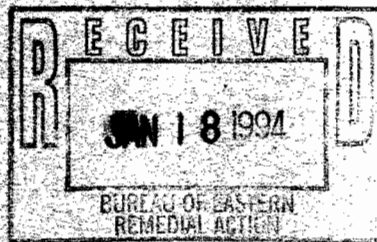


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**INTERIM REMEDIAL MEASURE
PILOT TEST REPORT
GRUMMAN AEROSPACE
BETHPAGE, NEW YORK**



January 1993

Prepared for

**Grumman Aerospace Corporation
Bethpage, New York**

Prepared by

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**INTERIM REMEDIAL MEASURE
PILOT TEST REPORT
GRUMMAN AEROSPACE CORPORATION
BETHPAGE, NEW YORK**

January 17, 1994

GMCE of New York, P.C. is submitting this report to the Grumman Aerospace corporation on the pilot test performed at the Grumman Aerospace corporation plant at Bethpage, New York. The report was prepared in conformance with GMCE's strict quality assurance/quality control procedures to ensure that the pilot test report meets industry standards in terms of the methods used and the information presented. If you have any questions or comments concerning the pilot test report, please contact one of the individuals listed below.

Respectfully submitted,

GMCE OF NEW YORK, P.C.



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Principal Engineer

CSG/RCM/AJB:MDR

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INTRODUCTION

Geraghty & Miller Consulting Engineers New York, P.C. (Geraghty & Miller) has in accordance with the New York State Department of Environmental Conservation (NYSDEC) approved work plan "Interim Remedial Measure, Pilot Test Work Plan, Grumman Aerospace Corporation, Bethpage, New York" dated September 1, 1993, as approved by the NYSDEC in their letter dated September 21, 1993 (Appendix A), conducted a pilot test for an Interim Remedial Measure (IRM) at the Grumman Aerospace facility in Bethpage, New York. A Remedial Investigation/Feasibility Study (RI/FS) is underway at the site, with Phase II of the RI recently being completed.

Soil-gas and soil sampling results generated during Phase I of the RI indicated that an aboveground trichloroethylene (TCE) storage tank near Plant 2 may be a source of contamination to the soil and the groundwater. In Phase II, additional sampling was conducted, including the collection of soil samples from a boring and the installation and sampling of a groundwater monitoring well. The results of the Phase II sampling indicated that soil near the tank had been impacted; the highest concentrations of TCE were detected in the sample from 8 to 10 feet below land surface. The results of the analysis of the groundwater sample indicated that groundwater has also been impacted, but to a lesser extent than the soil.

Because of the TCE concentrations detected in soil and the possibility for groundwater to be impacted to a greater extent in the future, Grumman has decided to undertake an IRM to mitigate the soil contamination. Groundwater contamination at this location and site-wide will be addressed as part of the overall remedy for the facility.

The IRM will be soil vapor extraction (SVE), which will be used to remove the contaminants from the soil. In its simplest form, SVE consists of applying a vacuum to an extraction well installed into the contaminated zone. Because TCE is relatively volatile, it will migrate with the extracted soil gases to the extraction well. The soil gases and vapors can then be treated to state standards (Air Guide 1) before they are discharged to the atmosphere.

The pilot test was performed to generate sufficient data to design the final SVE system. The pilot test consisted of applying different levels of vacuum to the extraction well and monitoring changes in performance parameters in the extraction and monitoring wells.

BACKGROUND

In Phase I of the RI, soil-gas samples were taken at several locations around the TCE tank. The locations of these samples are shown on Figure 1, and the results are provided in Table 1. Three soil samples were also taken during Phase I, one from each of three borings, labelled B-1, B-2, and B-3. These samples were taken at three different locations around the tank, at depths of 0 to 2.5, 2 to 4, and 8 to 10 feet below land surface, and analyzed for volatile organic compounds (VOCs). The boring locations are shown on Figure 1 and the sample results are in Table 2.

To determine if this area was a source of TCE that would require localized remediation, a boring (B-5) was drilled to 10 feet below the water table during Phase II. This boring was then completed as a monitoring well (Well GM-32S). Three soil samples were collected during the drilling of B-5 and submitted for laboratory analysis for VOCs. The samples were selected based on analyses of the headspace in the soil samples using a portable gas chromatograph (GC). After the installation and development of Well GM-32S, a groundwater sample was collected and submitted to the laboratory for VOC analysis. The location of B-5/GM-32S is shown on Figure 1, and the analytical results of the soil and groundwater samples are in Table 3.

As indicated in Table 3, the soil, particularly the sample from the 8- to 10-foot interval, which contained 1,200,000 micrograms per kilogram (ug/kg) of TCE, has been impacted. TCE was also detected at 640 ug/kg in the 18- to 20-foot interval and in the groundwater sample at 140 micrograms per liter (ug/L). However, although this area has been shown to be a TCE source, most of the TCE has been detected at depths that are less than 20 feet.

REMEDIAL APPROACH

Grumman has decided to undertake an IRM to mitigate the soil contamination associated with the TCE tank because it will serve as an ongoing source of groundwater contamination and will, therefore, be counterproductive to the overall groundwater remedy for the site. Soil vapor extraction was selected as the remedial technology for this area because of the favorable hydraulic properties of the formation (i.e., relatively high permeability) and the relatively localized distribution of contaminants. Prior to the design of the final SVE system, a pilot test was conducted to determine the optimal operating parameters.

METHODOLOGY

This section describes the methodology that was employed to conduct the SVE pilot test. The parameters collected during the pilot test will be used to design the final SVE system.

INSTALLATION OF SOIL VAPOR EXTRACTION WELL SVE-1

The Soil Vapor Extraction Well SVE-1 was installed in accordance with the NYSDEC approved workplan at the location shown on Figure 2. The well was installed using the hollow stem-auger drilling technique. A 10.5-inch borehole was advanced and split-spoon samples were collected at 5-foot intervals. The soil samples were screened with a photoionization detector (PID) and geologically logged by a Geraghty & Miller engineer. This data is recorded in Appendix B. In addition to the PID screening, samples were collected and analyzed with a portable gas chromatograph (GC) calibrated for trichloroethylene. The GC analytical data is given on Table 4.

The boring was terminated at a depth of 45 feet below land surface (bls) due to the detection of groundwater at 43 feet bls. The borehole was backfilled with clean silica sand to a height of 39 feet bls where the base of the soil vapor extraction well (SVE-1) was set.

The soil vapor extraction well was constructed of 5-foot sections of 4-inch diameter, schedule 40 PVC well screen (0.020-inch slot) alternating with 5-foot section of 4-inch diameter schedule 40 PVC casing. The upper 5 feet of the well was casing. The annulus around the well was filled to within 4 feet of land surface with a clean silica sand. Three feet of bentonite topped by a 1-foot concrete collar sealed the soil vapor extraction well at the surface. A well construction log for the soil vapor extraction well SVE-1 is given in Appendix B.

INSTALLATION OF SOIL VAPOR EXTRACTION MONITORING WELLS

Six soil vapor extraction monitoring wells were installed at the locations shown on Figure 2. Monitoring Wells MP-1 through MP-5 were constructed of 1.25-inch diameter schedule 40 PVC well screen (0.020-inch slot) and casing, installed in a 4.25-inch borehole in accordance with the NYSDEC approved workplan. The hollow-stem auger drilling technique was used for the installation. The annulus around the well was filled with clean silica sand to a height of 1 foot above the top of the screen. A 2-foot bentonite seal was emplaced above the silica sand to seal the well to the surface. The remainder of the annulus was backfilled with drill cuttings to a height of 1 foot bls where a 1-foot concrete collar was installed. The wells were completed at the surface with a 1.25-inch schedule 40 PVC cap.

Monitoring Well MP-6 had to be driven with a tripod due to the lack of access between the TCE tank and Plant 2. The well consisted of a 1.25-inch stainless steel drive point (0.020-inch slot) 5 feet in length coupled to a 1.25-inch schedule 40 black steel riser. The well was driven into the ground with a 140 pound tripod mounted slide hammer. The well was completed with a 1.25-inch schedule 40 PVC cap.

