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FINAL EXCAVATION DOCUMENTATION REPORT NIROP FRIDLEY MN

12/1/91

WENCK ASSOCIATES

Excavation Documentation Report

Prepared for:

Hazardous Materials Building Addition
Naval Industrial Reserve Ordnance Plant
Fridley, Minnesota

Submitted to:

FMC CORPORATION

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Section I
Introduction

This report documents the monitoring and sampling activities conducted in conjunction with the excavation of contaminated soil from the proposed hazardous materials building addition at the Naval Industrial Reserve Ordnance Plant (NIROP) in Fridley, Minnesota (see Figure 1).

Wenck Associates, Inc. was subcontracted on November 13, 1991, by Shingobee Builders to document the above soil excavation project per FMC Corporation (FMC) specifications. The specifications were summarized from an October 1991 Subsurface Investigation Report and Soil Removal Action Plan prepared by Bay West, Inc.

The following work was performed by Wenck Associates, Inc. in November and December 1991: Coordinated the installation of 25 excavation control points, documented the excavation of an estimated 2,992 combined yards of soil and concrete, sampled and coordinated the analysis of 18 confirmation soil samples, and surveyed the excavation and four soil stockpiles.

Section II
Installation of Excavation Control Points

A. LOCATION OF EXCAVATION CONTROL POINTS

Excavation control point locations were staked by scaling distances off of Bay West, Inc. Soil Category Location Figures 9 through 12 from their October 1991 Subsurface Exploration Report and Soil Removal Action Plan. The above locations were staked with respect to measurements from the existing building adjacent to two sides of the soil excavation site.

Field changes adding excavation control point borings B-24, B-25, B-26, B-27, and B-28 were authorized by FMC to further define the boundaries between two regions of differing proposed excavation depth. Field changes eliminating excavation control point borings B-5, B-10, and B-13 were also authorized by FMC due to their interference with excavation plans and their close proximity to other excavation control points.

Due to slight inconsistencies between the above Soil Category Location Figures and the actual site dimensions, the following excavation control point borings were shifted under the direction of FMC to more accurately reflect other site landmarks and or former soil boring locations: excavation control point borings B-17, B-19, B-20, B-22, B-24, B-25, B-26, B-27, and B-28. Site landmarks used to shift the locations of the above excavation control points were the abandon railroad tracks and the former dry well sump.

The final locations of the 25 excavation control point borings and the outline of the building adjacent to the site were then surveyed with respect to their horizontal and vertical coordinates (see Figure 2).

B. CONSTRUCTION OF EXCAVATION CONTROL POINTS

Stevens Well Drilling Co., Inc. was subcontracted by Wenck Associates, Inc. on November 15, 1991, to perform the drilling and installation of prepared excavation control points. The drilling was performed by Stevens Well Drilling Co., Inc. on November 20 and 21, 1991. Borings were drilled using a 3.25-inch I.D. hollow stem auger in accordance with ASTM protocol.

Excavation control points were constructed of 2-inch Schedule 40 PVC pipe. Two continuous sections of pipe were joined with one permanent coupling. The excavation control points were completed to a depth three feet below the proposed excavation or three feet below the anticipated groundwater surface. The above modifications to the original specifications were approved by FMC.

The sections of PVC pipe were labeled and marked in one foot intervals with permanent marker. The appropriate ground level elevation for each section was also marked with respect to the zero elevation mark set on top of the cement sidewalk on the north end of the excavation.

Section III
Documentation of Soil Excavation

A. SEGREGATION OF SOILS

Excavated soils were classified as Category 1, Category 2, Category 3, or Category 4 soils based on the October 1991, Subsurface Investigation Report and Soil Removal Plan. Excavation control points were utilized to delineate the boundaries between the various soil categories (see Figure 2).

The total yardage of excavated soils was recorded for each category of soil by recording the sample number assigned to jar headspace samples taken at approximately 10 cubic yard intervals. The total approximate yardage recorded is as follows: Category 1,440 cubic yards; Category 2, 1,830 cubic yards; Category 3, 790 cubic yards; and Category 4, 43 cubic yards. These soil volumes were based on an assumption that each loaded truck contained approximately 10 cubic yards of soil.

Segregated soils were stockpiled in four separate piles on-site, near the northwest corner of the facility. Soils from categories 2, 3, and 4 were placed on 6-mil plastic.

B. POST EXCAVATION SURVEYING/SOIL VOLUMES

The total volume of excavated soils was obtained by surveying the finished excavation and calculating the volume of soil removed.

Horizontal and vertical locations were surveyed with a total station instrument at

approximately 125 locations in and around the excavation. The data was then analyzed using DCA Earthworks Software which calculates soil volumes by the average end area method.

Prior to excavating, most of the site was lower than the grade at the outer perimeter of the excavation. Therefore, coordinates from the pre-excavation survey of the site's ground surface were used to define the upper limits of the excavated soil and concrete.

The total volume of soil and concrete removed was calculated to be 2,992 cubic yards. It is estimated that approximately 120 cubic yards of cement were removed from the surface of the excavation. Therefore, an estimated 2,872 cubic yards of soil were removed.

The four soil stockpiles containing Category 1 through Category 4 soils were also surveyed. Based on the two surveys and the documented load counts, the following volumes are estimated for the stockpiled soil:

Category 1	420 cubic yards
Category 2	1,572 cubic yards
Category 3	848 cubic yards
Category 4	32 cubic yards
	2,872 Total Yards

A density test on compacted site soils was performed by GME Consultants, Inc. Based on the result, the above soil categories are converted to a weight basis as shown below:

Category 1	587 tons
Category 2	2,196 tons
Category 3	1,185 tons
Category 4	45 tons

Depths associated with figures, tables, and laboratory data were approximated from excavation control points in the vicinity of each sample location. Post excavation surveying confirmed the relative accuracy of the documented depths. One slight modification extends the depth of the deep section of the excavation to between 20.0 and 22.0 feet.

C. ADDITIONAL SOIL REMOVAL

The specifications for the soil excavation project estimated approximately 2,570 cubic yards of soils would be removed. The actual volume of soil excavated was estimated to be 2,992 cubic yards. Therefore, the additional yardage was estimated to be 422 cubic yards. Figure 3 illustrates the surveyed perimeter of the larger than expected excavation.

The additional soils were removed from the following general areas:

1. Approximately 150 additional cubic yards of Category 1 soils were removed around the south and west perimeters of the excavation to provide the needed step back for the deeper than planned excavation of Category 2 and 3 soils.

2. Between 2 and 3 feet of additional Categories 1 and 2 soils were removed in the vicinity of confirmation sampling locations CS-4, CS-5, CS-10, CS-11, and CS-12.

3. Additional Category 2 soils were removed as the 20-foot plus deep section of the excavation was extended to the north in the vicinity of confirmation sampling locations CS-13, CS-14, and CS-15.

D. SOIL HEADSPACE ANALYSIS

Jar headspace samples were taken from the excavated soil at approximately 10 cubic yard intervals and analyzed in accordance with the MPCA's Jar Headspace Analytical Screening Procedure dated May 31, 1990. Samples were analyzed using a organic vapor analyzer (OVA) with a flame ionization detector (FID). The background response ranged from 2-11 ppm and was subtracted from the sample response for readings under 500 ppm, yielding a net sample response. The net sample response was recorded as total organic vapors as methane and multiplied by a factor of 1.5 to represent total organic vapors as a benzene equivalent.

The system of recording headspace samples first denotes the category number of the soil; then indicates the symbol (HS) for headspace; and lastly indicates the chronological yardage of soil removed for any particular soil category. For example, 1HS10 represents the first 10 yards of Category 1 soil. Headspace sampling locations are presented in Figures 4-8. Soil headspace readings are summarized in Table 1.

Section IV
Confirmatory Soil Testing

A. SOIL SAMPLING

Soil samples were collected from 18 locations on the floor of the excavation as specified in the October 1991, Subsurface Investigation Report and Soil Removal Action Plan. See Figure 9 for the confirmation sample locations identified as CS-1 - CS-18.

Five two-ounce glass containers with teflon lined caps were collected at each sample location in accordance with the soil sampling procedures outlined in the specifications. Samples were collected from soils 1.0-1.5 ft. below the excavation floor.

Confirmation samples CS-1 - CS-8 were collected on November 27, 1991 and confirmation samples CS-9 - CS-18 were collected on December 2, 1991. All samples were delivered to Aspen Research Corporation the same day they were collected.

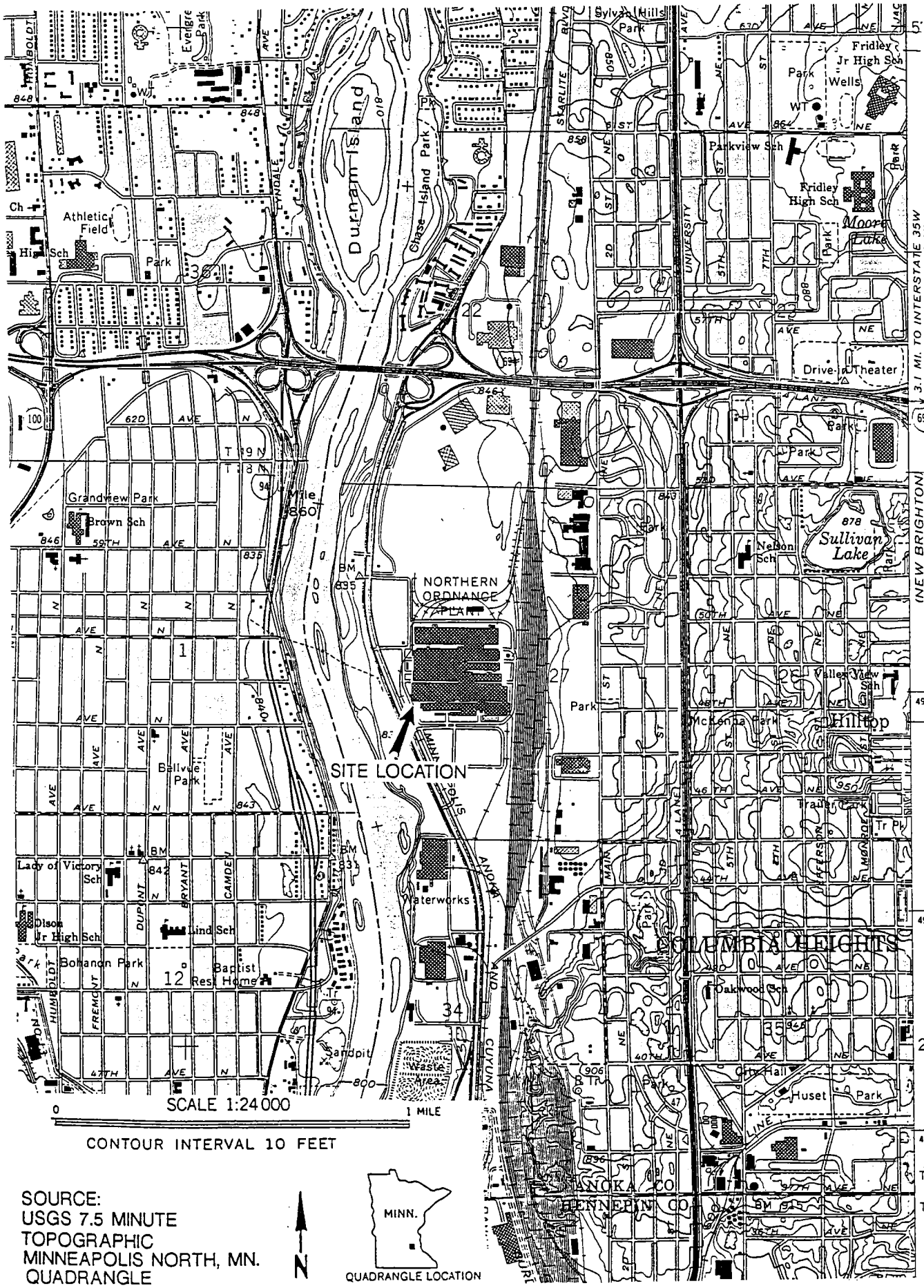
B. LABORATORY ANALYSIS

All soil samples were analyzed for total petroleum hydrocarbons (TPH) and volatile organics according to EPA methods 8015, and 8010/8020 modified respectively. The laboratory data is summarized in Table 2. Appendix A contains the individual laboratory reports and chain of custody documentation.

The TPH in the soil samples was found to be largely heavy-end petroleum hydrocarbons and not components of the No. 2 fuel oil standard which was initially run with the

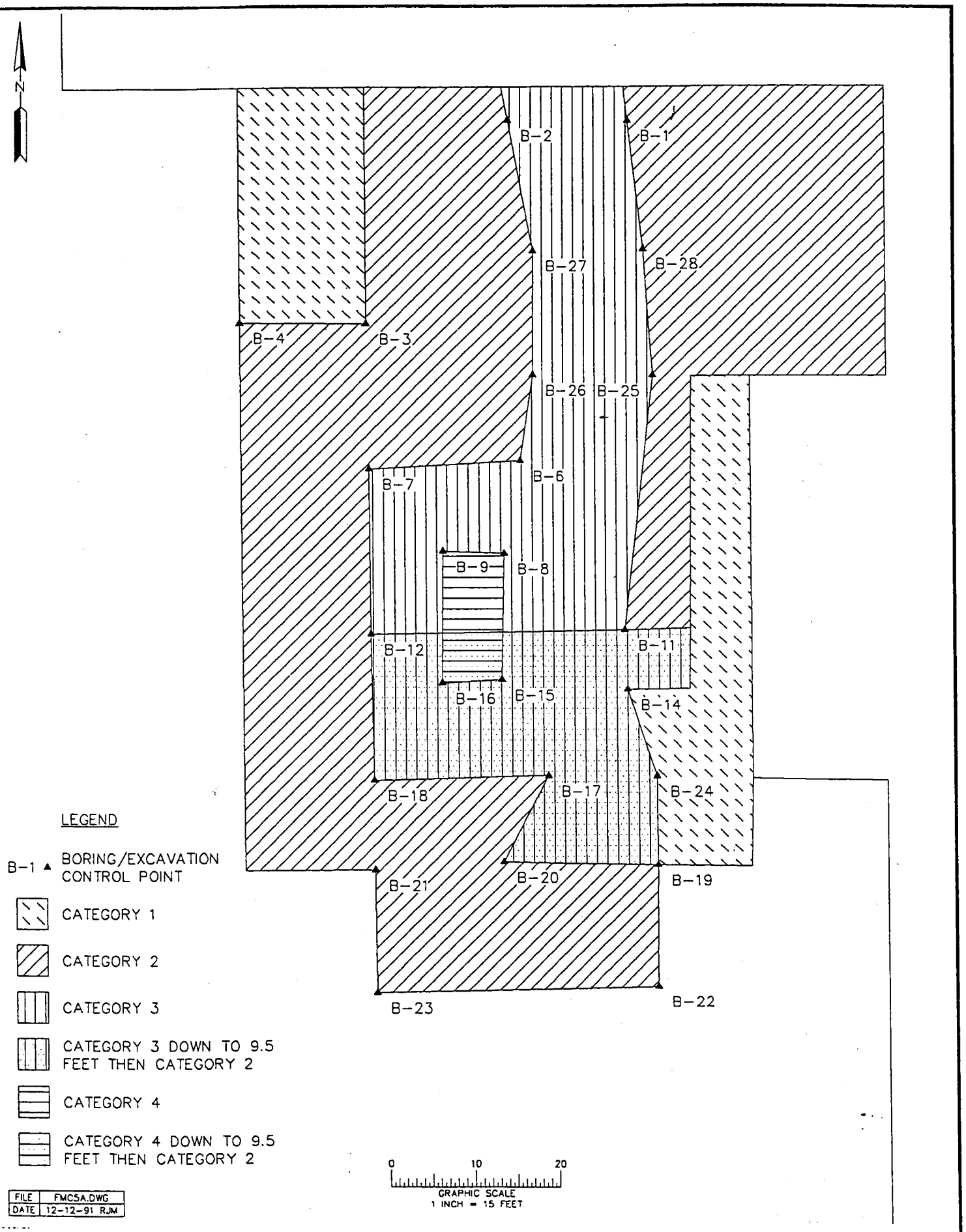
samples. It was determined that the samples closely matched a laboratory standard for "Lubekut" cutting oil and were thus quantified as TPH as cutting oil. Appendix B contains chromatograms comparing the output from confirmation sample CS-15 and a No. 2 fuel oil standard and confirmation sample CS-17 and a "Lubekut" cutting oil standard.

