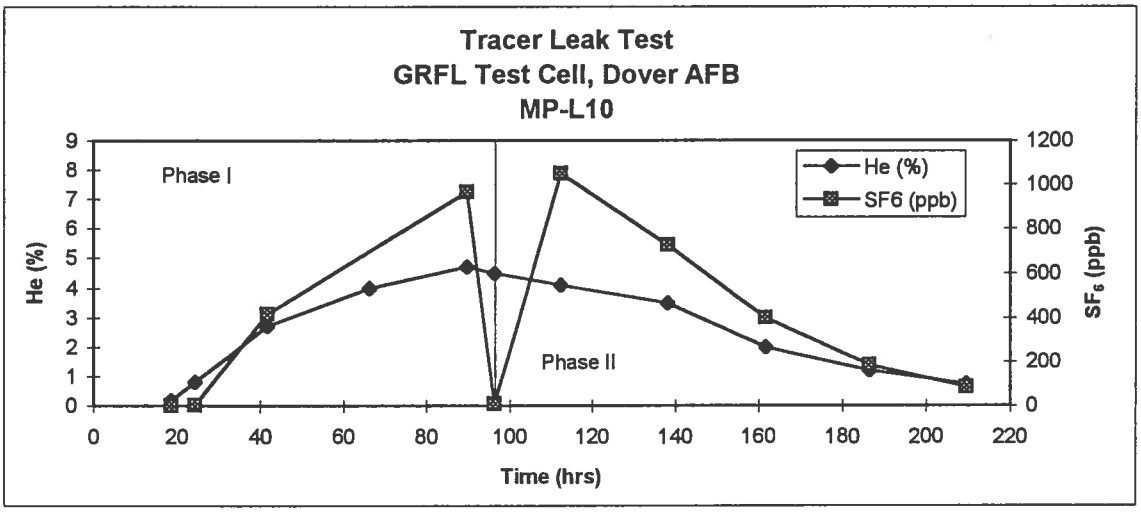
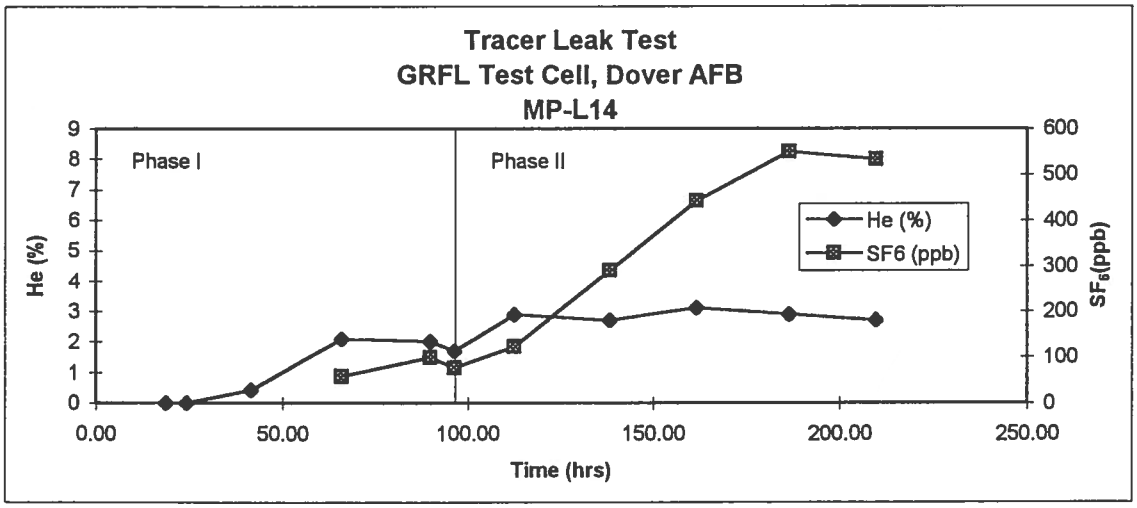
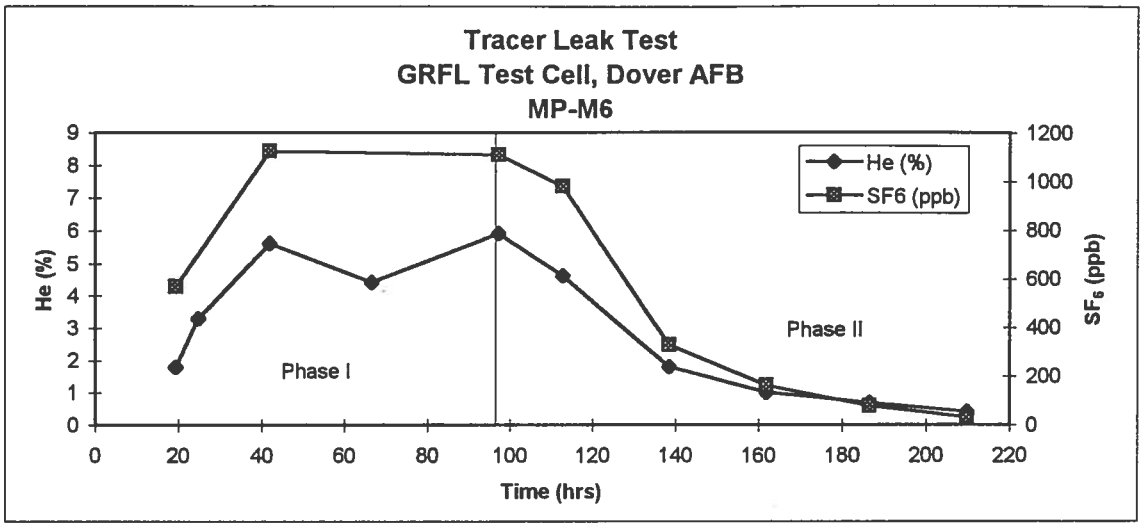
GRFL Test Cell, Dover AFB
MP-K10
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF6 (ppb)
Time (hrs)