Monitoring wells MP-1, MP-3, and MP-5 were situated in a triangular pattern around the soil vapor extraction well at a distance of approximately 10 feet. Monitoring wells MP-2 and MP-4 were installed approximately 20 feet from the extraction well, and MP-6 was installed approximately 15 feet from the extraction well. The screen settings and construction details for each monitoring well are given in Appendix B.

EQUIPMENT CONFIGURATION

The equipment configuration used during the soil vapor extraction pilot test is shown on Figure 3. A 10-foot section of 4-inch diameter schedule 40 PVC pipe was coupled at one end to the soil vapor extraction well and at the other end to the influent port of an EG&G Rotron, 2-horsepower regenerative blower (model DR 505); a magnehelic gauge was connected to the soil vapor extraction well head to measure induced vacuum. An 1/8-inch double walled stainless steel pitot tube (Dwyer Instruments) was installed 6 feet from the soil vapor extraction wellhead on the influent line and connected to a magnehelic gauge to measure the extracted soil gas flow rate. A dilution valve was also installed on the influent line after the pitot tube to regulate the applied vacuum and to dilute the contaminated process stream. The blower's effluent port was connected to two 200-pound vapor phase carbon canisters (Carbtrol model G-2). Sample ports were installed prior to, between, and after the carbon canisters.

PILOT TEST METHODOLOGY

The approved Pilot Test Work Plan submitted by Geraghty & Miller indicated that the Pilot Test would be conducted in a series of four steps. These steps included applying a vacuum of 5, 10, 15, and 20 inches of water column (in.w.c.) to the soil vapor extraction wellhead and monitoring operational parameters. However, it was determined after the blower was activated on the day of the pilot test that the formation does not require such high vacuums to induce air flow. With the dilution valve completely closed, the maximum vacuum achievable was 3 in.w.c. For this reason the procedures specified in the work plan were reviewed and the pilot test was run with NYSDEC approval in three steps (1, 2, and 3 in.w.c.) of vacuum applied to the soil vapor extraction wellhead in order to induce air flow.

The blower and ancillary piping were connected to the soil vapor extraction well (SVE-1). The blower was activated and the dilution valve was adjusted to deliver a vacuum of 1 in.w.c. to the well head. The soil vapor extraction well was allowed to develop for a period of 1 hour when the following parameters were recorded:

- Vacuum at the soil vapor extraction wellhead.
- Differential pressure at the Pitot Tube (data used to calculate the extracted soil gas flow rate).
- Induced vacuum influence at the surrounding monitoring wells.
- Total volatile organic compound (VOC) concentration, percent Oxygen, and percent lower explosive limit (LEL) measured from the sample ports prior to, between, and after the carbon canisters.

The first step of the pilot test lasted for a duration of 2 hours with the operational parameters being recorded every hour. The second and third step of the test followed the same procedure described above. However, the dilution valve was adjusted to deliver a vacuum to the wellhead of 2 in.w.c. (step 2) and 3 in.w.c. (step 3). Samples for laboratory analysis at VOCs were collected from the sample port prior to the treatment system at the end of each step of the test.

SOIL VAPOR EXTRACTION PILOT TEST DATA REVIEW AND EVALUATION

This section presents the review and discussion of the pilot test results.

AIR FLOW RATES VERSUS WELLHEAD VACUUM

The air flow rates achieved during the test at different levels of vacuum were calculated based on pitot tube measurements and on comparison between the VOCs measured at the sample port prior to treatment with the dilution valve fully closed and the vapor concentrations measured with the dilution valve adjusted to a certain vacuum at the wellhead. For example, the air flow rate from step 3 (3 in.w.c.) with the dilution valve fully closed, was 149 cubic feet per minute (cfm) (based on the Pitot tube readings). A reduction in the extracted soil gas flow rate from the Soil Vapor Extraction Well SVE-1 resulted in a subsequent reduction in the vapor concentrations. The field data and the calculated soil gas flow rates for each of the 3 tests are shown on Table 5.

INDUCED VACUUM INFLUENCE

The induced vacuum influence at 1 in.w.c. was 0.21 in.w.c. at Monitoring Wells MP-2 and 0.185 in.w.c. at MP-4, which were located approximately 20 feet from the wellhead. Monitoring Wells MP-1, MP-3 and MP-5, located approximately 10 feet from the wellhead, exhibited vacuum influence of 0.23, 0.29 and 0.22 in.w.c. respectively. Well MP-6, which was located 15 feet from the wellhead, did not exhibit vacuum influence. The areal anisotropy of Well MP-6 noted for each test is probably the result of the method of installation, as previously discussed.

The induced vacuum influence at 2 and 3 in.w.c. applied to the soil vapor extraction wellhead are shown on Table 5.

The induced vacuum influence in the monitoring wells generally increased with increases in the applied vacuum to the soil vapor extraction wellhead. Vacuum influence is an indication that air flow is present at the monitoring location. Lines of approximately equal vacuum influence for the three tests are shown on Figure 4. The vacuum influence measurement data from Well MP-6 appears to have been effected by the method of installation as previously discussed and therefore is not used to establish the lines of approximately equal vacuum influence as shown on Figure 4. An analysis of the data indicates a radius of influence of approximately 40 feet from SVE-1. This may be effected by the building foundations associated with Plant #2 on the south and east side of the TCE tank.

CHEMICAL COMPOSITION OF SOIL GAS

Three soil-gas samples were collected from the blower discharge prior to carbon treatment at the end of each test. The samples were submitted to Microseeps, Ltd. of Pittsburgh, Pennsylvania for laboratory analysis. The analysis performed was Microseeps Analytical Method AM4.01. Analytical Method AM4.01 is a modification of USEPA Method

3810 (Headspace) and 8000 (Gas Chromatography). Modifications implemented are to accommodate the gas phase sample type only. The samples collected were analyzed for 30 specific compounds (624 scan). The compounds included in the 624 scan are given in Appendix C.

The analytical results indicate that TCE was the VOC present in the highest concentrations in the three samples collected. In Test 1, (1 in.w.c.) TCE was detected at a concentration of 45.334 parts per million by volume (PPMV). In Test 2 (2 in..w.c.) TCE was detected at a concentration of 66.19 PPMV. In Test 3 (3 in.w.c.) TCE was detected at a concentration of 76.236 PPMV. The analytical data is given on Table 6.

TCE concentrations in the extracted soil gas increased with an increase in the applied wellhead vacuum. As described in the induced vacuum influence section, as the applied wellhead vacuum was increased (higher air flow rates), the induced vacuum influence also increased (more air flow in areas remote from the extraction well).

CONCLUSIONS

Based on the results of the vacuum extraction pilot test performed at Grumman Aerospace Corporation, located in Bethpage, New York, by Geraghty & Miller, the following conclusions can be made:

- The response of the formation to the application of vacuum can be characterized as exhibiting low vacuum/high flow conditions;
- The vacuum influence was induced within a relatively large area around the Soil Vapor Extraction Well SVE-1 during each test. The estimated radius of influence based on the monitoring data is approximately 40 feet;

- The monitoring data and laboratory sample analysis indicate that the existing contaminants can be extracted from the subsurface using the technology of soil vapor extraction.

RECOMMENDATIONS

The results of the pilot test indicate that the use of SVE is an appropriate IRM for remediation of the area around the aboveground TCE storage tank near Plant 2. Geraghty & Miller recommends the installation of a SVE system utilizing the SVE extraction well and monitoring points installed for the pilot system. Additional monitoring wells may be required to monitor the performance of the system. The system would consist of a small building containing a regenerative blower and appropriate off-gas treatment. A source of power is readily available at the site. Weekly monitoring will be required to ensure the system is operating properly.

Table 1. Results of Soil-Gas Survey by Plant 2, Phase I Remedial Investigation, Grumman Aerospace Corporation, Bethpage, New York.