Figures

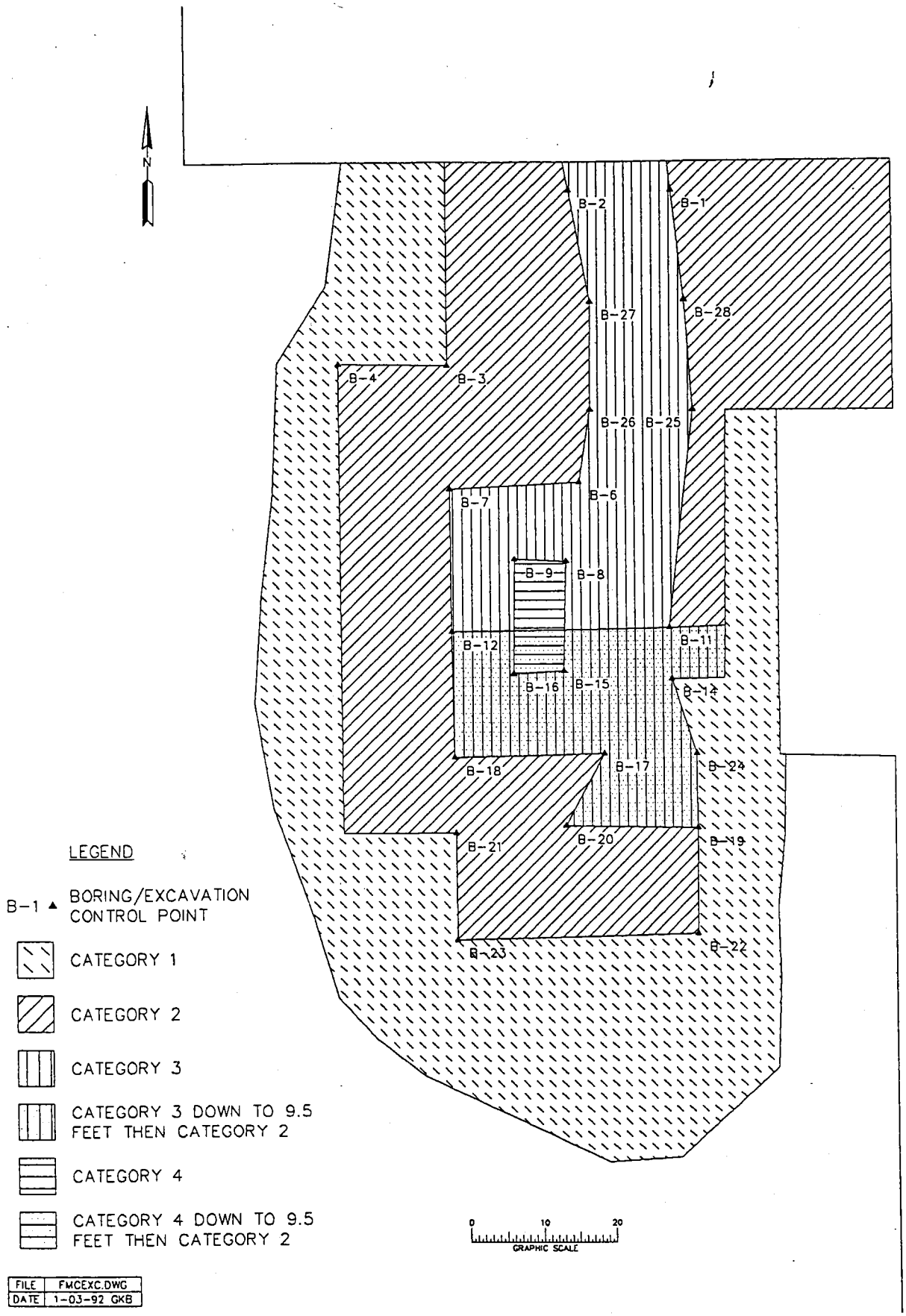


SOURCE:
USGS 7.5 MINUTE
TOPOGRAPHIC
MINNEAPOLIS NORTH, MN.
QUADRANGLE

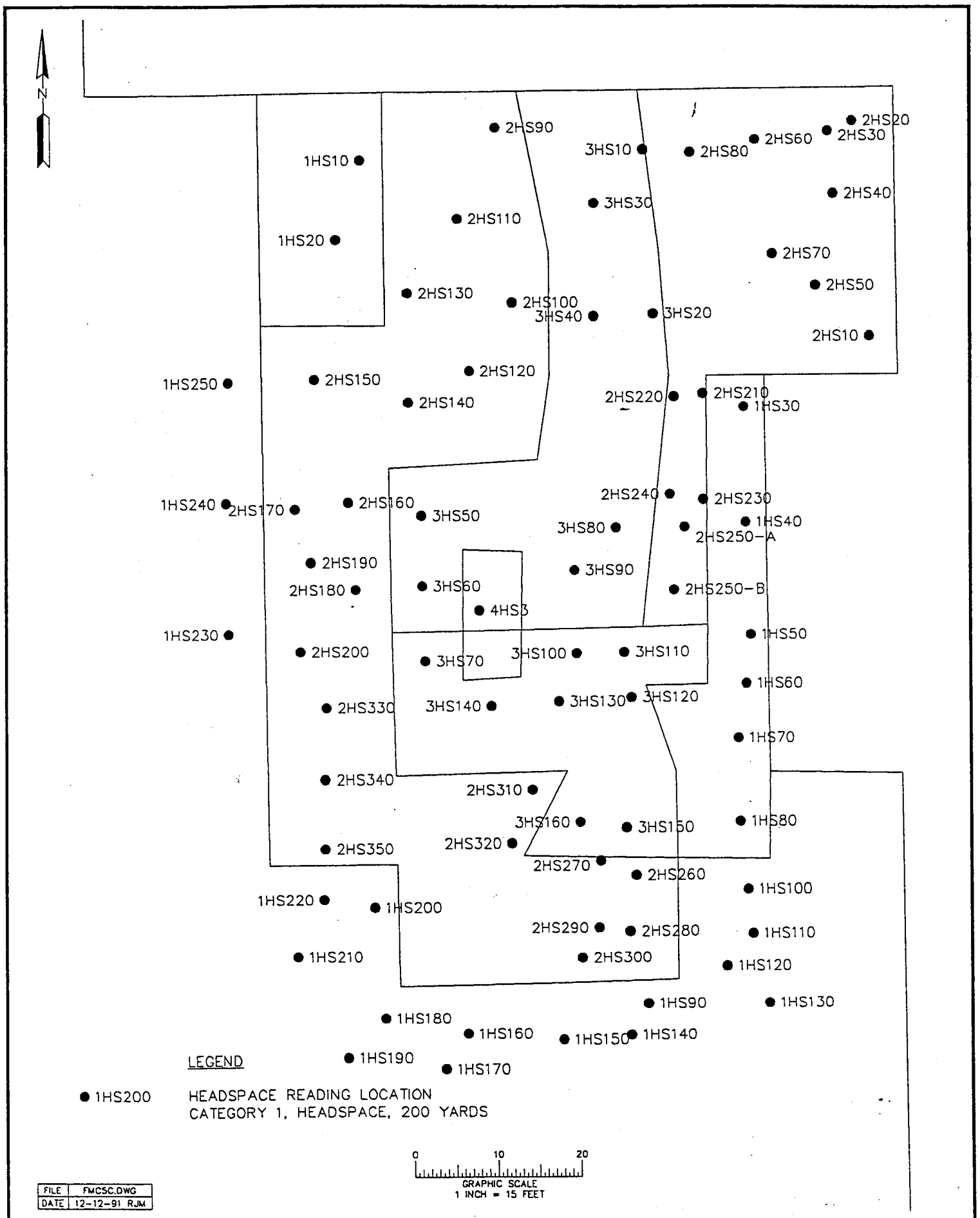
FMC CORPORATION	Wenck Wenck Associates, Inc. 1800 Pioneer Creek Ctr. Environmental Engineers Maple Plain, MN 55359	DEC 1991
Site Location Map		Figure 1



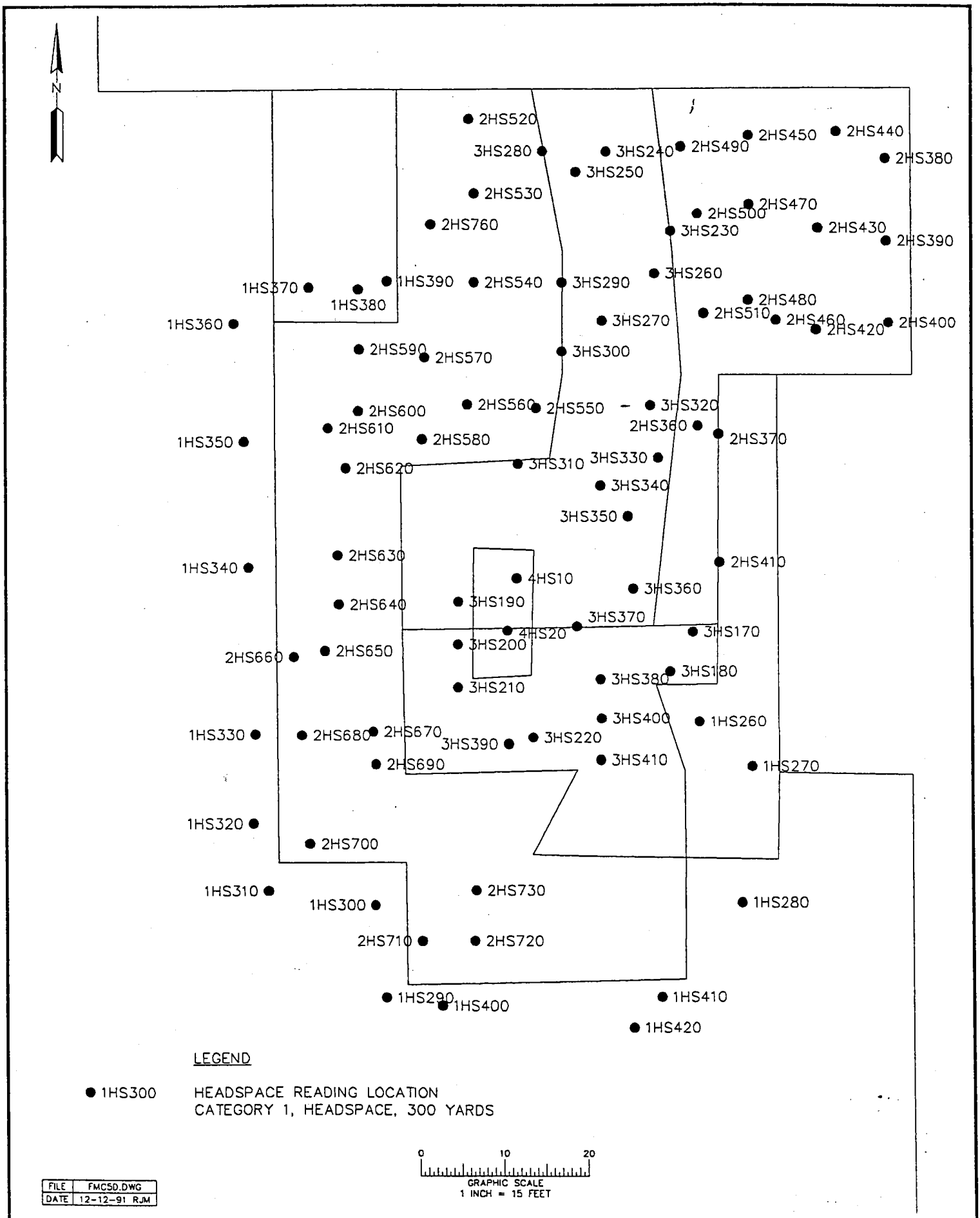
FMC CORPORATION	Wenck Wenck Associates, Inc. 1800 Pioneer Creek Ctr. Environmental Engineers Maple Plain, MN 55359	DEC 1991
Site Map		Figure 2



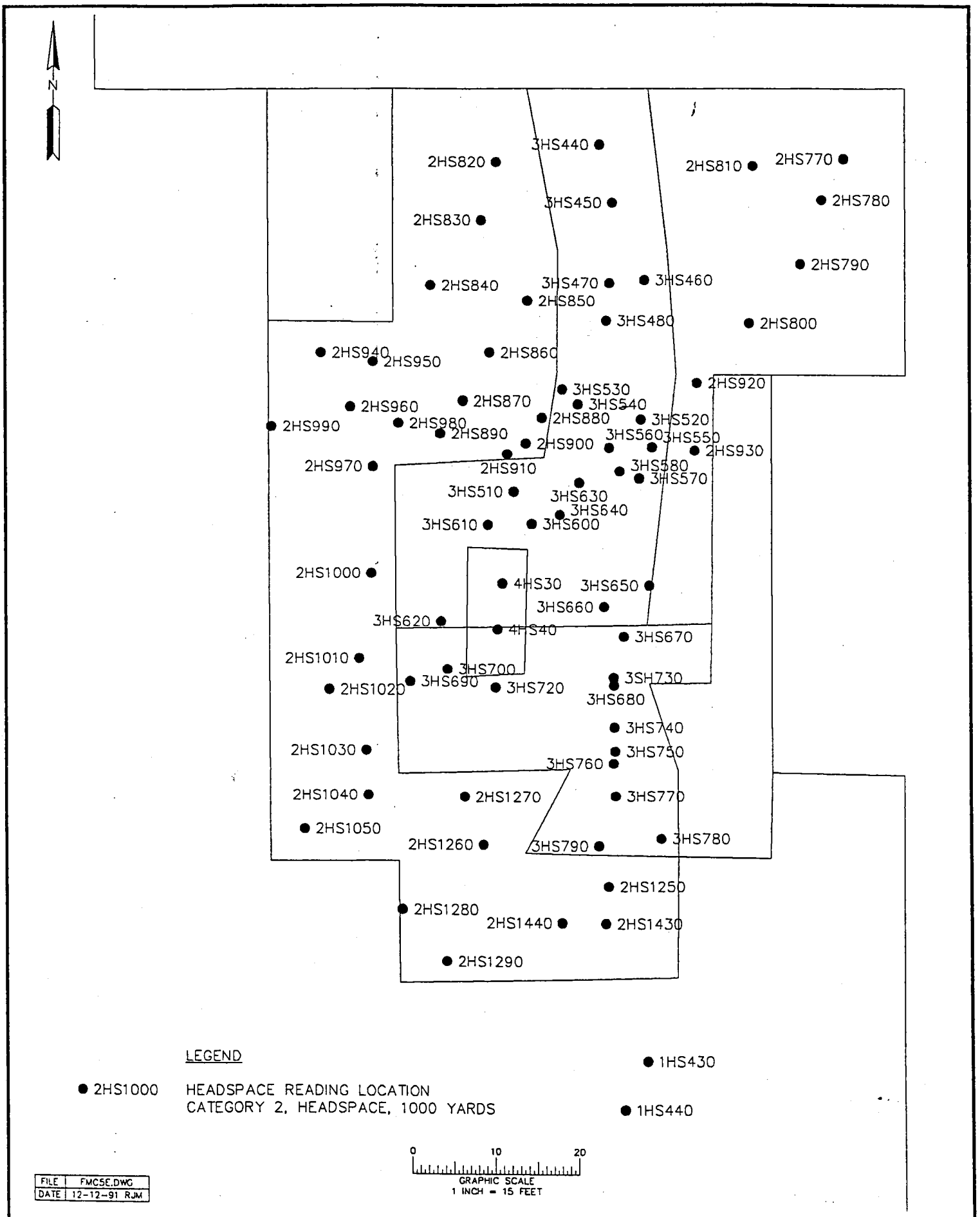
FMC CORPORATION	Wenck Wenck Associates, Inc. 1800 Pioneer Creek Ctr. Environmental Engineers Maple Plain, MN 55359	DEC 1991
Surveyed Excavation Perimeter		Figure 3