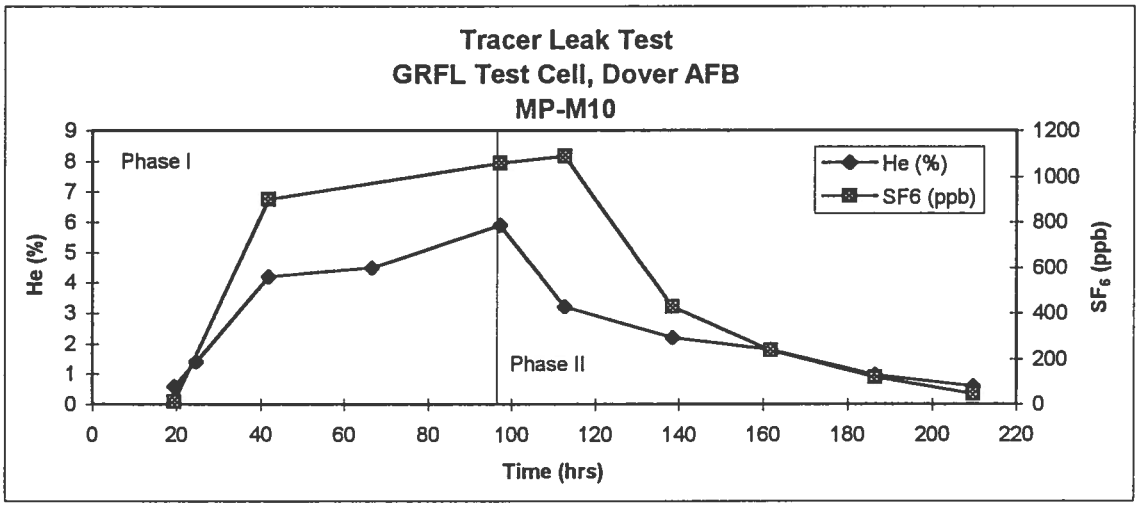

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-K14
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF6 (ppb)
Time (hrs)