Sample Identification	Date Sampled	Vinyl chloride (ppmv)	trans-1,2-Dichloroethene (ppmv)	cis-1,2-Dichloroethene (ppmv)	Trichloroethene (ppmv)	Tetrachloroethene (ppmv)	Total VOCs (ppmv)
SG-4A	4/29/91	<0.9	<0.3	9	100	0.5	109.5
SG-4B	4/29/91	<0.9	<0.3	10	100	<0.2	110
SG-4C	4/29/91	<0.9	<0.3	5	100	<0.2	105
SG-4D	4/29/91	<0.9	<0.3	10	60	<0.2	70

ppmv Parts per million by volume.
 VOCs Volatile organic compounds.

All samples were analyzed using a portable gas chromatograph.

Table 2. Trichloroethene Detected in Soil Samples by Plant 2, Phase I Remedial Investigation, Grumman Aerospace Corporation, Bethpage, New York.

Parameter	Sample Designation:		Field Blank		Trip Blank	
	Sample Depth (feet bis):	Sample Date:	Field Blank	Field Blank	Trip Blank	Trip Blank
Chloromethane	B-1 8-10	6/20/91	B-2 2-4	8/25/92	8/25/92	8/25/92
Bromomethane	8-10	6/20/91	2-4	8/25/92	8/25/92	8/25/92
Vinyl chloride	8-10	6/20/91	2-4	8/25/92	8/25/92	8/25/92
Chloroethane	<10		<10			
Methylene chloride	<5		3 J			
Acetone	13		7 J			
Carbon disulfide	<5		<5			
1,1-Dichloroethene	<5		<5			
1,1-Dichloroethane	<5		<5			
1,2-Dichloroethene (total)	<5		5			
Chloroform	<5		<5			3 J
1,2-Dichloroethane	<5		<5			<10
2-Butanone	<10		<10			<10
1,1,1-Trichloroethane	<5		<5			<10
Carbon tetrachloride	<5		<5			<10
Vinyl acetate	<10		<10			<10
Bromodichloromethane	<5		<5			<10
1,2-Dichloropropane	<5		<5			<10
cis-1,3-Dichloropropene	<5		<5			<10
Trichloroethene	48		44			<10
Dibromochloromethane	<5		<5			<10
1,1,2-Trichloroethane	<5		<5			<10
Benzene	<5		<5			<10
trans-1,3-Dichloropropene	<5		<5			<10
Bromoform	<5		<5			<10
4-Methyl-2-pentanone	<10		<10			<10
2-Hexanone	<10		<10			<10
Tetrachloroethene	<5		<5			<10
1,1,2,2-Tetrachloroethane	<5		<5			<10
Toluene	<5		<5			<10
Chlorobenzene	<5		<5			<10
Ethylbenzene	<5		<5			<10
Styrene	<5		<5			<10
Xylene (total)	<5		<5			<10
Total VOCs:	61		59		0	3

ug/kg Micrograms per kilogram.
 ug/L Micrograms per liter.
 VOCs Volatile organic compounds.
 IEA Industrial Environmental Analysts, Monroe, Connecticut.
 J Estimated value.
 bis Below land surface.
 B-1, B-2, B-3 Samples collected in shallow soil borings.

Table 3. Results of Soil Borings and Ground-Water Sampling by Plant 2, Phase II Remedial Investigation, Grumman Aerospace Corporation, Bethpage, New York.

Parameter	Sample Designation:		B-5 8/25/92 NET ug/kg	B-5 8-10 8/25/92 NET ug/kg	B-5 18-20 8/25/92 NET ug/kg	GM-32S 1/25/93 EcoTest ug/L	Field Blank 8/25/92 NET ug/L	Trip Blank 8/25/92 NET ug/L	Trip Blank 1/25/93 EcoTest ug/L
	Sample Depth (feet):	Sample Date:							
Chloromethane			<5500	<71000	<52	NA	<10	<10	NA
Bromomethane			<5500	<71000	<52	NA	<10	<10	NA
Vinyl chloride			<5500	<71000	<52	NA	<10	<10	NA
Chloroethane			<5500	<71000	<52	NA	<10	<10	NA
Methylene chloride			<5500	<71000	<52	NA	<10	<10	NA
Acetone			<5500	<71000	<52	NA	<10	<10	NA
Carbon disulfide			<5500	<71000	<52	NA	<10	<10	NA
1,1-Dichloroethane			<5500	<71000	<52	NA	<10	<10	NA
1,1-Dichloroethane			<5500	<71000	<52	NA	<10	<10	NA
1,2-Dichloroethane (total)			1300 J	<71000	<52	NA	<10	<10	NA
Chloroform			<5500	<71000	<52	NA	<10	<10	NA
1,2-Dichloroethane			<5500	<71000	<52	NA	<10	<10	NA
2-Butanone			R	R	<52	NA	<10	<10	NA
1,1,1-Trichloroethane			<5500	<71000	<52	NA	<10	<10	NA
Carbon tetrachloride			<5500	<71000	<52	NA	<10	<10	NA
Bromodichloromethane			<5500	<71000	<52	NA	<10	<10	NA
1,2-Dichloropropane			<5500	<71000	<52	NA	<10	<10	NA
cis-1,3-Dichloropropene			<5500	<71000	<52	NA	<10	<10	NA
Trichloroethene			36000	120000	640	140	<10	<10	<1
Dibromochloromethane			<5500	<71000	<52	NA	<10	<10	NA
1,1,2-Trichloroethane			<5500	<71000	<52	NA	<10	<10	NA
Benzene			<5500	<71000	<52	NA	<10	<10	NA
trans-1,3-Dichloropropene			<5500	<71000	<52	NA	<10	<10	NA
Bromoform			<5500	<71000	<52	NA	<10	<10	NA
4-Methyl-2-pentanone			<5500	<71000	<52	NA	<10	<10	NA
2-Hexanone			<5500	<71000	<52	NA	<10	<10	NA
Tetrachloroethene			<5500	<71000	<52	<1	<10	<10	<1
1,1,2,2-Tetrachloroethane			<5500	<71000	<52	NA	<10	<10	NA
Toluene			<5500	<71000	<52	NA	<10	<10	NA
Chlorobenzene			<5500	<71000	<52	NA	<10	<10	NA
Ethylbenzene			<5500	<71000	<52	NA	<10	<10	NA
Styrene			<5500	<71000	<52	NA	<10	<10	NA
Xylene (total)			<5500	<71000	<52	NA	<10	<10	NA
Total VOCs:			37300	1200000	640	140	0	3	0

ug/L Micrograms per liter.
 ug/kg Micrograms per kilogram.
 VOCs Volatile organic compounds.
 NET National Environmental Testing, Inc., Bedford, Massachusetts.
 EcoTest EcoTest Laboratories, Inc., North Babylon, New York.
 NA Not analyzed.
 J Estimated value.
 R Unusable value.
 B-5 Soil sample.
 GM- Ground-water sample.

Table 4. Gas Chromatograph Analytical Data Collected From Boring SVE-1,
November 2, 1993, Grumman Aerospace Corporation, Bethpage, New York.

SAMPLE CORE ID:	SAMPLE CORE DEPTH (FEET BELOW LAND SURFACE)	TCE CONCENTRATION (PPMV)
SVE 1-1	5	130
SVE 1-2	10	160
SVE 1-3	15	110
SVE 1-4	22	670
SVE 1-5	25	130
SVE 1-7	35	26
SVE 1-8	40	< 6
SVE 1-9	45	67

TCE - Trichloroethylene

Table 5. Pilot Test Data Collected on November 1, 1993, Grumman Aerospace, Bethpage, New York.