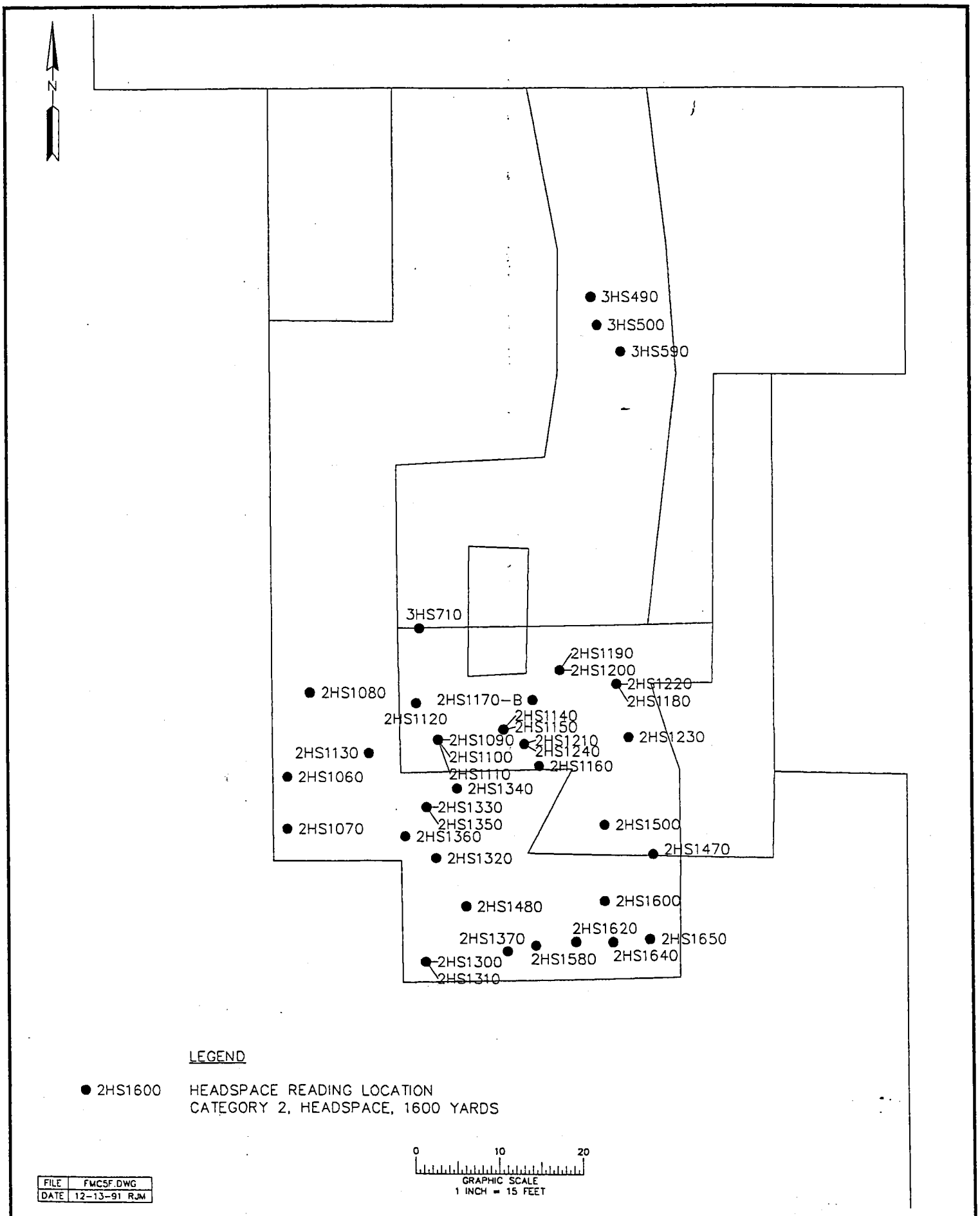
FMC CORPORATION	Wenck Associates, Inc. Environmental Engineers 1800 Pioneer Creek Ctr. Maple Plain, MN 55359	DEC 1991
Headspace Sampling Locations 0-3 ft.		Figure 4



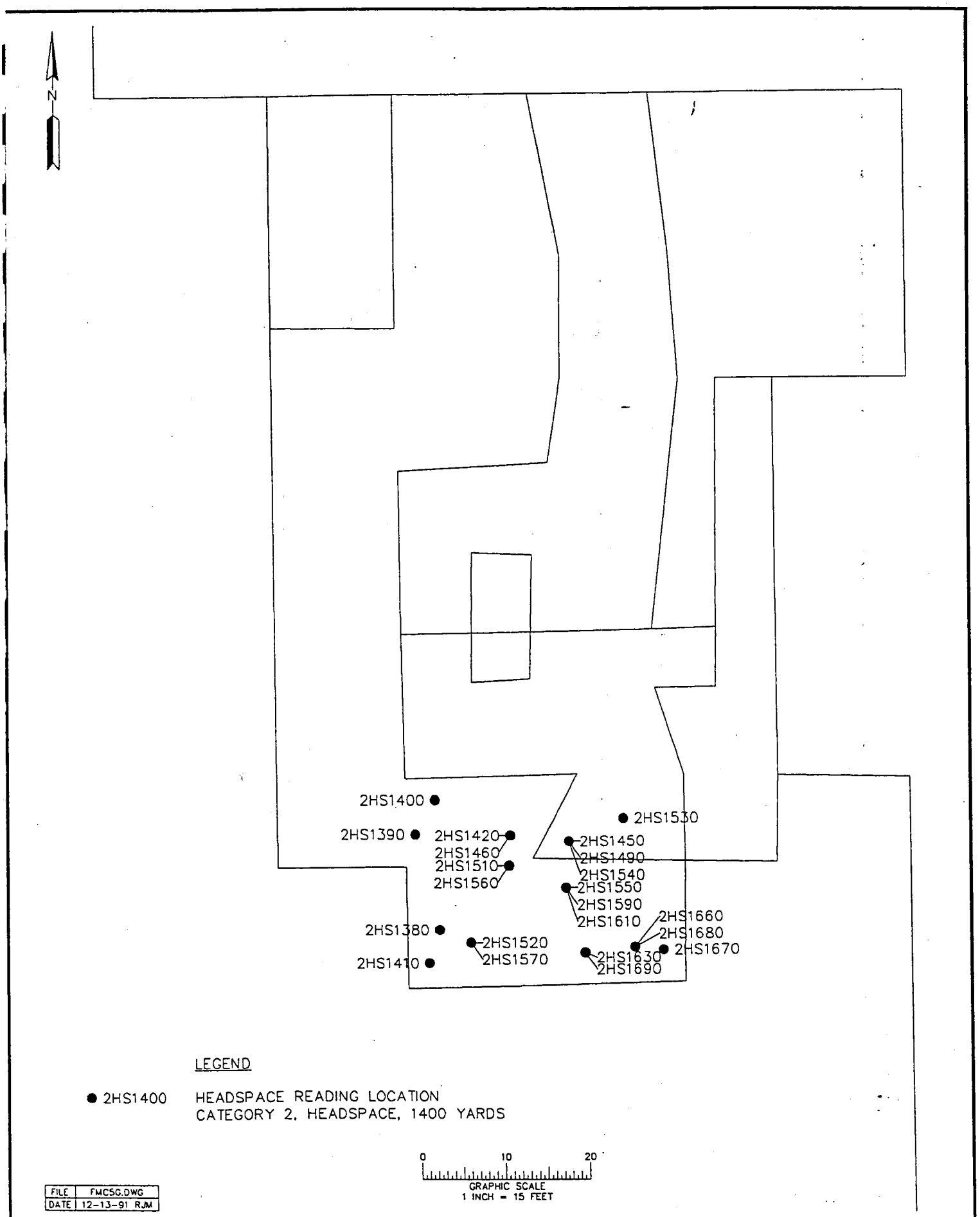
FMC CORPORATION	Wenck Associates, Inc. 1800 Pioneer Creek Ctr. Environmental Engineers Maple Plain, MN 55359	DEC 1991
Headspace Sampling Locations 3-6 ft.		Figure 5



FMC CORPORATION	Wenck Associates, Inc. Environmental Engineers 1800 Pioneer Creek Ctr. Maple Plain, MN 55359	DEC 1991
Headspace Sampling Locations 6-9.5 ft.		Figure 6



FMC CORPORATION	Wenck Associates, Inc. Environmental Engineers 1800 Pioneer Creek Ctr. Maple Plain, MN 55359	DEC 1991
Headspace Sampling Locations 9.5-15 ft.		Figure 7



FMC CORPORATION

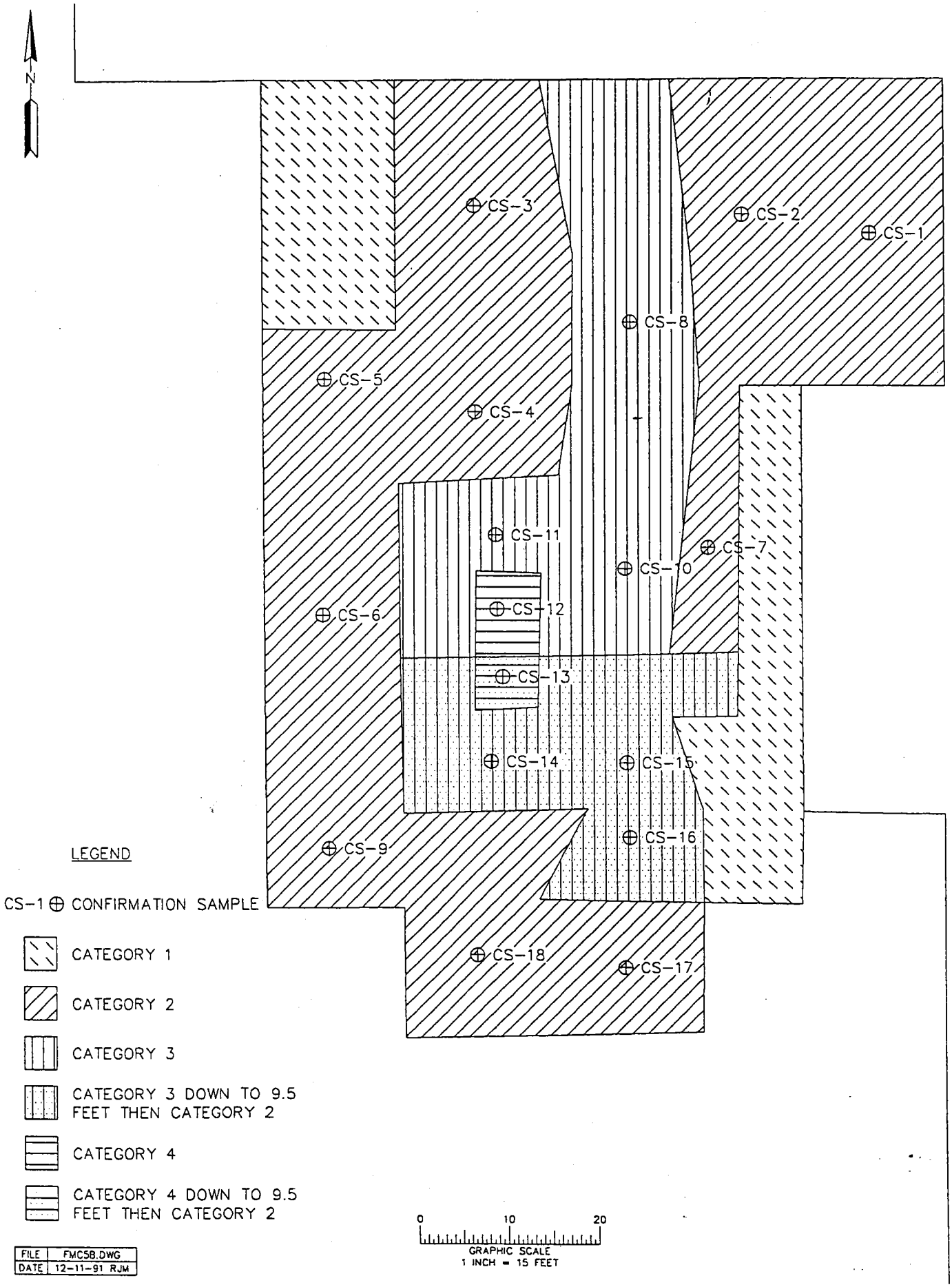
Headspace Sampling Locations 15-20 ft.

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Ctr.
Environmental Engineers Maple Plain, MN 55359

DEC 1991

Figure 8



FMC CORPORATION

Confirmation Sampling Locations

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Ctr.
Environmental Engineers Maple Plain, MN 55359

DEC 1991

Figure 9

Tables

TABLE 1

SOIL HEADSPACE ANALYSES

FMC Corporation

Sample Number(1)	Date Sampled	Date Analyzed	Depth (ft.)	Total Organic Vapor as Benzene (ppm)(2)
4HS3	22-Nov-91	22-Nov-91	0-3	123
2HS10	22-Nov-91	22-Nov-91	0-3	0
2HS20	22-Nov-91	22-Nov-91	0-3	3
2HS30	22-Nov-91	22-Nov-91	0-3	0
2HS40	22-Nov-91	22-Nov-91	0-3	0
2HS50	22-Nov-91	22-Nov-91	0-3	8
2HS60	22-Nov-91	22-Nov-91	0-3	9
2HS70	22-Nov-91	22-Nov-91	0-3	0
2HS80	22-Nov-91	22-Nov-91	0-3	317
3HS10	22-Nov-91	22-Nov-91	0-3	254
3HS20	22-Nov-91	22-Nov-91	0-3	512
3HS30	22-Nov-91	22-Nov-91	0-3	900
3HS40	22-Nov-91	22-Nov-91	0-3	468
2HS90	22-Nov-91	22-Nov-91	0-3	900
2HS100	22-Nov-91	22-Nov-91	0-3	168
2HS110	22-Nov-91	22-Nov-91	0-3	78
2HS120	22-Nov-91	22-Nov-91	0-3	71
2HS130	22-Nov-91	22-Nov-91	0-3	63
2HS140	22-Nov-91	22-Nov-91	0-3	227
2HS150	22-Nov-91	22-Nov-91	0-3	33
1HS10	22-Nov-91	22-Nov-91	0-3	18
1HS20	22-Nov-91	22-Nov-91	0-3	3
2HS160	22-Nov-91	22-Nov-91	0-3	158
2HS170	22-Nov-91	22-Nov-91	0-3	413
2HS180	22-Nov-91	22-Nov-91	0-3	143
2HS190	22-Nov-91	22-Nov-91	0-3	23
2HS200	22-Nov-91	22-Nov-91	0-3	45
3HS50	22-Nov-91	22-Nov-91	0-3	38
3HS60	22-Nov-91	22-Nov-91	0-3	135
3HS70	22-Nov-91	22-Nov-91	0-3	11
2HS210	22-Nov-91	22-Nov-91	0-3	24
2HS220	22-Nov-91	22-Nov-91	0-3	105
2HS230	22-Nov-91	22-Nov-91	0-3	33
2HS240	22-Nov-91	22-Nov-91	0-3	107
1HS30	22-Nov-91	22-Nov-91	0-3	0
1HS40	22-Nov-91	22-Nov-91	0-3	0
2HS250-A	22-Nov-91	22-Nov-91	0-3	0
3HS80	22-Nov-91	22-Nov-91	0-3	369

TABLE 1 (Cont.)

SOIL HEADSPACE ANALYSES

FMC Corporation

Sample Number(1)	Date Sampled	Date Analyzed	Depth (ft.)	Total Organic Vapor as Benzene (ppm)(2)
3HS90	22-Nov-91	22-Nov-91	0-3	174
3HS100	22-Nov-91	22-Nov-91	0-3	1125
3HS110	22-Nov-91	22-Nov-91	0-3	68
2HS250-B	25-Nov-91	25-Nov-91	0-3	660
1HS50	25-Nov-91	25-Nov-91	0-3	0
1HS60	25-Nov-91	25-Nov-91	0-3	6
1HS70	25-Nov-91	25-Nov-91	0-3	0
1HS80	25-Nov-91	25-Nov-91	0-3	14
3HS120	25-Nov-91	25-Nov-91	0-3	131
3HS130	25-Nov-91	25-Nov-91	0-3	273
3HS140	25-Nov-91	25-Nov-91	0-3	362
3HS150	25-Nov-91	25-Nov-91	0-3	152
3HS160	25-Nov-91	25-Nov-91	0-3	161
2HS260	25-Nov-91	25-Nov-91	0-3	33
2HS270	25-Nov-91	25-Nov-91	0-3	78
2HS280	25-Nov-91	25-Nov-91	0-3	153
2HS290	25-Nov-91	25-Nov-91	0-3	23
2HS300	25-Nov-91	25-Nov-91	0-3	41
1HS90	25-Nov-91	25-Nov-91	0-3	30
1HS100	25-Nov-91	25-Nov-91	0-3	0
1HS110	25-Nov-91	25-Nov-91	0-3	0
1HS120	25-Nov-91	25-Nov-91	0-3	0
1HS130	25-Nov-91	25-Nov-91	0-3	0
1HS140	25-Nov-91	25-Nov-91	0-3	5
2HS310	25-Nov-91	25-Nov-91	0-3	65
2HS320	25-Nov-91	25-Nov-91	0-3	9
2HS330	25-Nov-91	25-Nov-91	0-3	476
2HS340	25-Nov-91	25-Nov-91	0-3	41
2HS350	25-Nov-91	25-Nov-91	0-3	30
1HS150	25-Nov-91	25-Nov-91	0-3	36
1HS160	25-Nov-91	25-Nov-91	0-3	12
1HS170	25-Nov-91	25-Nov-91	0-3	50
1HS180	25-Nov-91	25-Nov-91	0-3	39
1HS190	25-Nov-91	25-Nov-91	0-3	9
1HS200	25-Nov-91	25-Nov-91	0-3	92
1HS210	25-Nov-91	25-Nov-91	0-3	587
1HS220	25-Nov-91	25-Nov-91	0-3	168

TABLE 1 (Cont.)