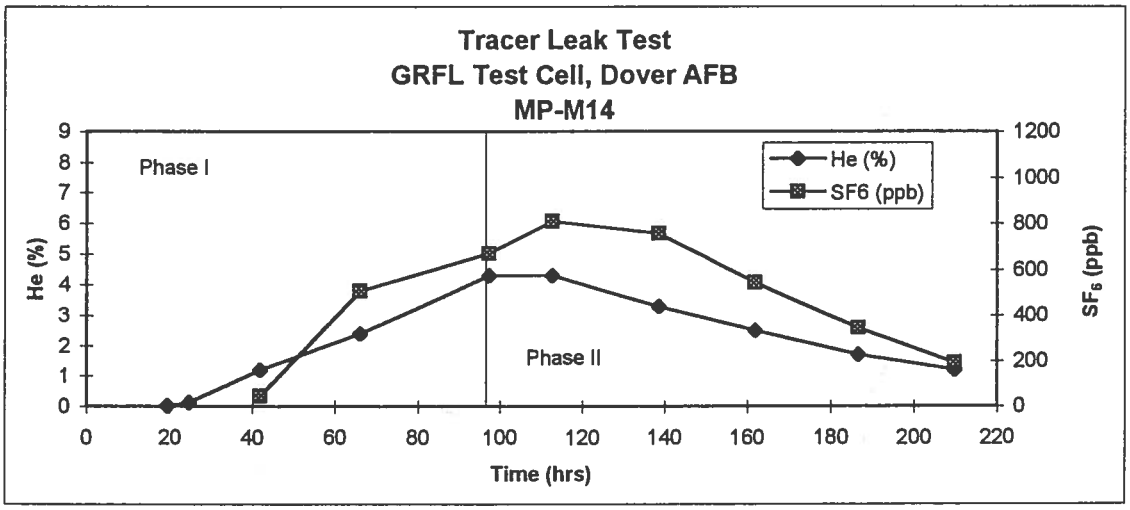

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-L6
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF_6 (ppb)
Time (hrs)

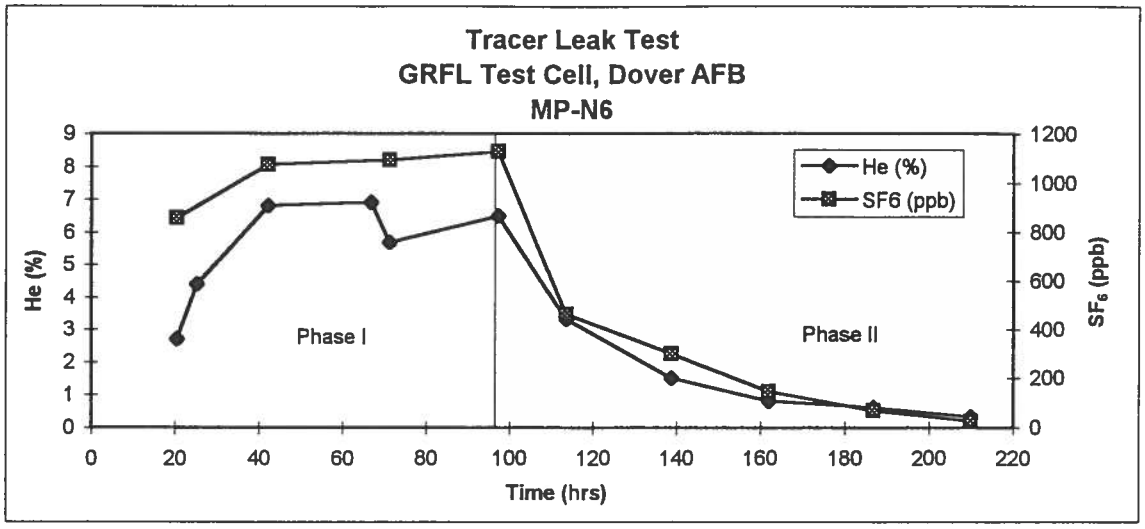

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-L10
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF_6 (ppb)
Time (hrs)