Elapsed Time (Min.)	Applied Suction To SVE-1 (in.w.c.)	Extracted Soil Gas Flow Rate (CFM)	Influent Process Stream Concentrations			Post Carbon Drum #1 Concentrations			Carbon Effluent Concentrations			Induced Vacuum Influence (in.w.c.)									
			PID (PPMV)	LEL (%)	O2 (%)	PID (PPMV)	LEL (%)	O2 (%)	PID (PPMV)	LEL (%)	O2 (%)	MP-1	MP-2	MP-3	MP-4	MP-5	MP-6				
STEP #1																					
5	1	89	70	0	20.5	0	0	21	0	21	0	0	0	0	0	0	0				
60	1	107	140	1	20.5	0	0	20.5	0	20.5	0	0	0	20.5	0.2	0.12	0.27	0.17	0.24	0.0	
120*	1	117	148	1	20.5	0	0	20.5	0	20.5	0	0	0	20.5	0.23	0.21	0.29	0.185	0.22	0.015	0.0
STEP #2																					
60	2	121	144	1	20.5	0	0	20.5	0	20.5	0	0	0	20.5	0.36	0.30	0.50	0.28	0.40	0.08	
120*	2	126	160	1	20.5	0	0	20.5	0	20.5	0	0	0	20.5	0.36	0.30	0.46	0.32	0.36	0.07	
STEP #3																					
60	3	144	180	2	20.5	0	0	20.5	0	20.5	0	0	0	20.5	0.45	0.45	0.58	0.40	0.50	0.04	
120*	3	149	180	2	20.5	0	0	20.5	0	20.5	0	0	0	20.5	0.45	0.38	0.68	0.41	0.50	0.06	

* Laboratory samples collected at this time interval.

in.w.c.

Inches of water column.

PPMV Parts per million by volume.

PID Photo Ionization Dectector

LEL Percent of the lower explosive limit.

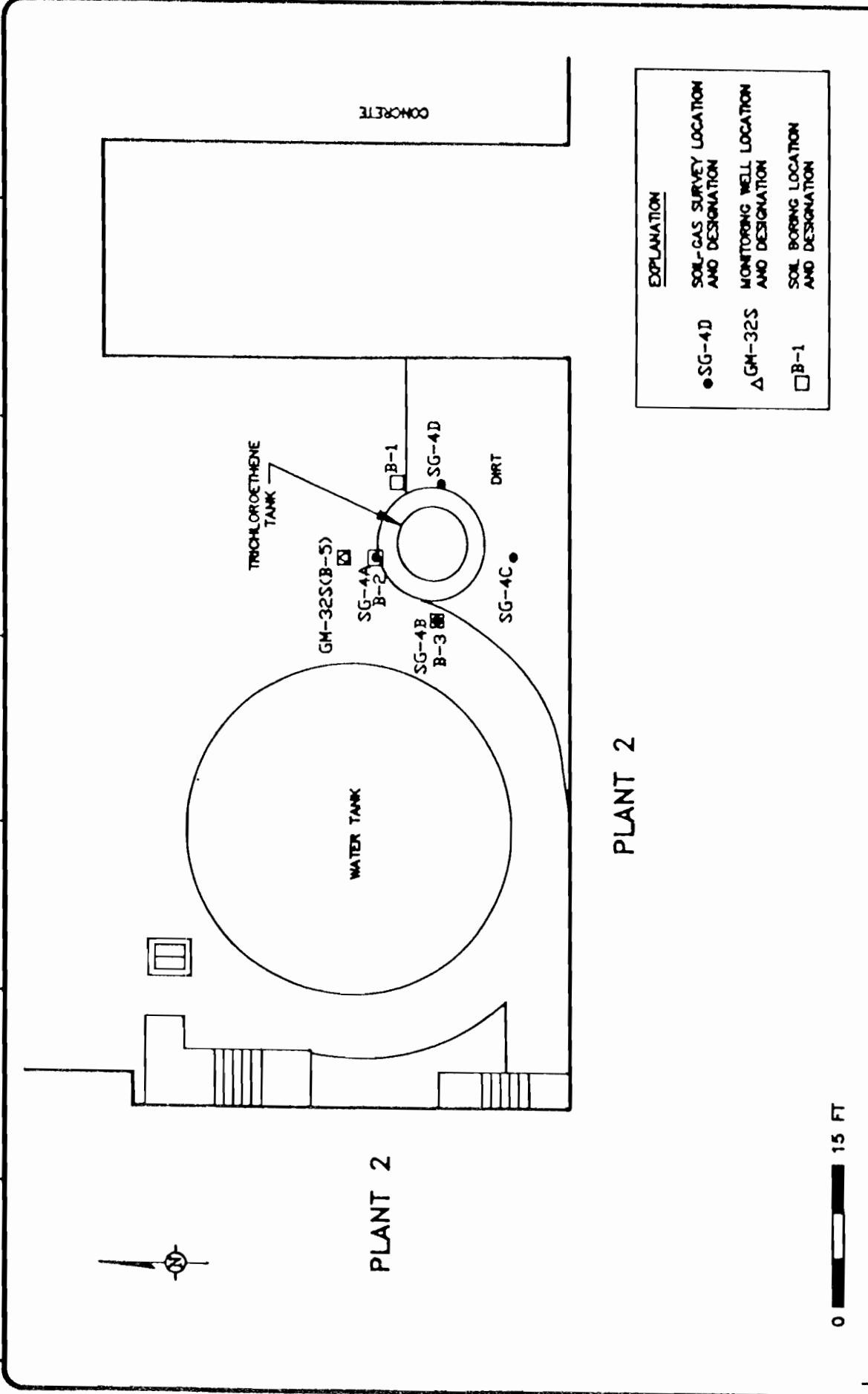
O2 Percent oxygen level.

CFM Cubic feet per minute.

Table 6. Soil Gas Contaminant Concentration Collected From the Soil Vapor Extraction Pilot Test on November 1, 1993, Grumman Aerospace Corporation, Bethpage, New York.

Compound Name	VET-1	VET-2	VET-3	Lower Detection Limit
Chloromethane	<1	<1	<1	1
Vinyl Chloride	<1	<1	<1	1
Bromomethane/Chloroethane*	<1	<1	<1	1
Fluorotrichloromethane	<.005	0.006	0.010	0.005
1,1 Dichloroethylene	<.01	<.01	<.01	0.01
Methylene Chloride	<1	<1	<1	1.0
Trans-1,2 Dichloroethylene	0.04	0.06	0.08	0.01
1,1 Dichloroethane	<.01	<.01	<.01	0.01
Chloroform	0.006	0.008	0.011	0.005
1,1,1 Trichloroethane	0.028	0.043	0.051	0.005
Carbon Tetrachloride	<.005	<.005	<.005	<.005
Benzene	<.07	<.07	<.07	0.07
1,2 Dichloroethane	<.01	<.01	<.01	0.01
Trichloroethylene	45.334	66.149	76.236	0.005
1,2 Dichloropropane	<.01	<.01	<.01	0.01
Bromodichloromethane	<.005	<.005	<.005	0.005
2-Chloroethyl Vinyl Ether	<5	<5	<5	5.0
Cis-1,3 Dichloropropylene	<.01	<.01	<.01	0.01
Toluene	<.07	<.07	<.07	0.07
Trans-1,3 Dichloropropylene	<.01	<.01	<.01	0.01
1,1,2 Trichloroethane	<.005	<.005	<.005	0.005
Tetrachloroethylene	0.081	0.129	0.158	0.005
Chlorodibromomethane	<.005	<.005	<.005	0.005
Chlorobenzene	<.07	<.07	<.07	0.07
Ethyl Benzene	<.07	<.07	<.07	0.07
Bromoform	<.005	<.005	<.005	0.005
1,1,2,2 Tetrachloroethane	<.005	<.005	<.005	0.005
1,3 Dichlorobenzene	<.07	<.07	<.07	0.07
1,4 Dichlorobenzene	<.07	<.07	<.07	0.07
1,2 Dichlorobenzene	<u><.07</u>	<u><.07</u>	<u><.07</u>	0.07
Total VOCs	45.49	66.40	78.55	

* Compounds elute together on ECD: Values represent either or a combination of both. Analysis performed by Miocroseeps, Ltd., Pittsburgh, Pennsylvania.