SOIL HEADSPACE ANALYSES

FMC Corporation

Sample Number(1)	Date Sampled	Date Analyzed	Depth (ft.)	Total Organic Vapor as Benzene (ppm)(2)
1HS230	25-Nov-91	25-Nov-91	0-3	33
1HS240	25-Nov-91	25-Nov-91	0-3	30
1HS250	25-Nov-91	25-Nov-91	0-3	0
2HS360	25-Nov-91	25-Nov-91	3-6	177
2HS370	25-Nov-91	25-Nov-91	3-6	5
2HS380	25-Nov-91	25-Nov-91	3-6	0
2HS390	25-Nov-91	25-Nov-91	3-6	0
2HS400	25-Nov-91	25-Nov-91	3-6	0
2HS410	25-Nov-91	25-Nov-91	3-6	158
3HS170	25-Nov-91	25-Nov-91	3-6	51
3HS180	25-Nov-91	25-Nov-91	3-6	11
1HS260	25-Nov-91	25-Nov-91	3-6	3
1HS270	25-Nov-91	25-Nov-91	3-6	6
1HS280	25-Nov-91	25-Nov-91	3-6	45
4HS10	25-Nov-91	25-Nov-91	3-6	185
4HS20	25-Nov-91	25-Nov-91	3-6	1800
3HS190	25-Nov-91	25-Nov-91	3-6	255
3HS200	25-Nov-91	25-Nov-91	3-6	516
3HS210	25-Nov-91	25-Nov-91	3-6	1800
3HS220	25-Nov-91	25-Nov-91	3-6	186
2HS420	25-Nov-91	25-Nov-91	3-6	213
2HS430	25-Nov-91	25-Nov-91	3-6	29
2HS440	25-Nov-91	25-Nov-91	3-6	3
2HS450	25-Nov-91	25-Nov-91	3-6	9
2HS460	25-Nov-91	25-Nov-91	3-6	12
2HS470	25-Nov-91	25-Nov-91	3-6	8
2HS480	25-Nov-91	25-Nov-91	3-6	0
2HS490	25-Nov-91	25-Nov-91	3-6	14
2HS500	25-Nov-91	25-Nov-91	3-6	140
2HS510	25-Nov-91	25-Nov-91	3-6	200
3HS230	25-Nov-91	25-Nov-91	3-6	3450
3HS240	25-Nov-91	25-Nov-91	3-6	3750
3HS250	25-Nov-91	25-Nov-91	3-6	2400
3HS260	25-Nov-91	25-Nov-91	3-6	3900
3HS270	25-Nov-91	25-Nov-91	3-6	6000
3HS280	25-Nov-91	25-Nov-91	3-6	1500
3HS290	25-Nov-91	25-Nov-91	3-6	6000
3HS300	25-Nov-91	25-Nov-91	3-6	2100

TABLE 1 (Cont.)

SOIL HEADSPACE ANALYSES

FMC Corporation

Sample Number(1)	Date Sampled	Date Analyzed	Depth (ft.)	Total Organic Vapor as Benzene (ppm)(2)
3HS310	25-Nov-91	25-Nov-91	3-6	6750
3HS320	25-Nov-91	25-Nov-91	3-6	3000
3HS330	25-Nov-91	25-Nov-91	3-6	4500
3HS340	25-Nov-91	25-Nov-91	3-6	6000
3HS350	25-Nov-91	25-Nov-91	3-6	2400
3HS360	25-Nov-91	25-Nov-91	3-6	3450
3HS370	25-Nov-91	25-Nov-91	3-6	510
3HS380	25-Nov-91	25-Nov-91	3-6	750
2HS520	26-Nov-91	26-Nov-91	3-6	0
2HS530	26-Nov-91	26-Nov-91	3-6	17
2HS540	26-Nov-91	26-Nov-91	3-6	369
2HS550	26-Nov-91	26-Nov-91	3-6	1050
2HS560	26-Nov-91	26-Nov-91	3-6	750
2HS570	26-Nov-91	26-Nov-91	3-6	1800
2HS580	26-Nov-91	26-Nov-91	3-6	1500
2HS590	26-Nov-91	26-Nov-91	3-6	75
2HS600	26-Nov-91	26-Nov-91	3-6	1275
2HS610	26-Nov-91	26-Nov-91	3-6	915
2HS620	26-Nov-91	26-Nov-91	3-6	53
2HS630	26-Nov-91	26-Nov-91	3-6	68
2HS640	26-Nov-91	26-Nov-91	3-6	218
2HS650	26-Nov-91	26-Nov-91	3-6	108
2HS660	26-Nov-91	26-Nov-91	3-6	5
3HS390	26-Nov-91	26-Nov-91	3-6	8
2HS670	26-Nov-91	26-Nov-91	3-6	24
2HS680	26-Nov-91	26-Nov-91	3-6	5
2HS690	26-Nov-91	26-Nov-91	3-6	6
2HS700	26-Nov-91	26-Nov-91	3-6	0
2HS710	26-Nov-91	26-Nov-91	3-6	5
2HS720	26-Nov-91	26-Nov-91	3-6	290
2HS730	26-Nov-91	26-Nov-91	3-6	120
3HS400	26-Nov-91	26-Nov-91	3-6	188
3HS410	26-Nov-91	26-Nov-91	3-6	330
3HS420	26-Nov-91	26-Nov-91	3-6	2
3HS430	26-Nov-91	26-Nov-91	3-6	6
2HS740	26-Nov-91	26-Nov-91	3-6	167
2HS750	26-Nov-91	26-Nov-91	3-6	182

TABLE 1 (Cont.)

SOIL HEADSPACE ANALYSES

FMC Corporation

Sample Number(1)	Date Sampled	Date Analyzed	Depth (ft.)	Total Organic Vapor as Benzene (ppm)(2)
1HS290	26-Nov-91	26-Nov-91	3-6	30
1HS300	26-Nov-91	26-Nov-91	3-6	30
1HS310	26-Nov-91	26-Nov-91	3-6	68
1HS320	26-Nov-91	26-Nov-91	3-6	60
1HS330	26-Nov-91	26-Nov-91	3-6	30
1HS340	26-Nov-91	26-Nov-91	3-6	12
1HS350	26-Nov-91	26-Nov-91	3-6	0
1HS360	26-Nov-91	26-Nov-91	3-6	0
2HS760	26-Nov-91	26-Nov-91	3-6	3
1HS370	26-Nov-91	26-Nov-91	3-6	15
1HS380	26-Nov-91	26-Nov-91	3-6	39
1HS390	26-Nov-91	26-Nov-91	3-6	12
2HS770	26-Nov-91	26-Nov-91	6-8	2
2HS780	26-Nov-91	26-Nov-91	6-8	98
2HS790	26-Nov-91	26-Nov-91	6-8	48
2HS800	26-Nov-91	26-Nov-91	6-9.5	11
2HS810	26-Nov-91	26-Nov-91	6-9.5	5
2HS820	26-Nov-91	26-Nov-91	6-9.5	3
2HS830	26-Nov-91	26-Nov-91	6-9.5	368
2HS840	26-Nov-91	26-Nov-91	6-9.5	0
2HS850	26-Nov-91	26-Nov-91	6-9.5	113
2HS860	26-Nov-91	26-Nov-91	6-9.5	105
2HS870	26-Nov-91	26-Nov-91	6-9.5	2400
2HS880	26-Nov-91	26-Nov-91	6-9.5	900
3HS440	26-Nov-91	26-Nov-91	6-9.5	15
3HS450	26-Nov-91	26-Nov-91	6-9.5	188
3HS460	26-Nov-91	26-Nov-91	6-9.5	14
2HS890	26-Nov-91	26-Nov-91	6-9.5	2400
2HS900	26-Nov-91	26-Nov-91	6-9.5	2400
2HS910	26-Nov-91	26-Nov-91	6-9.5	2250
3HS470	26-Nov-91	26-Nov-91	6-9.5	3000
2HS920	26-Nov-91	26-Nov-91	6-9.5	165
2HS930	26-Nov-91	26-Nov-91	6-9.5	128
2HS940	26-Nov-91	26-Nov-91	6-9.5	225
2HS950	26-Nov-91	26-Nov-91	6-9.5	135
3HS480	26-Nov-91	26-Nov-91	6-9.5	1275
3HS490	26-Nov-91	26-Nov-91	9.5-14.5	98
3HS500	26-Nov-91	26-Nov-91	9.5-14.5	18

TABLE 1 (Cont.)

SOIL HEADSPACE ANALYSES

FMC Corporation

Sample Number(1)	Date Sampled	Date Analyzed	Depth (ft.)	Total Organic Vapor as Benzene (ppm)(2)
3HS510	26-Nov-91	26-Nov-91	6-9.5	263
3HS520	26-Nov-91	26-Nov-91	6-9.5	2100
3HS530	26-Nov-91	26-Nov-91	6-9.5	1500
3HS540	26-Nov-91	26-Nov-91	6-9.5	518
3HS550	26-Nov-91	26-Nov-91	6-9.5	278
3HS560	26-Nov-91	26-Nov-91	6-9.5	443
3HS570	26-Nov-91	26-Nov-91	6-9.5	750
3HS580	26-Nov-91	26-Nov-91	6-9.5	456
3HS590	26-Nov-91	26-Nov-91	9.5-14.5	6
3HS600	26-Nov-91	26-Nov-91	6-9.5	1650
3HS610	26-Nov-91	26-Nov-91	6-9.5	590
2HS960	26-Nov-91	26-Nov-91	6-9.5	56
2HS970	26-Nov-91	26-Nov-91	6-9.5	0
2HS980	26-Nov-91	26-Nov-91	6-9.5	122
2HS990	26-Nov-91	26-Nov-91	6-9.5	33
2HS1000	26-Nov-91	26-Nov-91	6-9.5	9
3HS620	26-Nov-91	26-Nov-91	6-9.5	9
2HS1010	26-Nov-91	26-Nov-91	6-9.5	9
2HS1020	26-Nov-91	26-Nov-91	6-9.5	1
4HS30	26-Nov-91	26-Nov-91	6-9.5	750
4HS40	26-Nov-91	26-Nov-91	6-9.5	1125
3HS630	26-Nov-91	26-Nov-91	6-9.5	444
3HS640	26-Nov-91	26-Nov-91	6-9.5	8
3HS650	27-Nov-91	27-Nov-91	6-9.5	32
3HS660	27-Nov-91	27-Nov-91	6-9.5	663
3HS670	27-Nov-91	27-Nov-91	6-9.5	375
3HS680	27-Nov-91	27-Nov-91	6-9.5	360
2HS1030	27-Nov-91	27-Nov-91	6-9.5	3
2HS1040	27-Nov-91	27-Nov-91	6-9.5	137
2HS1050	27-Nov-91	27-Nov-91	6-9.5	36
2HS1060	27-Nov-91	27-Nov-91	9.5-13	9
2HS1070	27-Nov-91	27-Nov-91	9.5-13	0
3HS690	27-Nov-91	27-Nov-91	6-9.5	99
2HS1080	27-Nov-91	27-Nov-91	9.5-13	18
3HS700	27-Nov-91	27-Nov-91	6-9.5	219
3HS710	27-Nov-91	27-Nov-91	9.5-13	203
3HS720	27-Nov-91	27-Nov-91	6-9.5	113

TABLE 1 (Cont.)

SOIL HEADSPACE ANALYSES

FMC Corporation

Sample Number(1)	Date Sampled	Date Analyzed	Depth (ft.)	Total Organic Vapor as Benzene (ppm)(2)
2HS1090	27-Nov-91	27-Nov-91	9.5-15	122
2HS1100	27-Nov-91	27-Nov-91	9.5-15	3
2HS1110	27-Nov-91	27-Nov-91	9.5-15	32
2HS1120	27-Nov-91	27-Nov-91	9.5-15	12
2HS1130	27-Nov-91	27-Nov-91	9.5-15	5
2HS1140	27-Nov-91	27-Nov-91	9.5-15	12
2HS1150	27-Nov-91	27-Nov-91	9.5-15	234
2HS1160	27-Nov-91	27-Nov-91	9.5-15	263
2HS1170-A	27-Nov-91	27-Nov-91	9.5-15	18
3HS730	27-Nov-91	27-Nov-91	6-9.5	98
3HS740	27-Nov-91	27-Nov-91	6-9.5	294
3HS750	27-Nov-91	27-Nov-91	6-9.5	242
3HS760	27-Nov-91	27-Nov-91	6-9.5	377
3HS770	27-Nov-91	27-Nov-91	6-9.5	195
3HS780	27-Nov-91	27-Nov-91	6-9.5	122
3HS790	27-Nov-91	27-Nov-91	6-9.5	593
2HS1170-B	27-Nov-91	27-Nov-91	9.5-15	2700
2HS1180	27-Nov-91	27-Nov-91	9.5-15	225
2HS1190	27-Nov-91	27-Nov-91	9.5-15	153
2HS1200	27-Nov-91	27-Nov-91	9.5-15	108
2HS1210	27-Nov-91	27-Nov-91	9.5-15	125
2HS1220	27-Nov-91	27-Nov-91	9.5-15	632
2HS1230	27-Nov-91	27-Nov-91	9.5-15	660
2HS1240	27-Nov-91	27-Nov-91	9.5-15	1575
2HS1250	27-Nov-91	27-Nov-91	6-9.5	23
2HS1260	27-Nov-91	27-Nov-91	6-9.5	66
2HS1270	27-Nov-91	27-Nov-91	6-9.5	338
2HS1280	27-Nov-91	27-Nov-91	6-9.5	42
2HS1290	27-Nov-91	27-Nov-91	6-9.5	2
1HS400	27-Nov-91	27-Nov-91	3-6	0
2HS1300	27-Nov-91	27-Nov-91	9.5-15	60
2HS1310	27-Nov-91	27-Nov-91	9.5-15	122
2HS1320	27-Nov-91	27-Nov-91	9.5-15	122
2HS1330	27-Nov-91	27-Nov-91	9.5-15	32
2HS1340	27-Nov-91	27-Nov-91	9.5-15	84
2HS1350	27-Nov-91	27-Nov-91	9.5-15	444
2HS1360	27-Nov-91	27-Nov-91	9.5-15	293
2HS1370	27-Nov-91	27-Nov-91	9.5-15	204

TABLE 1 (Cont.)