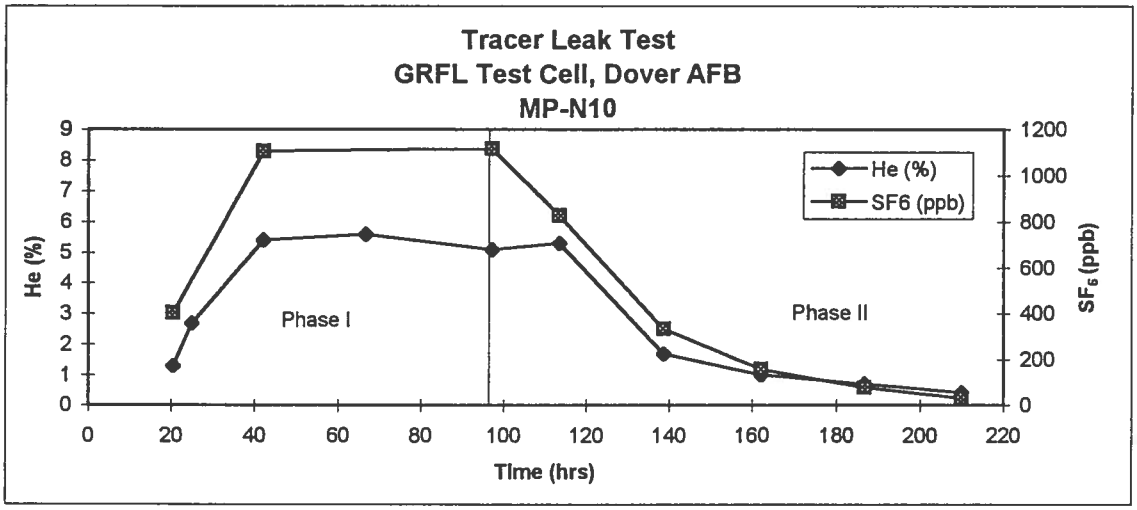

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-L14
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF_6(ppb)
Time (hrs)