EXPLANATION	
● SG-4D	SOIL-GAS SURVEY LOCATION AND DESIGNATION
△ GM-32S	MONITORING WELL LOCATION AND DESIGNATION
□ B-1	SOIL BORING LOCATION AND DESIGNATION

FIGURE
1

SOIL-GAS, SOIL BORING, AND MONITORING WELL LOCATIONS
BY THE TRICHLOROETHENE TANK AT PLANT 2

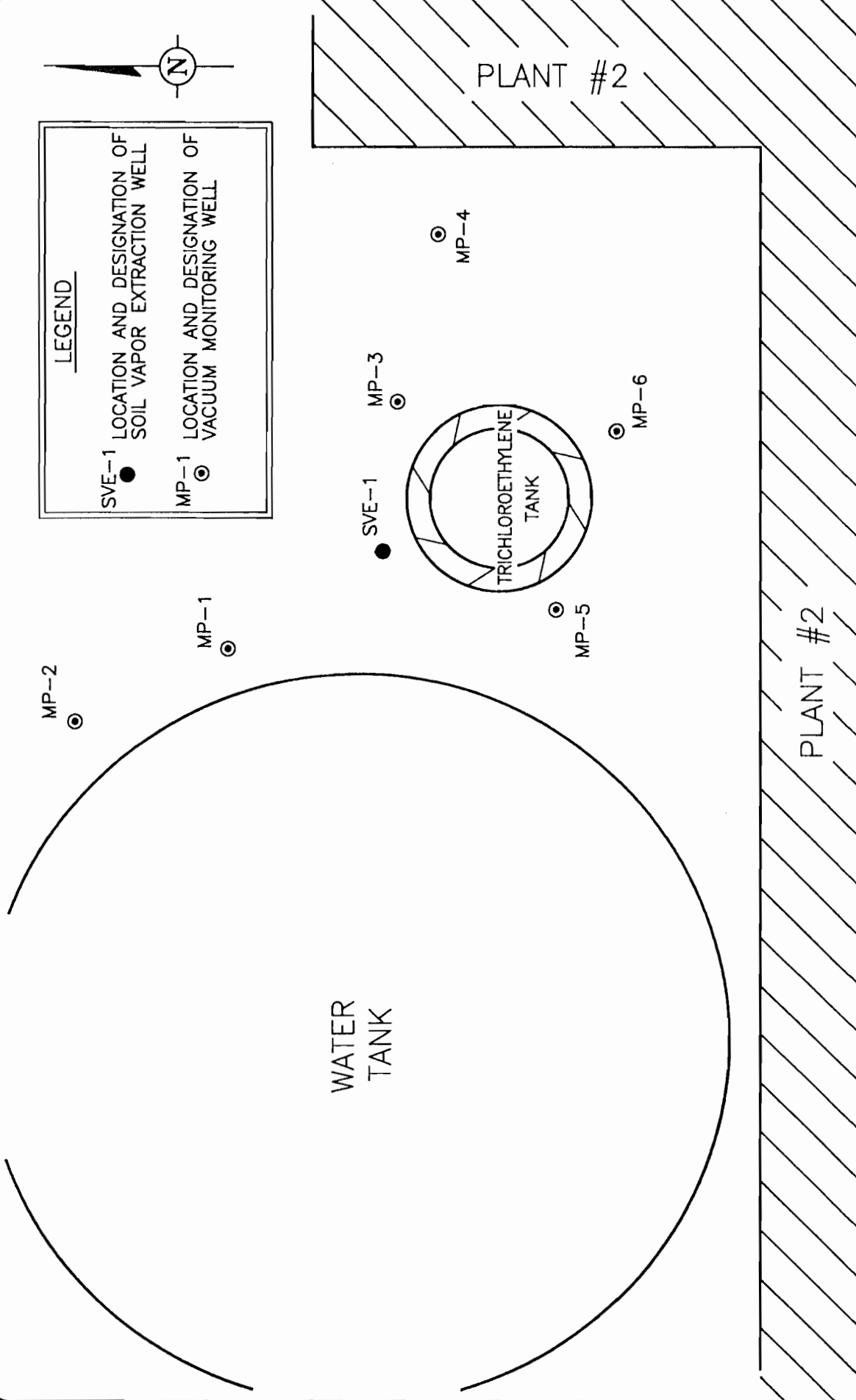
GRUMMAN AEROSPACE CORPORATION
BETHPAGE, NEW YORK

GERAGHTY & MILLER, INC.
Environmental Services

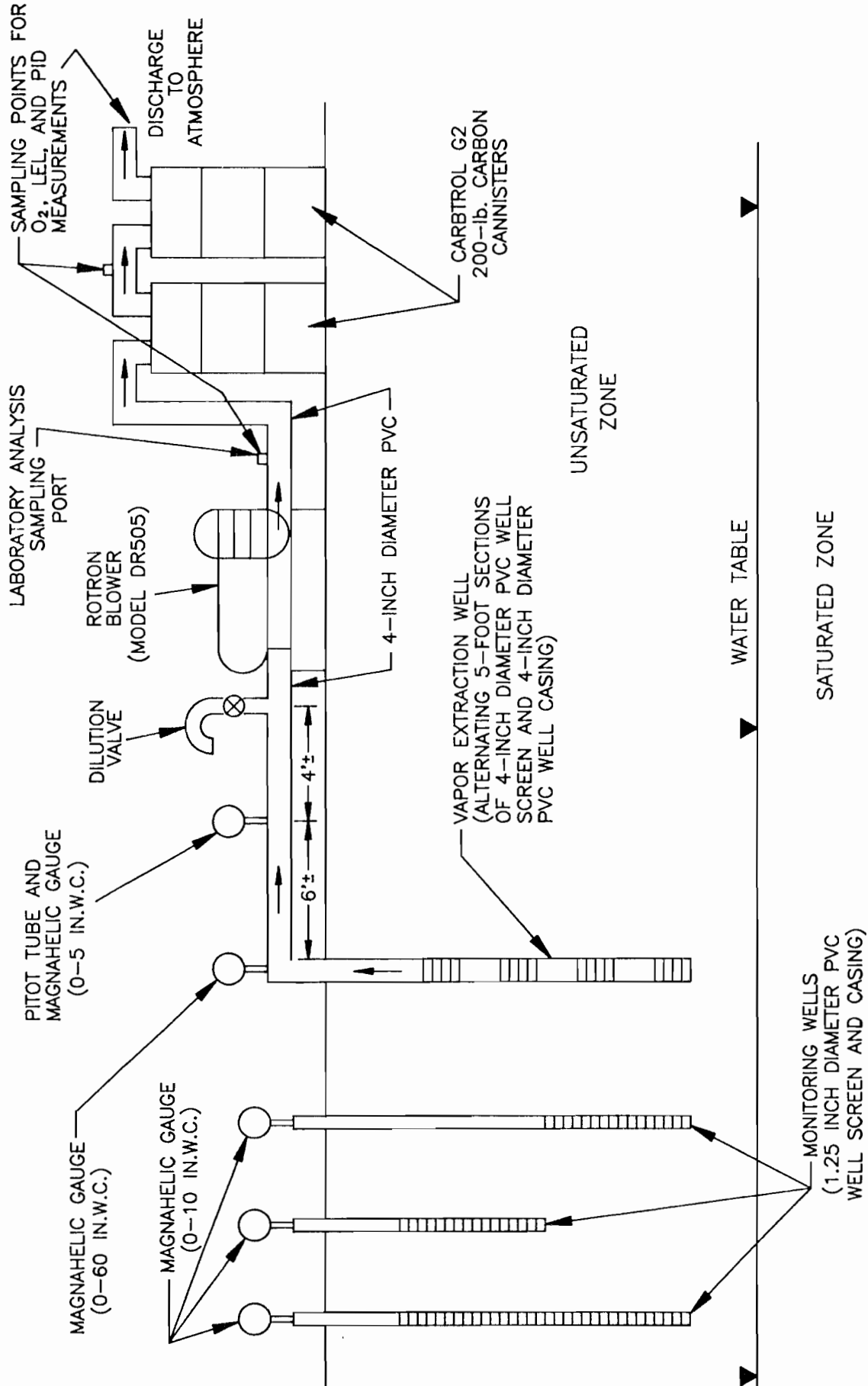


LEGEND

- SVE-1 ● LOCATION AND DESIGNATION OF SOIL VAPOR EXTRACTION WELL
- MP-1 ⊙ LOCATION AND DESIGNATION OF VACUUM MONITORING WELL



LOCATION OF SOIL VAPOR EXTRACTION AND VACUUM MONITORING WELLS
GRUMMAN AEROSPACE CORPORATION
 BETHPAGE, NEW YORK



SCALE: NONE

SOIL VAPOR EXTRACTION PILOT TEST EQUIPMENT CONFIGURATION

FIGURE



GRUMMAN AEROSPACE CORPORATION
BETHPAGE, NEW YORK

3

LEGEND

SVE-1 LOCATION AND DESIGNATION OF SOIL VAPOR EXTRACTION WELL

MP-1 LOCATION AND DESIGNATION OF VACUUM MONITORING WELL

--- LINES OF APPROXIMATELY EQUAL VACUUM INFLUENCE

.38
.30
.21

— 3 IN. W.C.
 — 2 IN. W.C.
 — 1 IN. W.C.