SOIL HEADSPACE ANALYSES

FMC Corporation

Sample Number(1)	Date Sampled	Date Analyzed	Depth (ft.)	Total Organic Vapor as Benzene (ppm)(2)
2HS1380	27-Nov-91	27-Nov-91	17-18	116
2HS1390	27-Nov-91	27-Nov-91	17-18	267
2HS1400	27-Nov-91	27-Nov-91	17-18	594
2HS1410	27-Nov-91	27-Nov-91	17-18	114
2HS1420	27-Nov-91	27-Nov-91	17-18	431
1HS410	27-Nov-91	27-Nov-91	3-6	6
1HS420	27-Nov-91	27-Nov-91	3-6	6
2HS1430	27-Nov-91	27-Nov-91	6-8	116
2HS1440	27-Nov-91	27-Nov-91	6-8	101
2HS1450	27-Nov-91	27-Nov-91	15-19	333
2HS1460	27-Nov-91	27-Nov-91	15-19	446
2HS1470	27-Nov-91	27-Nov-91	9.5-15	483
2HS1480	27-Nov-91	27-Nov-91	9.5-15	410
2HS1490	27-Nov-91	27-Nov-91	15-19	332
2HS1500	27-Nov-91	27-Nov-91	9.5-15	369
2HS1510	27-Nov-91	27-Nov-91	15-19	480
2HS1520	27-Nov-91	27-Nov-91	15-19	330
2HS1530	27-Nov-91	27-Nov-91	15-19	368
2HS1540	27-Nov-91	27-Nov-91	15-19	632
2HS1550	27-Nov-91	27-Nov-91	15-20	407
2HS1560	27-Nov-91	27-Nov-91	15-20	611
2HS1570	27-Nov-91	27-Nov-91	15-20	219
1HS430	27-Nov-91	27-Nov-91	6-9.5	54
1HS440	27-Nov-91	27-Nov-91	6-9.5	2
2HS1580	27-Nov-91	27-Nov-91	9.5-15	518
2HS1590	27-Nov-91	27-Nov-91	15-20	360
2HS1600	27-Nov-91	27-Nov-91	9.5-15	168
2HS1610	27-Nov-91	27-Nov-91	15-20	275
2HS1620	27-Nov-91	27-Nov-91	9.5-15	99
2HS1630	27-Nov-91	27-Nov-91	15-20	129
2HS1640	27-Nov-91	27-Nov-91	9.5-15	191
2HS1650	27-Nov-91	27-Nov-91	9.5-15	114
2HS1660	27-Nov-91	27-Nov-91	15-20	114
2HS1670	27-Nov-91	27-Nov-91	15-20	128
2HS1680	27-Nov-91	27-Nov-91	15-20	105
2HS1690	27-Nov-91	27-Nov-91	15-20	152
2HS1700	27-Nov-91	27-Nov-91	Mixed(3)	60
2HS1710	27-Nov-91	27-Nov-91	Mixed(3)	363

TABLE 1 (Cont.)

SOIL HEADSPACE ANALYSES

FMC Corporation

Sample Number(1)	Date Sampled	Date Analyzed	Depth (ft.)	Total Organic Vapor as Benzene (ppm)(2)
2HS1720	27-Nov-91	27-Nov-91	Mixed(3)	288
2HS1730	27-Nov-91	27-Nov-91	Mixed(3)	353
2HS1740	27-Nov-91	27-Nov-91	Mixed(3)	588
2HS1750	27-Nov-91	27-Nov-91	Mixed(3)	29
2HS1760	27-Nov-91	27-Nov-91	Mixed(3)	293
2HS1770	27-Nov-91	27-Nov-91	Mixed(3)	174
2HS1780	27-Nov-91	27-Nov-91	Mixed(3)	203
2HS1790	27-Nov-91	27-Nov-91	Mixed(3)	263
2HS1800	27-Nov-91	27-Nov-91	Mixed(3)	203
2HS1810	27-Nov-91	27-Nov-91	Mixed(3)	143

NOTES:

(1) 1HS10=Category I soil, Headspace sample, From first 10 yds. removed.

(2) OVA detector response was recorded as total organic vapors as methane and multiplied by a factor of 1.5 to represent total organic vapors as a benzene equivalent.

(3) These soils were a mixture from the vicinity of control points B-6, B-20 and the southern sidewall of the excavation.

2HS250-A and 2HS250-B represent discrete ten yard headspace samples
2HS1170-A and 2HS1170-B represent discrete ten yard headspace samples

TABLE 2

CONFIRMATION SOIL SAMPLES ANALYTICAL RESULTS

FMC Corporation

Sample ID	Depth (ft.)	Date Sampled	Sampled By	Analyzed By	TPH as cutting oil (mg/kg)	Ethylbenzene (ug/kg)	Xylenes (ug/kg)	Other modified 8010/8020 Parameters (ug/kg)
CS-1	8.0	27-Nov-91	Wenck	ARC	BPQL<55	<14	<28	ND
CS-2	9.5	27-Nov-91	Wenck	ARC	BPQL<55	<14	<28	ND
CS-3	9.5	27-Nov-91	Wenck	ARC	BPQL<55	<14	<28	ND
CS-4	12.5	27-Nov-91	Wenck	ARC	4800	<14	<28	ND
CS-5	10.0	27-Nov-91	Wenck	ARC	BPQL<55	<14	<28	ND
CS-6	8.0	27-Nov-91	Wenck	ARC	BPQL<55	<14	<28	ND
CS-7	9.5	27-Nov-91	Wenck	ARC	BPQL<55	<14	<28	ND
CS-8	14.5	27-Nov-91	Wenck	ARC	BPQL<55	<14	<28	ND
CS-9	13.0	02-Dec-91	Wenck	ARC	1600	<14	<28	ND
CS-10	12.5	02-Dec-91	Wenck	ARC	680	<14	<28	ND
CS-11	12.5	02-Dec-91	Wenck	ARC	BPQL<55	<14	<28	ND
CS-12	12.5	02-Dec-91	Wenck	ARC	3800	<14	<28	ND
CS-13	20.0	02-Dec-91	Wenck	ARC	BPQL<55	BPQL<140	BPQL<280	ND
CS-14	20.0	02-Dec-91	Wenck	ARC	3800	<14	<28	ND
CS-15	20.0	02-Dec-91	Wenck	ARC	18000	410	1400	ND
CS-16	20.0	02-Dec-91	Wenck	ARC	13000	1300	2700	ND
CS-17	20.0	02-Dec-91	Wenck	ARC	20000	500	1000	ND
CS-18	20.0	02-Dec-91	Wenck	ARC	11000	920	2900	ND

NOTES:

TPH - Total Petroleum Hydrocarbons as Cutting Oil
BPQL - Below Pratical Quantitation Limit
Wenck - Wenck Associaties, Inc.
ARC - Aspen Research Corporation
ND - Not Detected

Appendix A

Laboratory Reports and Chain of Custody Documentation

ARC
Aspen Research Corporation
Turning Questions into Answers

December 13, 1991

Andrew Syverson
Wenck Associates, Inc.
1800 Pioneer Creek Center
Maple Plain , MN 55359

Reference:	WAI Project:	FMC
	W.O.#:	91-94
	ARC Project No:	3905, 3916
	Sampling Date/s:	November 27, December 2, 1991

Dear Mr. Syverson:

Enclosed are the results of our analyses related to the above referenced project.

The following parameters were analyzed as described in *Test Methods for the Evaluation of Solid Waste*, SW-846, Third Edition:

Parameter	Test Method
Volatile Organic Analytes	Modified EPA 8010/8020
TPH as Cutting Oil	EPA Method 8015

The determination of total petroleum hydrocarbons was performed by hexane extraction followed by analysis with high resolution gas chromatography using flame ionization detection. This method allows for the identification and quantification of petroleum type products within a specified molecular weight range (C-10 to C-36).

The product analysed in the soil extracts was found to resemble Lubekut which is a cutting oil. Since a site specific standard was not provided, and past data appeared incorrect, Lubekut was used to calibrate the instrument and quantify the samples.

The profile of Lubekut consist of two portions, a low and high molecular weight range. The light end range begins at approximately C-9 and ends approximately C-12. The high range begins approximately C-18 and ends approximately C-36. A similar profile is found in samples; CS-12, CS-15, CS-16, CS-17, CS-18. The light end portion was absent in samples CS-4, CS-9, CS-10, CS-14; however the high end range was still present. The absence of the light end portion may possibly be due to weathering or the solubility of those constituents. Chromatograms for samples CS-9, CS-10, CS-11, CS-13; contain constituents which elute prior to dodecane, C-10. These constituents were possibly introduced within the laboratory.

Method detection limits, MDLs, are specific to the analyte. Lubekut does not resemble any petroleum products for which ARC has established MDLs. Therefore ARC is unable to report *not detected* (ND) for Lubekut, as ND implies the concentration is less than a MDL which in this case has not been determined.

Thank you for using Aspen Research Corporation. We look forward to providing you with continued analytical service and support. As always, if you have questions or comments, or we can be of further assistance, please don't hesitate to call.

Respectfully,

Robert Miller
Associate Chemist
ASPEN RESEARCH CORPORATION

436 West County Road D
New Brighton, MN 55112-3522

Phone (612) 631-9234
FAX (612) 631-9270

Analytical Results for EPA Method 8010

WAI Project ID: FMC
Sampling Date: November 27, 1991
Analysis Date: December 2, 1991
ARC Project ID:3905

ARC Number:	16046	16050	16055	16060					
Sample ID:	CS1 8'	CS2 9.5'	CS3 9.5'	CS4 9.5'			LAB BLK		
	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	MDL	PQL	(ug/L)	MDL	PQL
Dichlorodifluoromethane	ND	ND	ND	ND	80	800	ND	0.6	6
Chloromethane	ND	ND	ND	ND	70	700	ND	0.5	5
Vinyl Chloride	ND	ND	ND	ND	27	270	ND	0.2	2
Bromomethane	ND	ND	ND	ND	40	400	ND	0.3	3
Chloroethane	ND	ND	ND	ND	70	700	ND	0.5	5
Trichlorofluoromethane	ND	ND	ND	ND	55	550	ND	0.4	4
1,1-Dichloroethene	ND	ND	ND	ND	14	140	ND	0.1	1
Methylene Chloride	ND	ND	ND	ND	27	270	ND	0.2	2
trans-1,2-Dichloroethene	ND	ND	ND	ND	27	270	ND	0.2	2
1,1-Dichloroethane	ND	ND	ND	ND	27	270	ND	0.2	2
Chloroform	ND	ND	ND	ND	27	270	ND	0.2	2
1,1,1-Trichloroethane	ND	ND	ND	ND	40	400	ND	0.3	3
Carbon Tetrachloride	ND	ND	ND	ND	55	550	ND	0.4	4
1,2-Dichloroethane	ND	ND	ND	ND	14	140	ND	0.1	1
Trichloroethene	ND	ND	ND	ND	40	400	ND	0.3	3
1,2-Dichloropropane	ND	ND	ND	ND	27	270	ND	0.2	2
Bromodichloromethane	ND	ND	ND	ND	27	270	ND	0.2	2
2-Chloroethyl vinyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	ND	ND	ND	ND	8	80	ND	0.06	0.6
trans-1,3-Dichloropropene	ND	ND	ND	ND	5	50	ND	0.04	0.4
1,1,2-Trichloroethane	ND	ND	ND	ND	27	270	ND	0.2	2
Tetrachloroethene	ND	ND	ND	ND	27	270	ND	0.2	2
Dibromochloromethane	ND	ND	ND	ND	14	140	ND	0.1	1
Chlorobenzene	ND	ND	ND	ND	12	120	ND	0.09	0.9
Bromoform	ND	ND	ND	ND	27	270	ND	0.2	2
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	27	270	ND	0.2	2
1,3-Dichlorobenzene	ND	ND	ND	ND	10	100	ND	0.08	0.8
1,4-Dichlorobenzene	ND	ND	ND	ND	10	100	ND	0.07	0.7
1,2-Dichlorobenzene	ND	ND	ND	ND	12	120	ND	0.09	0.9
ELCD File Spec. E00000-	60.04R	60.05R	60.06R	60.07R			60.02R		

Key:

ND = Not Detected
MDL = Method Detection Limit
PQL = Practical Quantitation Limit
BPQL = Below Practical Quantitation Limit

Analytical Results for EPA Method 8010

WAI Project ID: FMC
Sampling Date: November 27 , 1991
Analysis Date: December 2, 1991
ARC Project ID:3905

ARC Number:	16065	16070	16075	16080					
Sample ID:	CS5 10'	CS6 8'	CS7 9.5'	CS8 14.5			LAB BLK		
	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	MDL	PQL	(ug/L)	MDL	PQL
Dichlorodifluoromethane	ND	ND	ND	ND	80	800	ND	0.6	6
Chloromethane	ND	ND	ND	ND	70	700	ND	0.5	5
Vinyl Chloride	ND	ND	ND	ND	27	270	ND	0.2	2
Bromomethane	ND	ND	ND	ND	40	400	ND	0.3	3
Chloroethane	ND	ND	ND	ND	70	700	ND	0.5	5
Trichlorofluoromethane	ND	ND	ND	ND	55	550	ND	0.4	4
1,1-Dichloroethene	ND	ND	ND	ND	14	140	ND	0.1	1
Methylene Chloride	ND	ND	ND	ND	27	270	ND	0.2	2
trans-1,2-Dichloroethene	ND	ND	ND	ND	27	270	ND	0.2	2
1,1-Dichloroethane	ND	ND	ND	ND	27	270	ND	0.2	2
Chloroform	ND	ND	ND	ND	27	270	ND	0.2	2
1,1,1-Trichloroethane	ND	ND	ND	ND	40	400	ND	0.3	3
Carbon Tetrachloride	ND	ND	ND	ND	55	550	ND	0.4	4
1,2-Dichloroethane	ND	ND	ND	ND	14	140	ND	0.1	1
Trichloroethene	ND	ND	ND	ND	40	400	ND	0.3	3
1,2-Dichloropropane	ND	ND	ND	ND	27	270	ND	0.2	2
Bromodichloromethane	ND	ND	ND	ND	27	270	ND	0.2	2
2-Chloroethyl vinyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	ND	ND	ND	ND	8	80	ND	0.06	0.6
trans-1,3-Dichloropropene	ND	ND	ND	ND	5	50	ND	0.04	0.4
1,1,2-Trichloroethane	ND	ND	ND	ND	27	270	ND	0.2	2
Tetrachloroethene	ND	ND	ND	ND	27	270	ND	0.2	2
Dibromochloromethane	ND	ND	ND	ND	14	140	ND	0.1	1
Chlorobenzene	ND	ND	ND	ND	12	120	ND	0.09	0.9
Bromoform	ND	ND	ND	ND	27	270	ND	0.2	2
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	27	270	ND	0.2	2
1,3-Dichlorobenzene	ND	ND	ND	ND	10	100	ND	0.08	0.8
1,4-Dichlorobenzene	ND	ND	ND	ND	10	100	ND	0.07	0.7
1,2-Dichlorobenzene	ND	ND	ND	ND	12	120	ND	0.09	0.9
ELCD File Spec. E00000-	60.08R	60.09R	60.10R	60.11R			60.02R		

Key:

ND = Not Detected
MDL = Method Detection Limit
PQL = Practical Quantitation Limit
BPQL = Below Practical Quantitation Limit

Analytical Results for EPA Method 8010

WAI Project ID: FMC
Sampling Date: December 2, 1991
Analysis Date: December 4, 1991
ARC Project ID:3916

ARC Number:	16094	16099	16104	16109					
Sample ID:	CS-9	CS-10	CS-11	CS-13			LAB BLK		
	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	MDL	PQL	(ug/L)	MDL	PQL
Dichlorodifluoromethane	ND	ND	ND	ND	80	800	ND	0.6	6
Chloromethane	ND	ND	ND	ND	70	700	ND	0.5	5
Vinyl Chloride	ND	ND	ND	ND	27	270	ND	0.2	2
Bromomethane	ND	ND	ND	ND	40	400	ND	0.3	3
Chloroethane	ND	ND	ND	ND	70	700	ND	0.5	5
Trichlorofluoromethane	ND	ND	ND	ND	55	550	ND	0.4	4
1,1-Dichloroethene	ND	ND	ND	ND	14	140	ND	0.1	1
Methylene Chloride	ND	ND	ND	ND	27	270	ND	0.2	2
trans-1,2-Dichloroethene	ND	ND	ND	ND	27	270	ND	0.2	2
1,1-Dichloroethane	ND	ND	ND	ND	27	270	ND	0.2	2
Chloroform	ND	ND	ND	ND	27	270	ND	0.2	2
1,1,1-Trichloroethane	ND	ND	ND	ND	40	400	ND	0.3	3
Carbon Tetrachloride	ND	ND	ND	ND	55	550	ND	0.4	4
1,2-Dichloroethane	ND	ND	ND	ND	14	140	ND	0.1	1
Trichloroethene	ND	ND	ND	ND	40	400	ND	0.3	3
1,2-Dichloropropane	ND	ND	ND	ND	27	270	ND	0.2	2
Bromodichloromethane	ND	ND	ND	ND	27	270	ND	0.2	2
2-Chloroethyl vinyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	ND	ND	ND	ND	8	80	ND	0.06	0.6
trans-1,3-Dichloropropene	ND	ND	ND	ND	5	50	ND	0.04	0.4
1,1,2-Trichloroethane	ND	ND	ND	ND	27	270	ND	0.2	2
Tetrachloroethene	ND	ND	ND	ND	27	270	ND	0.2	2
Dibromochloromethane	ND	ND	ND	ND	14	140	ND	0.1	1
Chlorobenzene	ND	ND	ND	ND	12	120	ND	0.09	0.9
Bromoform	ND	ND	ND	ND	27	270	ND	0.2	2
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	27	270	ND	0.2	2
1,3-Dichlorobenzene	ND	ND	ND	ND	10	100	ND	0.08	0.8
1,4-Dichlorobenzene	ND	ND	ND	ND	10	100	ND	0.07	0.7
1,2-Dichlorobenzene	ND	ND	ND	ND	12	120	ND	0.09	0.9
ELCD File Spec. E00000-	60.20R	60.21R	60.22R	60.23R			60.19R		