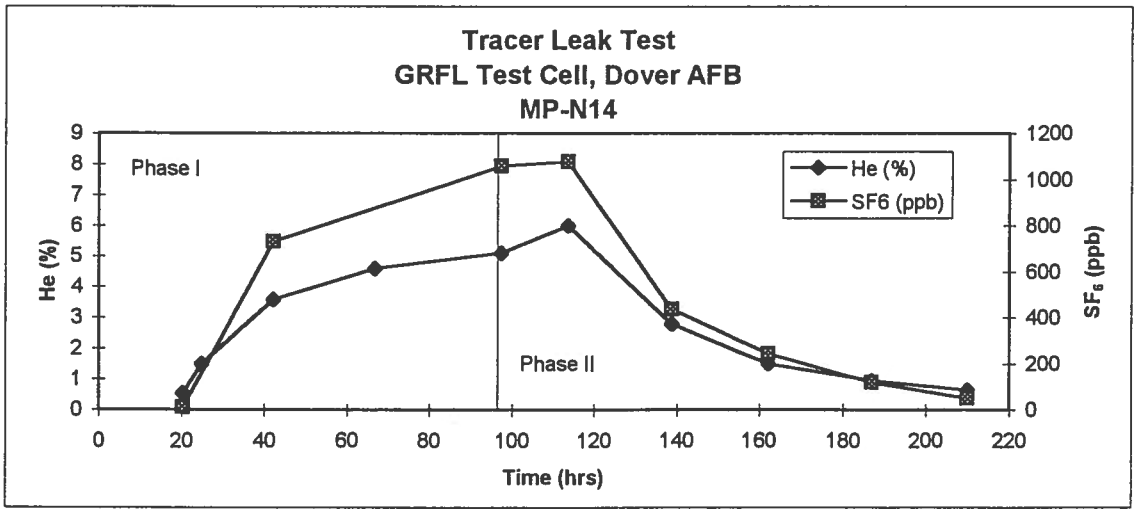

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-M6
He (%)
SF6 (ppb)
Phase I
Phase II
He (%)
SF6 (ppb)
Time (hrs)

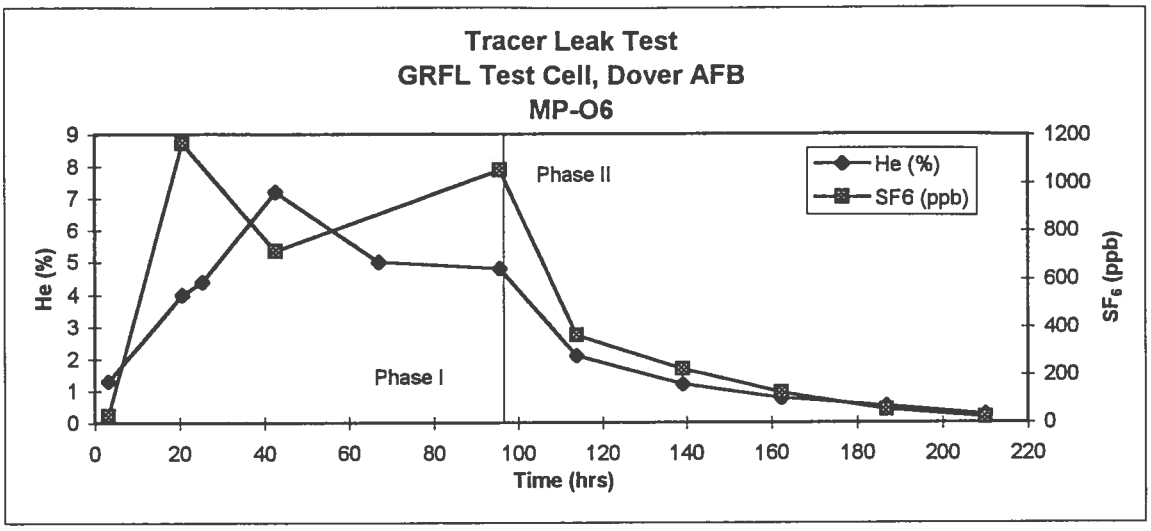

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-M10
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF6 (ppb)
Time (hrs)