NOTE: VACUUM INFLUENCE MEASUREMENT DATA FROM MP-6 APPEARS TO HAVE BEEN EFFECTED BY THE METHOD OF INSTALLATION AND THEREFORE IS NOT USED TO DETERMINE THE LINES OF APPROXIMATELY EQUAL VACUUM INFLUENCE.

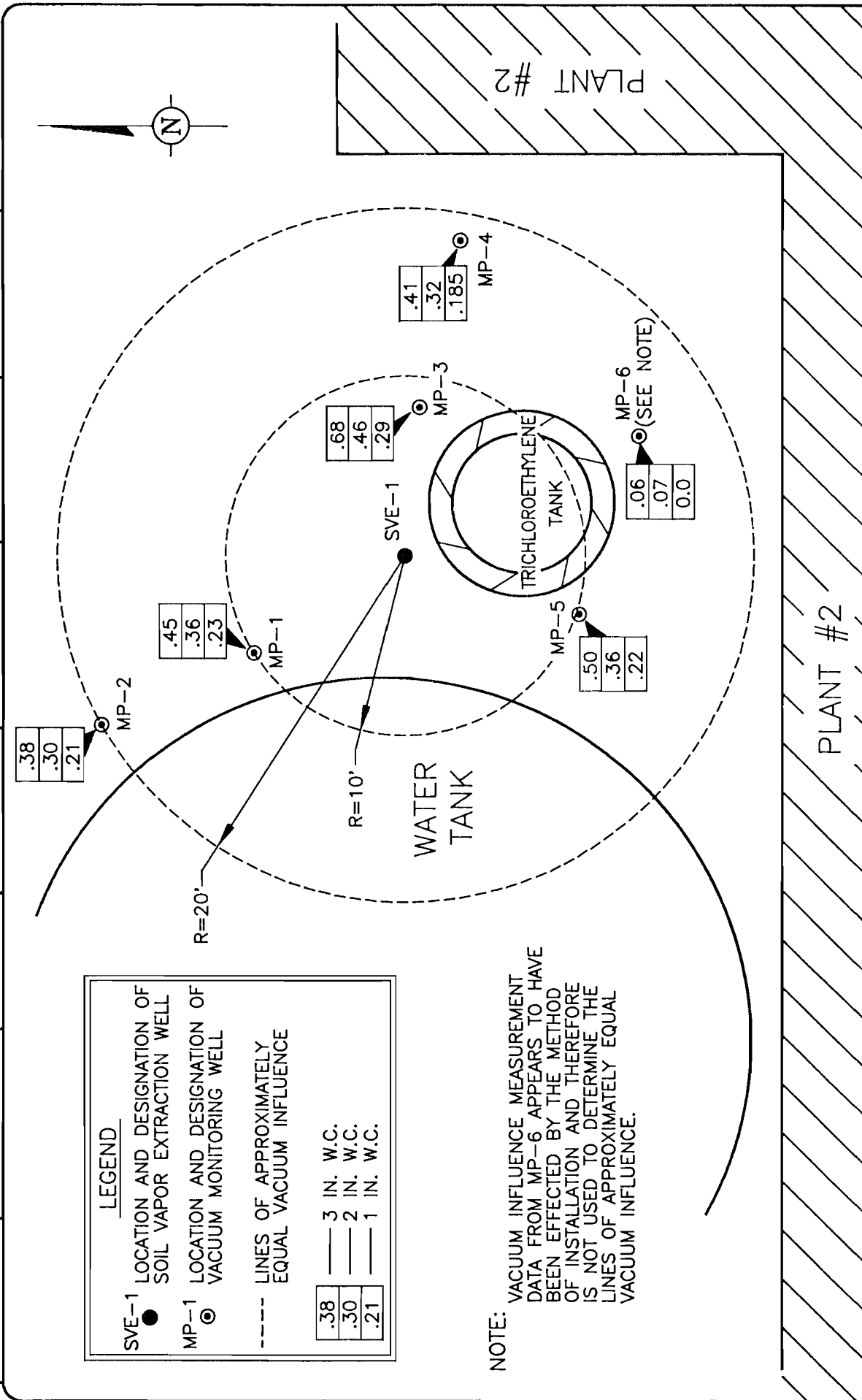


APPROXIMATE RADIUS OF INFLUENCE VS. APPLIED VACUUM

GRUMMAN AEROSPACE CORPORATION
 BETHPAGE, NEW YORK

FIGURE

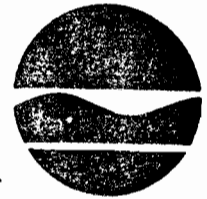
4



APPENDIX A

**NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
LETTER DATED SEPTEMBER 21, 1993**

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233



Thomas C. Jorling
Commissioner

September 21, 1993

Mr. John H. Ohlmann, P.E.
Director, Corporate Environmental Protection
Grumman Corporation
Bethpage, NY 11714-3580

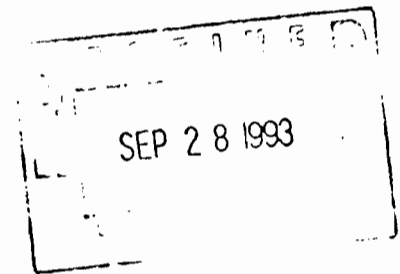
Dear Mr. Ohlmann:

RE: GRUMMAN CORPORATION
SITE NUMBER 130003A

The revised work plan dated September 1, 1993 for the IRM at the aboveground TCE tank adjacent to Plant #02 is hereby approved. Please notify this office five business days in advance of commencing field work. If you have any questions regarding this matter, please feel free to contact me at (518) 457-3395.

Very truly yours,

John D. Barnes, P.E.
Environmental Engineer 2
Bureau of Eastern Remedial Action
Div. of Hazardous Waste Remediation



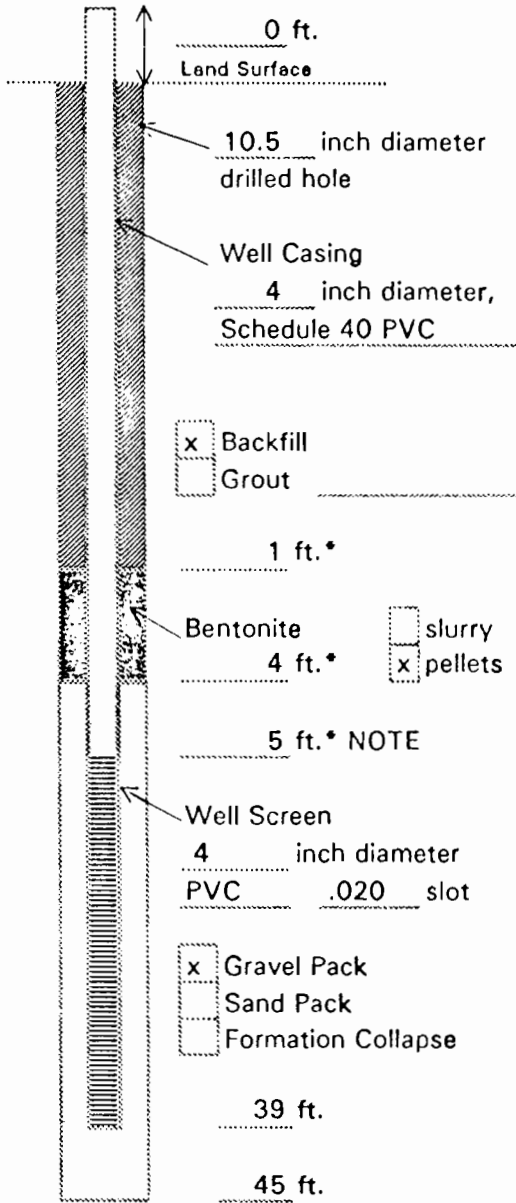
JB/dd
grum46

c: S. Ervolina
S. McCormick
R. Knizek/D. Evans
L. Wilson
A. Barber (G&M)

APPENDIX B

SOIL BORING AND WELL CONSTRUCTION LOGS

WELL CONSTRUCTION LOG
(UNCONSOLIDATED)



Measuring Point is
Top of Well Casing
Unless Otherwise Noted.