Key:

ND = Not Detected
MDL = Method Detection Limit
PQL = Practical Quantitation Limit
BPQL = Below Practical Quantitation Limit

Analytical Results for EPA Method 8010

WAI Project ID: FMC
Sampling Date: December 2, 1991
Analysis Date: December 4, 1991
ARC Project ID:3916

ARC Number:	16134	16139					
Sample ID:	CS-17	CS-18			LAB BLK		
	(ug/kg)	(ug/kg)	MDL	PQL	(ug/L)	MDL	PQL
Dichlorodifluoromethane	ND	ND	80	800	ND	0.6	6
Chloromethane	ND	ND	70	700	ND	0.5	5
Vinyl Chloride	ND	ND	27	270	ND	0.2	2
Bromomethane	ND	ND	40	400	ND	0.3	3
Chloroethane	ND	ND	70	700	ND	0.5	5
Trichlorofluoromethane	ND	ND	55	550	ND	0.4	4
1,1-Dichloroethene	ND	ND	14	140	ND	0.1	1
Methylene Chloride	ND	ND	27	270	ND	0.2	2
trans-1,2-Dichloroethene	ND	ND	27	270	ND	0.2	2
1,1-Dichloroethane	ND	ND	27	270	ND	0.2	2
Chloroform	ND	ND	27	270	ND	0.2	2
1,1,1-Trichloroethane	ND	ND	40	400	ND	0.3	3
Carbon Tetrachloride	ND	ND	55	550	ND	0.4	4
1,2-Dichloroethane	ND	ND	14	140	ND	0.1	1
Trichloroethene	ND	ND	40	400	ND	0.3	3
1,2-Dichloropropane	ND	ND	27	270	ND	0.2	2
Bromodichloromethane	ND	ND	27	270	ND	0.2	2
2-Chloroethyl vinyl ether	NA	NA	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	ND	ND	8	80	ND	0.06	0.6
trans-1,3-Dichloropropene	ND	ND	5	50	ND	0.04	0.4
1,1,2-Trichloroethane	ND	ND	27	270	ND	0.2	2
Tetrachloroethene	ND	ND	27	270	ND	0.2	2
Dibromochloromethane	ND	ND	14	140	ND	0.1	1
Chlorobenzene	ND	ND	12	120	ND	0.09	0.9
Bromoform	ND	ND	27	270	ND	0.2	2
1,1,2,2-Tetrachloroethane	ND	ND	27	270	ND	0.2	2
1,3-Dichlorobenzene	ND	ND	10	100	ND	0.08	0.8
1,4-Dichlorobenzene	ND	ND	10	100	ND	0.07	0.7
1,2-Dichlorobenzene	ND	ND	12	120	ND	0.09	0.9
ELCD File Spec.							
E00000-	60.29R	60.30R			60.26R		

Key:

ND = Not Detected
MDL = Method Detection Limit
PQL = Practical Quantitation Limit
BPQL = Below Practical Quantitation Limit

Analytical Results for BETX by EPA Method 8020

Project ID: FMC
Sampling Date: November 27, 1991
Analysis Date: December 2, 1991
ARC Project ID: 3905

ARC Number:	16045	16050	16055	16060					
Sample ID:	CS-1	CS-2	CS-3	CS-4	MDL	PQL	Lab Blank	MDL	PQL
	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)			(ug/L)		
Benzene	ND	ND	ND	ND	14	140	ND	0.1	1
Ethylbenzene	ND	ND	ND	ND	14	140	ND	0.1	1
Toluene	ND	ND	ND	ND	14	140	ND	0.1	1
Xylenes	ND	ND	ND	ND	28	280	ND	0.2	2
PID Filespec									
P00000-	60.04R	60.05R	60.06R	60.07R			60.02R		

Key:

ND = Not Detected
MDL = Method Detection Limit
PQL = Practical Quantitation Limit
BPQL = Below Practical Quantitation Limit

Analytical Results for BETX by EPA Method 8020

Project ID: FMC
Sampling Date: November 27, 1991
Analysis Date: December 2, 1991
ARC Project ID: 3905

ARC Number:	16065	16070	16075	16080					
Sample ID:	CS-5	CS-6	CS-7	CS-8	MDL	PQL	Lab Blank	MDL	PQL
	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)			(ug/L)		
Benzene	ND	ND	ND	ND	14	140	ND	0.1	1
Ethylbenzene	ND	ND	ND	ND	14	140	ND	0.1	1
Toluene	ND	ND	ND	ND	14	140	ND	0.1	1
Xylenes	ND	ND	ND	ND	28	280	ND	0.2	2
PID Filespec									
P00000-	60.08R	60.09R	60.10R	60.11R			60.02R		

Key:

ND = Not Detected
MDL = Method Detection Limit
PQL = Practical Quantitation Limit
BPQL = Below Practical Quantitation Limit

Analytical Results for BETX by EPA Method 8020

Project ID: FMC
Sampling Date: December 2, 1991
Analysis Date: December 4, 1991
ARC Project ID: 3916

ARC Number:	16094	16099	16104	16109					
Sample ID:	CS-9	CS-10	CS-11	CS-13	MDL	PQL	Lab Blank	MDL	PQL
	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)			(ug/L)		
Benzene	ND	ND	ND	ND	14	140	ND	0.1	1
Ethylbenzene	ND	ND	ND	BPQL	14	140	ND	0.1	1
Toluene	ND	ND	ND	ND	14	140	ND	0.1	1
Xylenes	ND	ND	ND	BPQL	28	280	ND	0.2	2
PID Filespec									
P00000-	60.20R	60.21R	60.22R	60.23R			60.19R		

Key:

ND = Not Detected
MDL = Method Detection Limit
PQL = Practical Quantitation Limit
BPQL = Below Practical Quantitation Limit

Analytical Results for BETX by EPA Method 8020

Project ID: FMC
Sampling Date: December 2, 1991
Analysis Date: December 4, 1991
ARC Project ID: 3916

ARC Number:	16114	16119	16124	16129					
Sample ID:	CS-14	CS-15	CS-12	CS-16	MDL	PQL	Lab Blank	MDL	PQL
	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)			(ug/L)		
Benzene	ND	ND	ND	ND	14	140	ND	0.1	1
Ethylbenzene	ND	410	ND	1300	14	140	ND	0.1	1
Toluene	ND	ND	ND	ND	14	140	ND	0.1	1
Xylenes	ND	1400	ND	2700	28	280	ND	0.2	2
PID Filespec									
P00000-	60.24R	60.25R	60.27R	60.28R			60.26R		

Key:

ND = Not Detected
MDL = Method Detection Limit
PQL = Practical Quantitation Limit
BPQL = Below Practical Quantitation Limit

Analytical Results for BETX by EPA Method 8020

Project ID: FMC
Sampling Date: December 2, 1991
Analysis Date: December 4, 1991
ARC Project ID: 3916

ARC Number:	16134	16139					
Sample ID:	CS-17	CS-18	MDL	PQL	Lab Blank	MDL	PQL
	(ug/kg)	(ug/kg)			(ug/L)		
Benzene	ND	ND	14	140	ND	0.1	1
Ethylbenzene	500	920	14	140	ND	0.1	1
Toluene	ND	ND	14	140	ND	0.1	1
Xylenes	1000	2900	28	280	ND	0.2	2
PID Filespec							
P00000-	60.29R	60.30R			60.26R		

Key:

ND = Not Detected
MDL = Method Detection Limit
PQL = Practical Quantitation Limit
BPQL = Below Practical Quantitation Limit

Analysis of Total Petroleum Hydrocarbons Greater than Dodecane
using Hexane Extraction and On Column Injection HRGC/FID

Client Project ID: FMC
ARC Project ID: 3905
Sampling Date: November 27, 1991
Analysis Date: December 5-10, 1991

Sample ID	ARC#	TPH (mg/kg)	File Spec. A00000-	Product ID
CS-1 8ft	16044	BPQL	19.19	
CS-2 9.5ft	16049	BPQL	19.20	
CS-3 9.5ft	16054	BPQL	19.21	--
CS-4 12.5ft	16059	4800	19.07	**Cutting Oil
CS-5 10ft	16064	BPQL	18.85	
CS-6 8ft	16069	BPQL	18.86	
CS-7 9.5ft	16074	BPQL	18.87	
CS-8 14.5ft	16079	BPQL	18.88	
Method Blank		BPQL	19.23	

PQL Lubekut(cutting oil) 55 mg/kg

ND = Not Detected
PQL = Practical Quantitation Limit
BPQL = Below Practical Quanitation Limit (the compound was detected at a concentration above the MDL but below the PQL)

** Lubekut cutting oil was used for calibration, see chromatograms.

* Product nature is determined based on comparison to standard petroleum products. Weathered products may exhibit changes in relative concentrations of standard constituents making making products identification tentative.

Analysis of Total Petroleum Hydrocarbons Greater than Dodecane
using Hexane Extraction and On Column Injection HRGC/FID

Client Project ID: FMC
ARC Project ID: 3916
Sampling Date: November 27, 1991
Analysis Date: December 5-10, 1991

Sample ID	ARC#	TPH (mg/kg)	File Spec. A00000-	Product ID
CS-9 13ft	16093	1600	18.93	**Cutting Oil
CS-10 12.5ft	16098	680	18.94	**Cutting Oil
CS-11 12.5ft	16103	BPQL	18.95	
CS-12 12.5ft	16123	3800	18.99	**Cutting Oil
CS-13 20ft	16108	BPQL	18.96	
CS-14 20ft	16113	3800	18.97	**Cutting Oil
CS-15 20ft	16118	18000	18.98	**Cutting Oil
CS-16 20ft	16128	13000	19.00	**Cutting Oil
CS-17 20ft	16133	20000	19.01	**Cutting Oil
CS-18 20ft	16138	11000	19.02	**Cutting Oil
Method Blank		BPQL	19.23	

PQL Lubekut(cutting oil) 55 mg/kg

ND = Not Detected
PQL = Practical Quantitation Limit
BPQL = Below Practical Quanitation Limit (the compound was detected at a concentration above the MDL but below the PQL)

** Lubekut cutting oil was used for calibration, see chromatograms.

* Product nature is determined based on comparison to standard petroleum products. Weathered products may exhibit changes in relative concentrations of standard constituents making making products identification tentative.

Wenck Associates, Inc.
1800 Pioneer Creek Dr.
Maple Plain, MN 55359
(612) 479-4200

CHAIN OF CUSTODY RECORD

FIELD COORDINATOR: Brian Holst

PROJ. NO.: 91-94

PROJECT NAME: FMC

SAMPLERS (Signature): Andrew E. Syverson

AIRBILL NO.:

STA. NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NUMBER OF CONTAINERS	TPH 8015*	Solvents 8010/8020	Mod. 8010/8020	4x not outline of proposed		
1	11/1 1991	1:15 p.m.		✓	CS-1 8.0 ft.	5-20z.	✓		✓			
2	"	1:45 p.m.		✓	CS-2 9.5 ft.	"	✓		✓			
3	"	2:00 p.m.		✓	CS-3 9.5 ft.	"	✓		✓			
4	"	2:30 p.m.		✓	CS-4 9.5 ft.	"	✓		✓			
5	"	2:50 p.m.		✓	CS-5 10.0 ft.	"	✓		✓			
6	"	3:30 p.m.		✓	CS-6 8.0 ft.	"	✓		✓			
7	"	4:00 p.m.		✓	CS-7 9.5 ft.	"	✓		✓			
8	"	4:30 p.m.		✓	CS-8 14.5 ft.	"	✓		✓			

REMARKS:
* Call Andrew Syverson 4-545-9378 if you have any question!
5 day turnaround
*would like numbers ASAP

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Relinquished by: (Signature)	Date	Time	Received by: (Signature)
[signature]	11/27/91	4:45	[signature]				
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Relinquished by: (Signature)	Date	Time	Received by: (Signature)

Relinquished by: (Signature)	Date	Time	Received for Laboratory by: (Signature)	Date	Time	Remarks
			[signature] ARC	11/27/91	17:18	

DISTRIBUTION: Original Accompanies Shipment; Copy to Coordinator Field Files

Wenck Associates, Inc.
1800 Pioneer Creek Dr.
Maple Plain, MN 55359
(612) 479-4200

CHAIN OF CUSTODY RECORD

FIELD COORDINATOR: Brian Holst

PROJ. NO.: 91-94

PROJECT NAME: FMC

SAMPLERS (Signature): Charles E. Anderson

AIRBILL NO.:

STA. NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NUMBER OF CONTAINERS	TPH as Jet Fuel by EPA 8015			Modified 8010/8020	Please Sheet Submitted with Sampler	CS-1 - CS-8	REMARKS
1	12/1/91	9:20 a.m.		✓	CS-9	5-2oz	✓			✓			5-day Turnaround
2	"	9:50 a.m.		✓	CS-10	"	✓			✓			
3	"	10:15 a.m.		✓	CS-11	"	✓			✓			
4	"	10:50 a.m.		✓	CS-13	"	✓			✓			
5	"	11:20 a.m.		✓	CS-14	"	✓			✓			
6	"	11:50 a.m.		✓	CS-15	"	✓			✓			
7	"	12:15 p.m.		✓	CS-12	"	✓			✓			
8	"	12:30 p.m.		✓	CS-16	"	✓			✓			
9	"	12:50 p.m.		✓	CS-17	"	✓			✓			
10	"	1:30 p.m.		✓	CS-18	"	✓			✓			

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Relinquished by: (Signature)	Date	Time	Received by: (Signature)
Charles E. Anderson	12/2/91	2:20 p.m.					
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Relinquished by: (Signature)	Date	Time	Received by: (Signature)

Relinquished by: (Signature)	Date	Time	Received for Laboratory by: (Signature)	Date	Time	Remarks
			[illegible]	[illegible]	[illegible]	

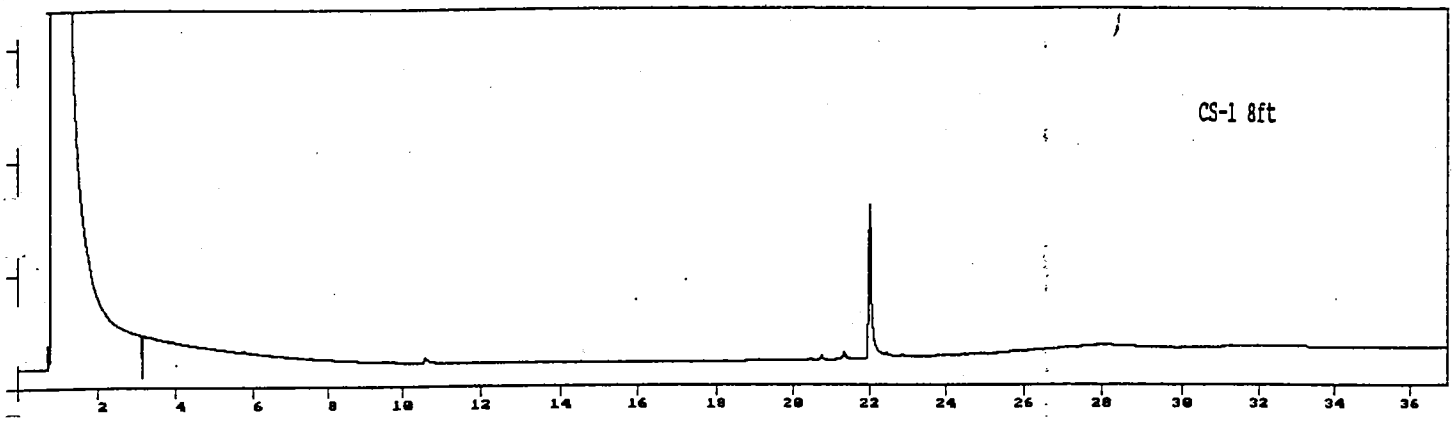
DISTRIBUTION: Original Accompanies Shipment; Copy to Coordinator Field Files