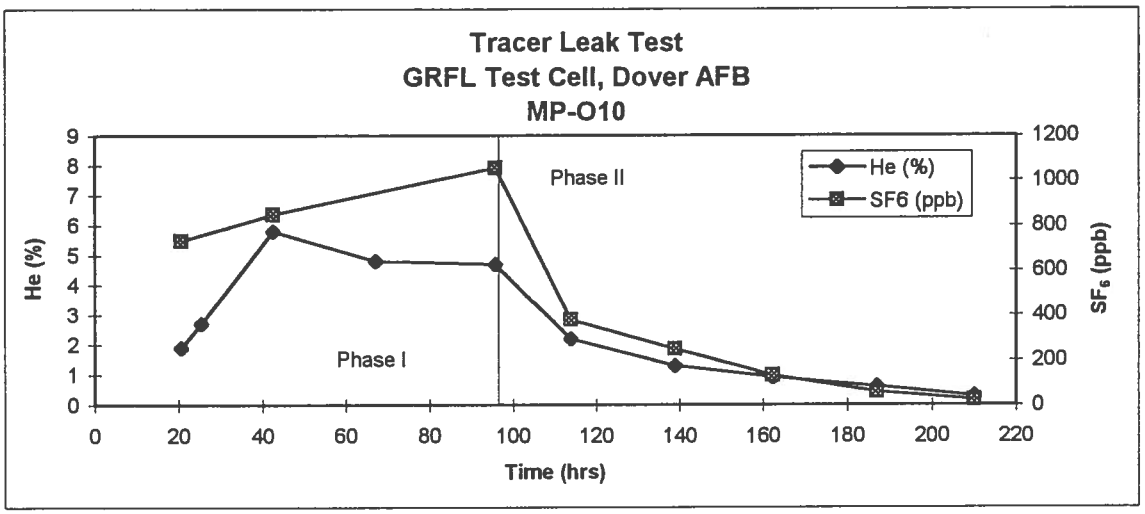

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-M14
Phase I
Phase II
He (%)
SF6 (ppb)
He (%)
SF6 (ppb)
Time (hrs)

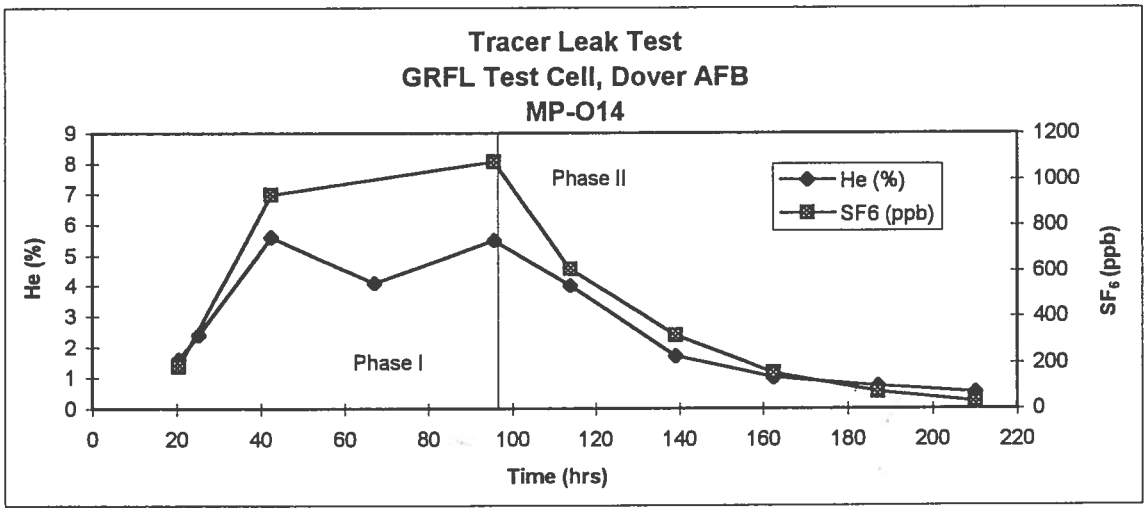

Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-N6
He (%)
SF6 (ppb)
Phase I
Phase II
He (%)
SF6 (ppb)
Time (hrs)


Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-N10
He (%)
SF6 (ppb)
Phase I
Phase II
He (%)
SF6 (ppb)
Time (hrs)


Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-N14
Phase I
He (%)
SF6 (ppb)
Phase II
He (%)
SF6 (ppb)
Time (hrs)


Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-O6
He (%)
SF6 (ppb)
Phase I
Phase II
Time (hrs)
SF6 (ppb)


Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-O10
He (%)
SF6 (ppb)
Phase I
Phase II
Time (hrs)
SF6 (ppb)


Tracer Leak Test
GRFL Test Cell, Dover AFB
MP-O14
He (%)
SF6 (ppb)
Phase I
Phase II
Time (hrs)
SF6 (ppb)