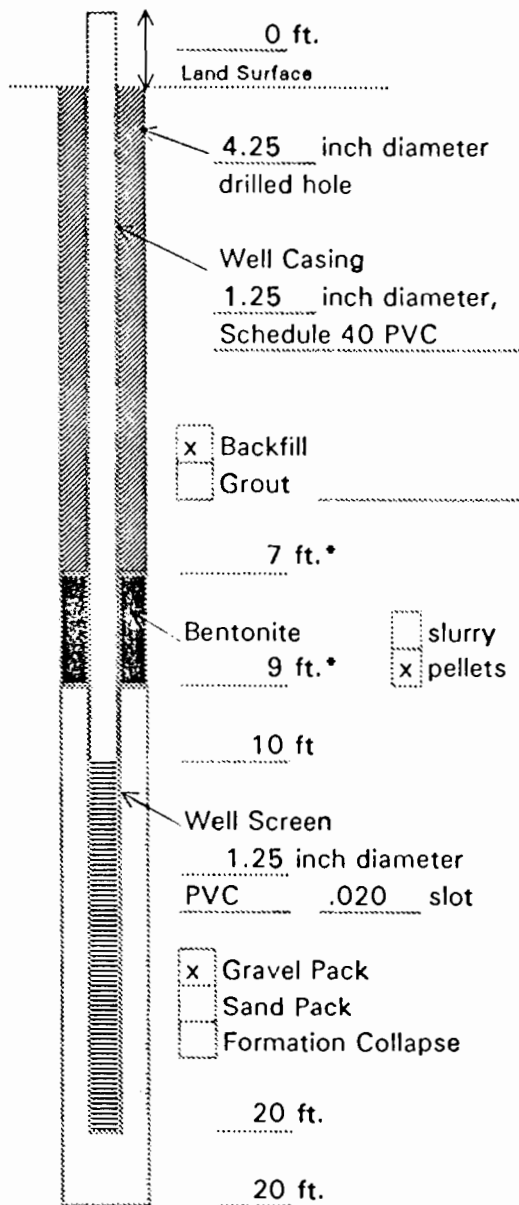
* Depth Below Land Surface

Project Grumman Aerospace Corp. Well SVE-1
 Town/City Bethpage
 County Nassau State New York
 Permit No. _____
 Land-Surface Elevation and Datum N/A feet Surveyed Estimated
 Installation Date(s) October 25, 1993
 Drilling Method Hollow Stem Auger
 Drilling Contractor Delta Well & Pump
 Drilling Fluid None
 Development Technique(s) and Date(s)
No Development Required
 Fluid Loss During Drilling None gallons
 Water Removed During Development None gallons
 Static Depth to Water N/A feet below M.P.
 Pumping Depth to Water N/A feet below M.P.
 Pumping Duration N/A hours
 Yield N/A gpm N/A Date N/A
 Specific Capacity N/A gpm/ft.
 Well Purpose Soil Vapor Extraction Well
 Remarks Groundwater was encountered at 44 feet. Set casing 5 ft above groundwater at 39 ft. Soil samples were collected at every 5 ft interval and analyzed for TCE with a portable GC.
 Prepared by Steve Devernoe

*NOTE: 5 foot sections of well screen alternating with 5 foot sections of casing make up the construction of the soil vapor extraction well with the top 5 feet being casing.

WELL CONSTRUCTION LOG

(UNCONSOLIDATED)



Measuring Point is
Top of Well Casing
Unless Otherwise Noted.

* Depth Below Land Surface

Project Grumman Aerospace Corp. Well MP-1
 Town/City Bethpage
 County Nassau State New York
 Permit No. _____
 Land-Surface Elevation
 and Datum N/A _____ feet

Surveyed
 Estimated

Installation Date(s) October 25, 1993
 Drilling Method Hollow Stem Auger
 Drilling Contractor Delta Well & Pump
 Drilling Fluid None

Development Technique(s) and Date(s)
No Development Required

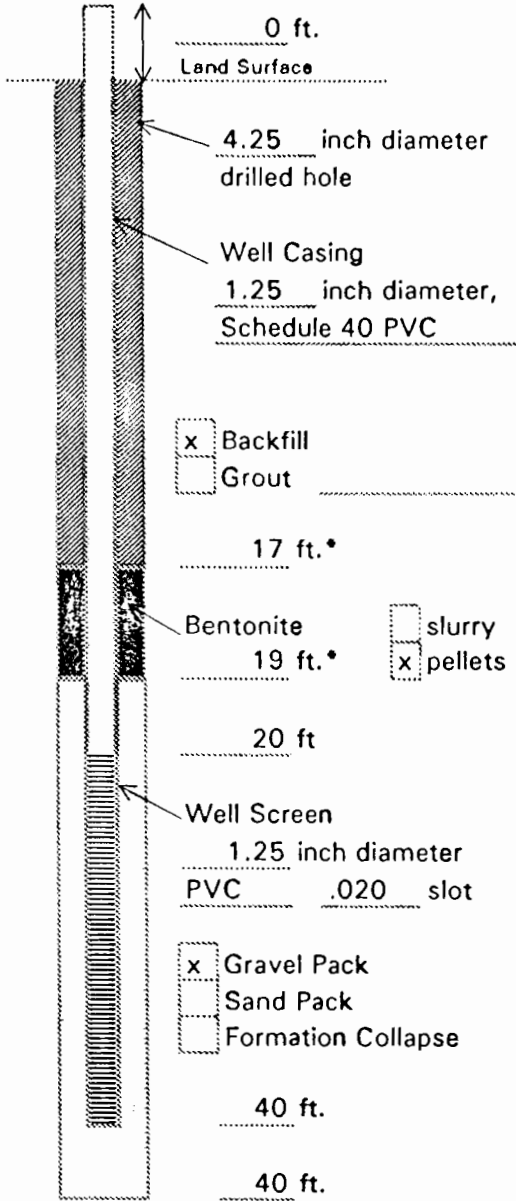
Fluid Loss During Drilling None _____ gallons
 Water Removed During Development None _____ gallons
 Static Depth to Water N/A _____ feet below M.P.
 Pumping Depth to Water N/A _____ feet below M.P.
 Pumping Duration N/A _____ hours
 Yield N/A _____ gpm N/A _____ Date N/A
 Specific Capacity N/A _____ gpm/ft.

Well Purpose Soil Vapor Extraction Monitoring Well

Remarks _____

Prepared by Steve Devernoe

WELL CONSTRUCTION LOG
(UNCONSOLIDATED)



Measuring Point is
Top of Well Casing
Unless Otherwise Noted.

* Depth Below Land Surface

Project Grumman Aerospace Corp. Well MP-3
 Town/City Bethpage
 County Nassau State New York
 Permit No. _____
 Land-Surface Elevation and Datum N/A feet Surveyed Estimated

Installation Date(s) October 26, 1993
 Drilling Method Hollow Stem Auger
 Drilling Contractor Delta Well & Pump
 Drilling Fluid None

Development Technique(s) and Date(s)
No Development Required

Fluid Loss During Drilling None gallons
 Water Removed During Development None gallons
 Static Depth to Water N/A feet below M.P.
 Pumping Depth to Water N/A feet below M.P.
 Pumping Duration N/A hours
 Yield N/A gpm N/A Date N/A
 Specific Capacity N/A gpm/ft.