Appendix B

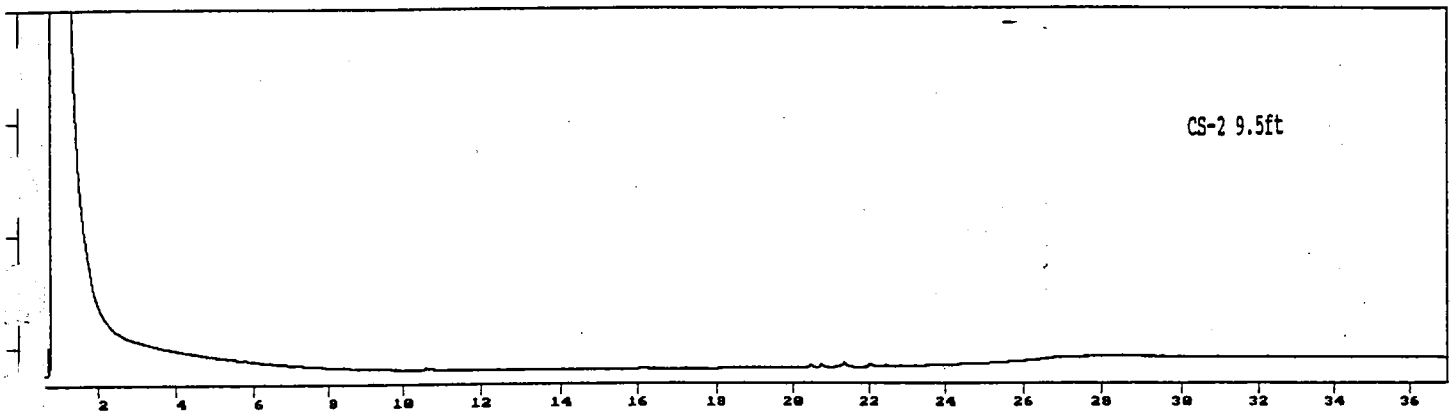
Chromatograms Comparing TPH Standards

Chrom Perfect COMPARE Program output. Date = 12-13-1991 Time = 10:07:59

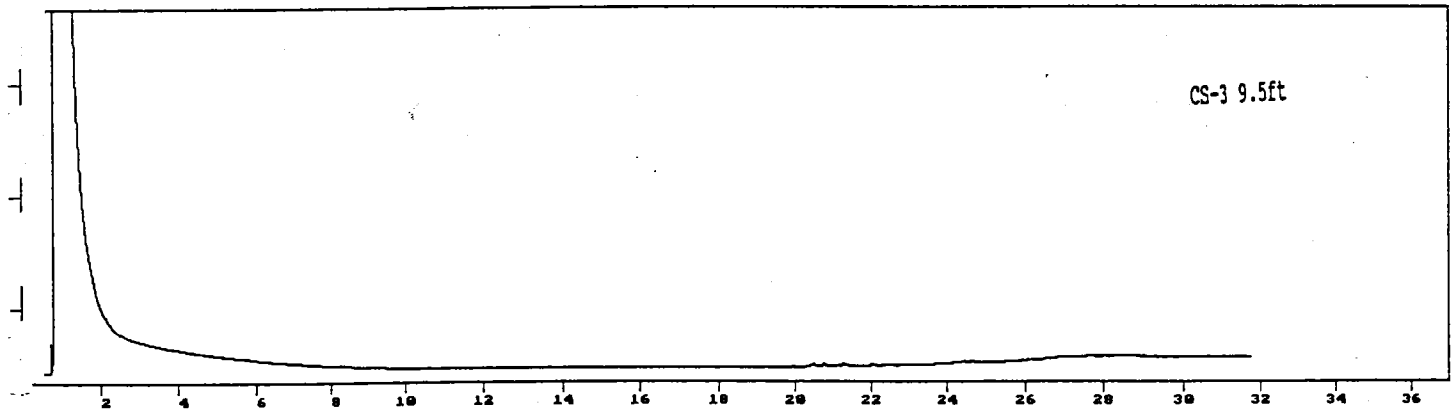
File=D:\cp\df\A0000019.19R from 0.00 to 37.00 min. Low Y = -0.13382 mv High Y = 4.86618 mv Span = 5.00000mv



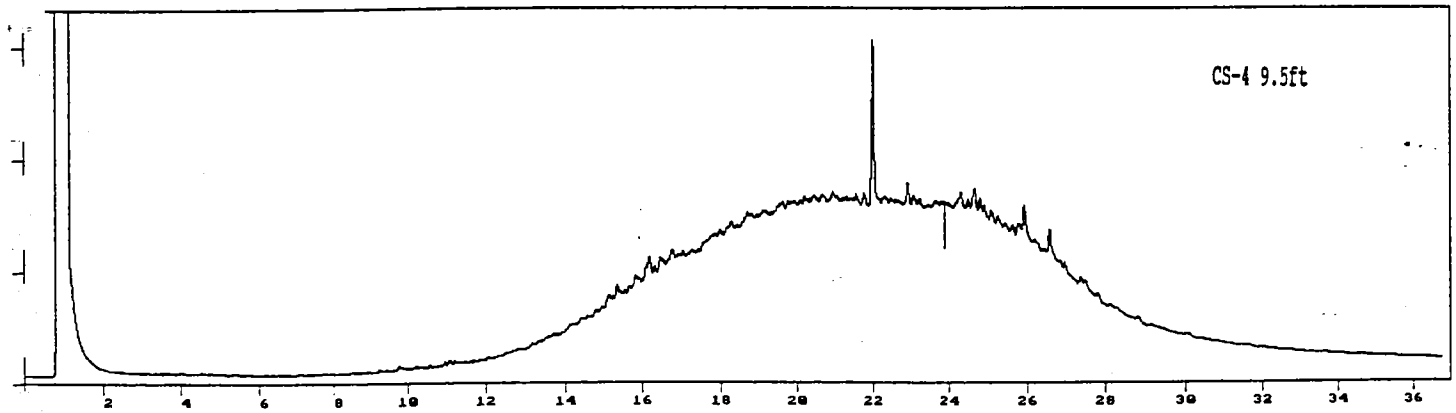
e=D:\cp\df\A0000019.20R from 0.00 to 37.00 min. Low Y = -0.01197 mv High Y = 4.98803 mv Span = 5.00000mv



File=D:\cp\df\A0000019.21R from 0.00 to 37.00 min. Low Y = -0.01004 mv High Y = 4.98996 mv Span = 5.00000mv

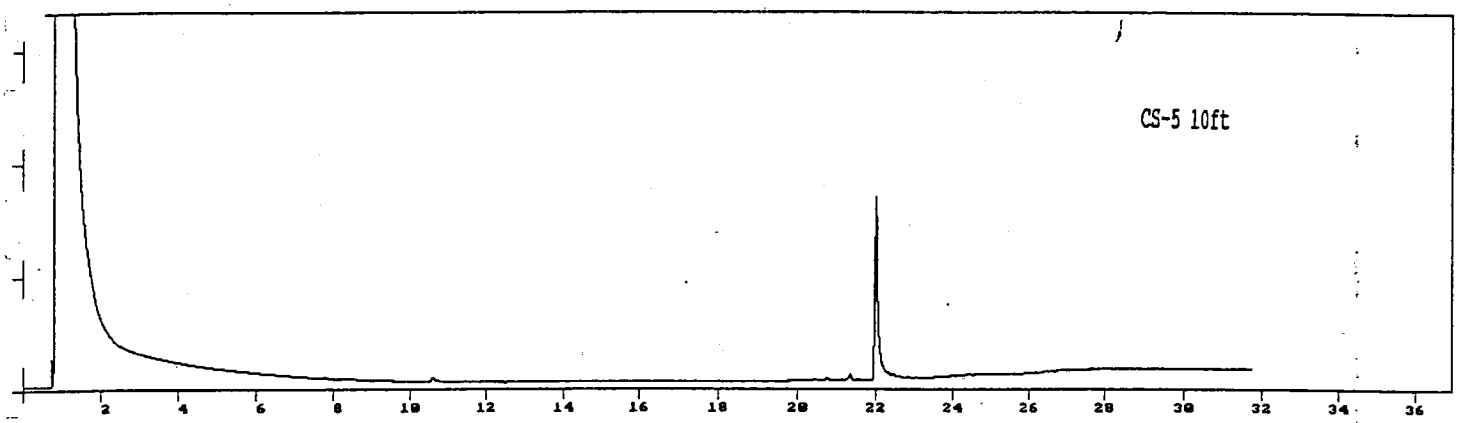


e=D:\cp\df\A0000019.07R from 0.00 to 37.00 min. Low Y = -0.46450 mv High Y = 30.00000 mv Span = 30.46450mv

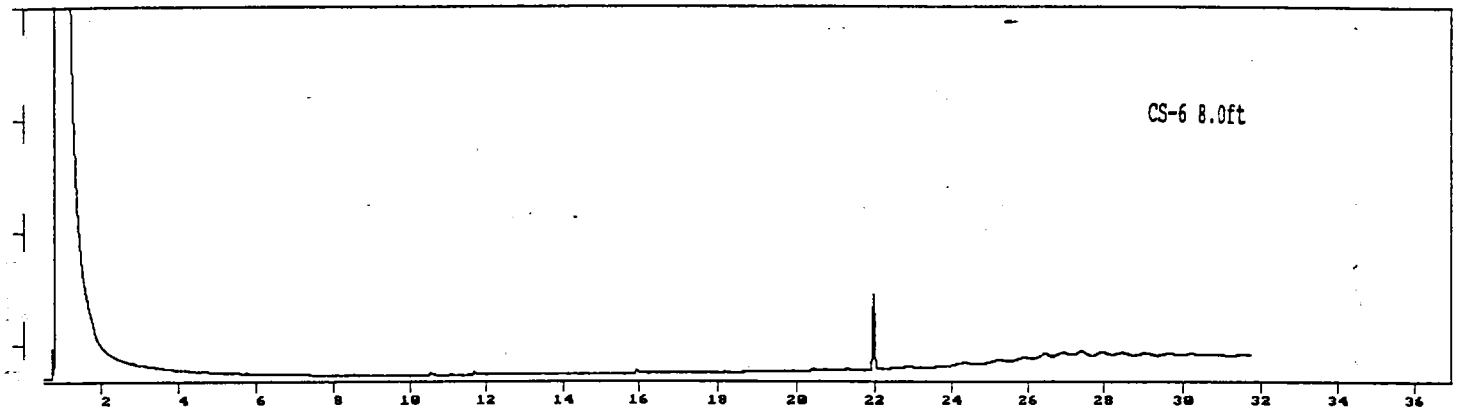


Chrom Perfect COMPARE Program output. Date = 12-13-1991 Time = 10:29:35

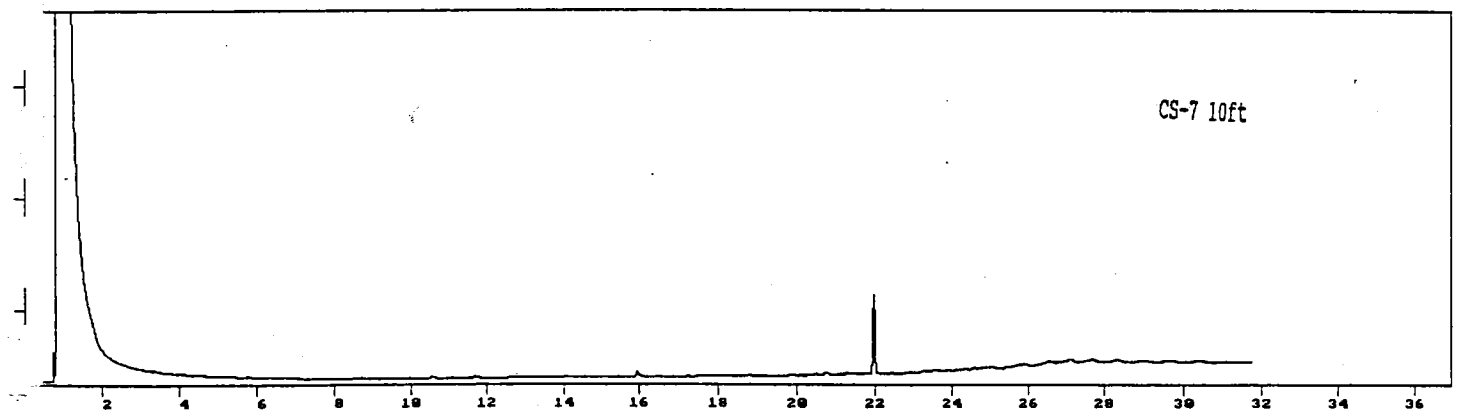
File=D:\cp\df\A0000019.22R from 0.00 to 37.00 min. Low Y = 0.08354 mv High Y = 5.08354 mv Span = 5.00000mv



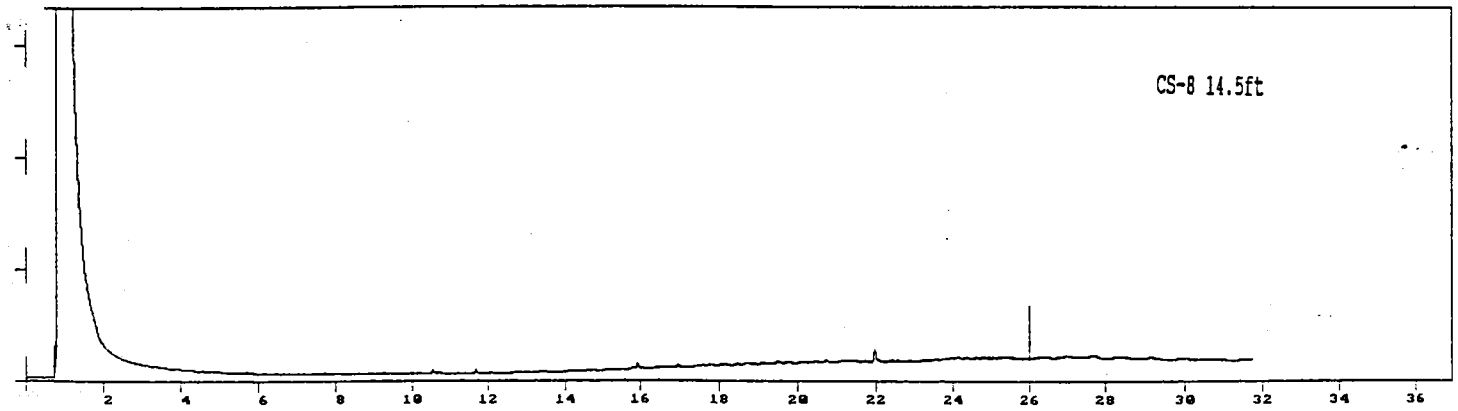
e=D:\cp\df\A0000018.86R from 0.00 to 37.00 min. Low Y = 0.12531 mv High Y = 5.12531 mv Span = 5.00000mv



File=D:\cp\df\A0000018.87R from 0.00 to 37.00 min. Low Y = 0.11591 mv High Y = 5.11591 mv Span = 5.00000mv