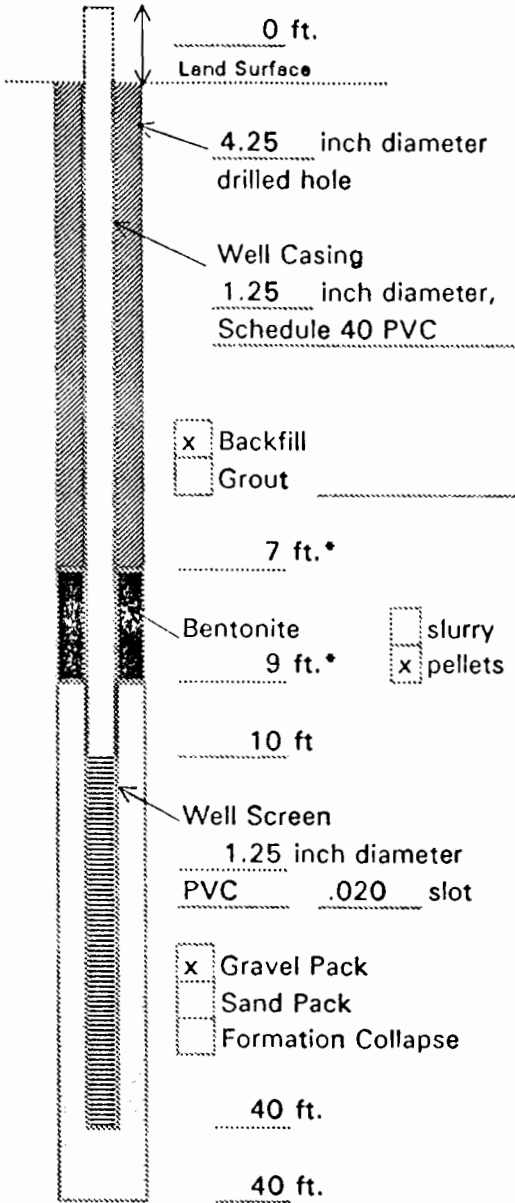
Well Purpose Soil Vapor Extraction Monitoring Well

Remarks _____

Prepared by Steve Devernoe

WELL CONSTRUCTION LOG

(UNCONSOLIDATED)



Measuring Point is
Top of Well Casing
Unless Otherwise Noted.

* Depth Below Land Surface

Project Grumman Aerospace Corp. Well MP-4
 Town/City Bethpage
 County Nassau State New York
 Permit No. _____
 Land-Surface Elevation and Datum N/A feet Surveyed Estimated

Installation Date(s) October 26, 1993
 Drilling Method Hollow Stem Auger
 Drilling Contractor Delta Well & Pump
 Drilling Fluid None

Development Technique(s) and Date(s)
No Development Required

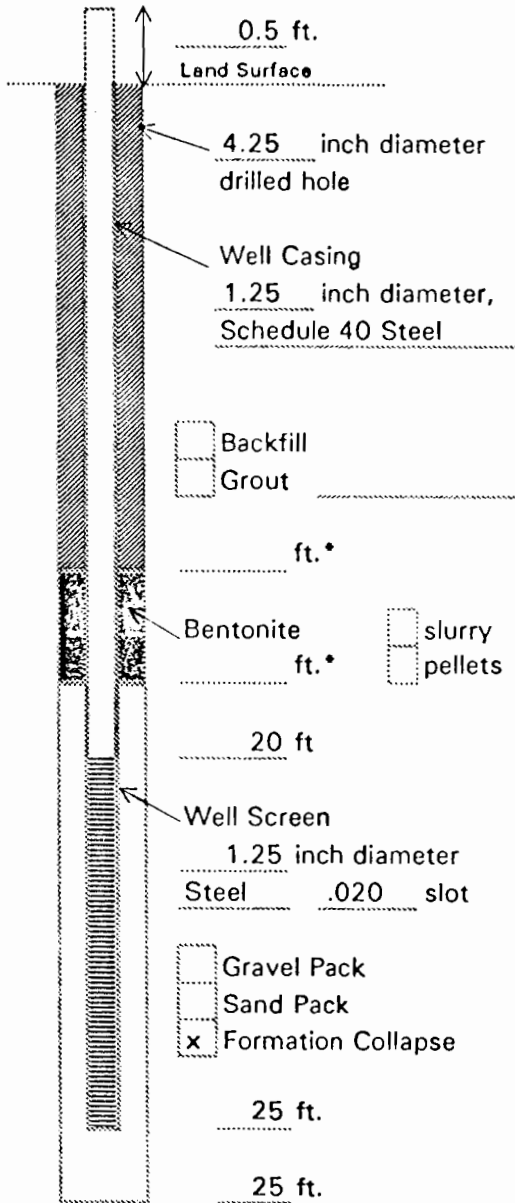
Fluid Loss During Drilling None gallons
 Water Removed During Development None gallons
 Static Depth to Water N/A feet below M.P.
 Pumping Depth to Water N/A feet below M.P.
 Pumping Duration N/A hours
 Yield N/A gpm N/A Date N/A
 Specific Capacity N/A gpm/ft.

Well Purpose Soil Vapor Extraction Monitoring Well

Remarks _____

Prepared by Steve Devernoe

WELL CONSTRUCTION LOG
(UNCONSOLIDATED)



Measuring Point is
Top of Well Casing
Unless Otherwise Noted.

* Depth Below Land Surface

Project Grumman Aerospace Corp. Well MP-6
 Town/City Bethpage
 County Nassau State New York
 Permit No. _____
 Land-Surface Elevation and Datum N/A feet Surveyed Estimated
 Installation Date(s) October 27, 1993
 Drilling Method Drive Point (Tri-pod)
 Drilling Contractor Delta Well & Pump
 Drilling Fluid None
 Development Technique(s) and Date(s)
No Development Required
 Fluid Loss During Drilling None gallons
 Water Removed During Development None gallons
 Static Depth to Water N/A feet below M.P.
 Pumping Depth to Water N/A feet below M.P.
 Pumping Duration N/A hours
 Yield N/A gpm N/A Date N/A
 Specific Capacity N/A gpm/ft.
 Well Purpose Soil Vapor Extraction Monitoring Well
 Remarks MP-6 was installed with a tri-pod due to limited access between the tank and Plant-2.
 Prepared by Steve Devernoe

APPENDIX C

624 SCAN COMPOUND LIST

624 Scan Compound List, Grumman Aerospace Corporation, Bethpage, New York.

Compound	Blank	Lower Detection Limit
Chloromethane	ND	1
Vinyl Chloride	ND	1
Bromomethane/Chloroethane*	ND	1
Fluorotrichloromethane	ND	0.005
1,1 Dichloroethylene	ND	0.01
Methylene Chloride	ND	1.00
Trans-1,2 Dichloroethylene	ND	0.10
1,1 Dichloroethane	ND	0.01
Chloroform	ND	0.005
1,1,1 Trichloroethane	ND	0.005
Carbon Tetrachloride	ND	0.005
Benzene	ND	0.07
1,2 Dichloroethane	ND	0.01
Trichloroethylene	ND	0.005
1,2 Dichloropropane	ND	0.01
Bromodichloromethane	ND	0.005
Cis-1,3 Dichloropropylene	ND	0.01
Toulene	ND	0.07
Trans-1,3 Dichloropropylene	ND	0.01
1,1,2 Trichloroethane	ND	0.005
Tetrachloroethylene	ND	0.005
Chlorodibromoethane	ND	0.005
Chlorobenzene	ND	0.07
Ethyl Benzene	ND	0.07
Bromoform	ND	0.005
1,1,2,2 Tetrachloroethane	ND	0.005
1,3 Dichlorobenzene	ND	0.07
1,4 Dichlorobenzene	ND	0.07
1,2 Dichlorobenzene	ND	0.07

* Compounds elute together on ECD - Values represent either or a combination of both.

** Compounds elute together on FID - Value represents a combination of both.