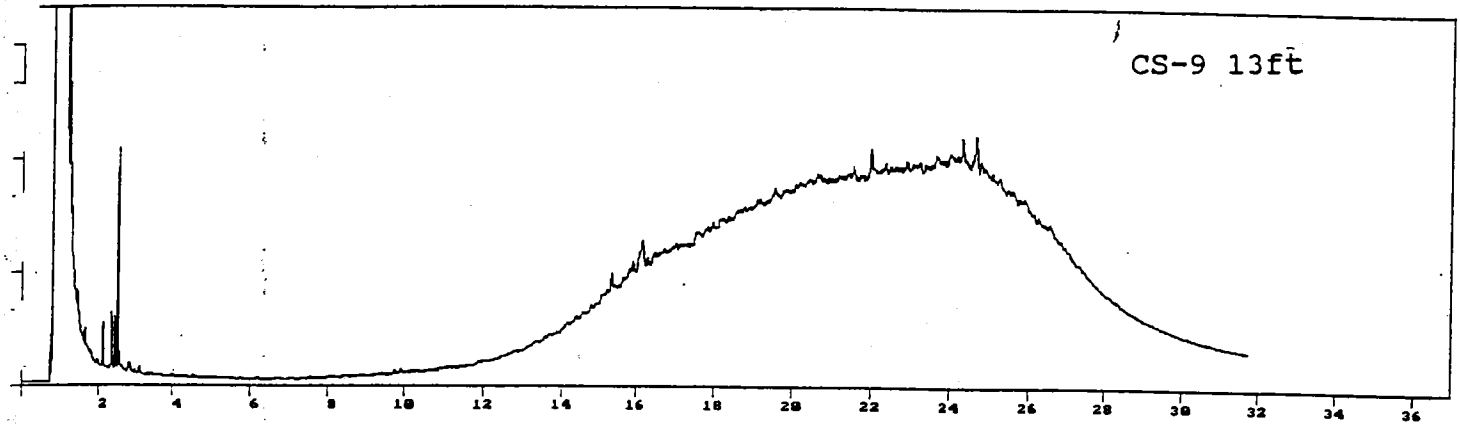


File=D:\cp\df\A0000018.88R from 0.00 to 37.00 min. Low Y = 0.11079 mv High Y = 5.11079 mv Span = 5.00000mv

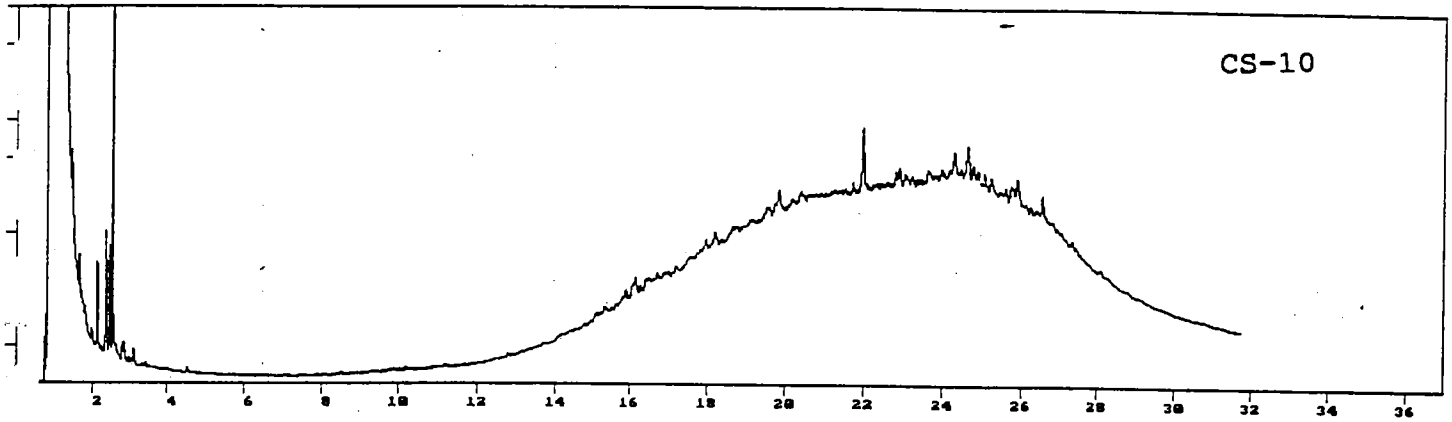


Chrom Perfect COMPARE Program output. Date = 12-09-1991 Time = 09:49:56

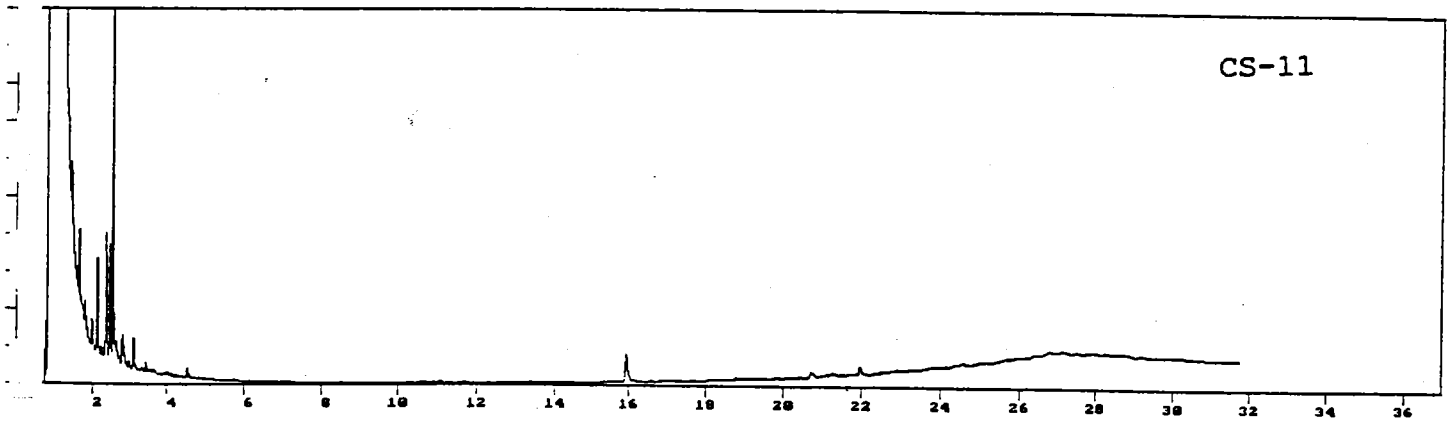
File=D:\cp\df\A0000018.93R from 0.00 to 37.00 min. Low Y = 0.06529 mv High Y = 10.00000 mv Span = 9.93471mv



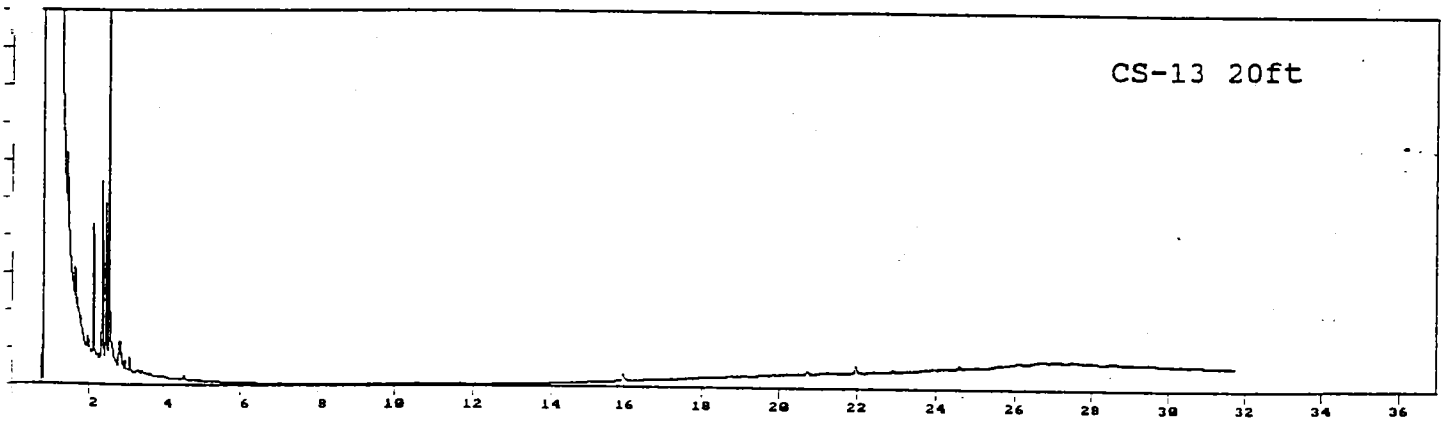
File=D:\cp\df\A0000018.94R from 0.00 to 37.00 min. Low Y = 0.16089 mv High Y = 5.00000 mv Span = 4.83911mv



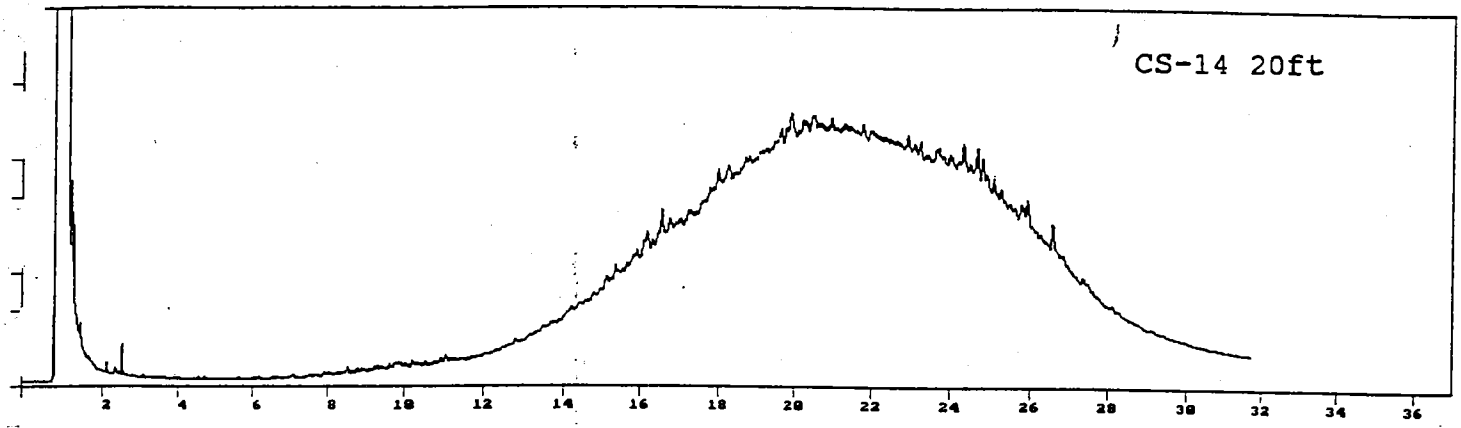
File=D:\cp\df\A0000018.95R from 0.00 to 37.00 min. Low Y = 0.20731 mv High Y = 5.00000 mv Span = 4.79269mv



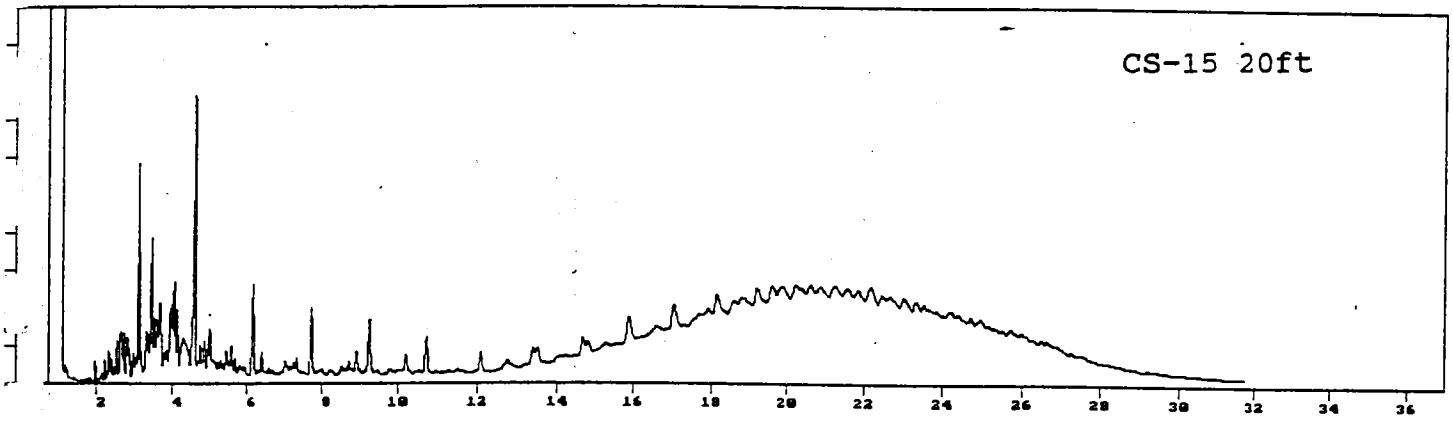
File=D:\cp\df\A0000018.96R from 0.00 to 37.00 min. Low Y = 0.21086 mv High Y = 5.00000 mv Span = 4.78914mv



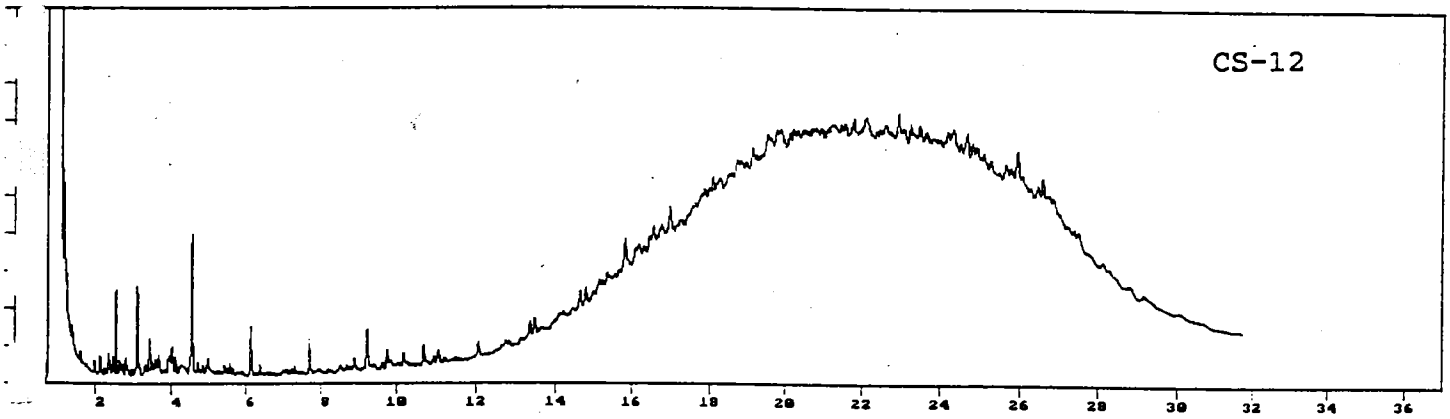
...rom Perfect COMPARE Program output. Date = 12-09-1991 Time = 10:20:11
File=D:\cp\df\A0000018.97R from 0.00 to 37.00 min. Low Y = -0.09420 mv High Y = 20.00000 mv Span = 20.09420mv



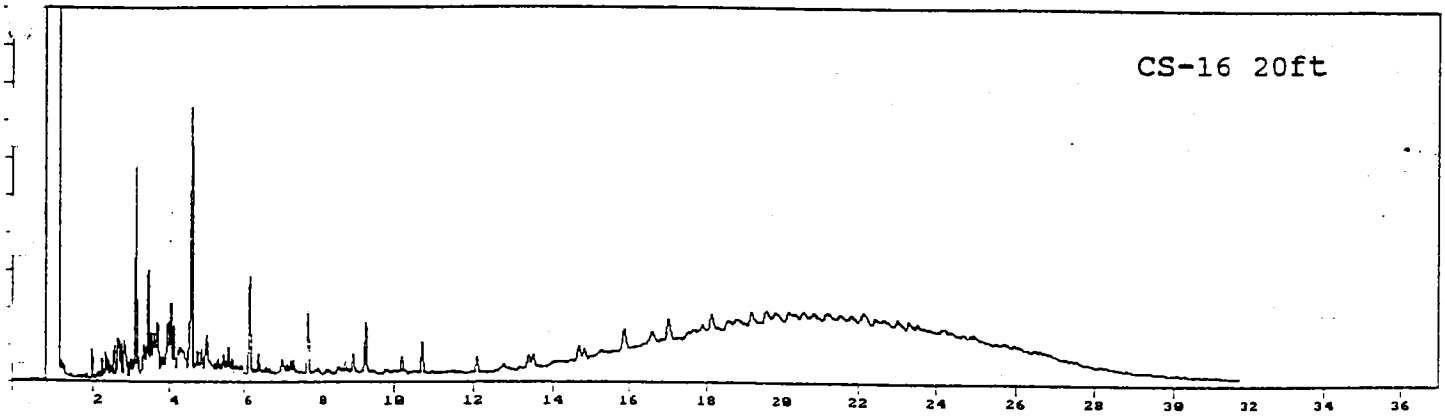
e=D:\cp\df\A0000018.98R from 0.00 to 37.00 min. Low Y = -0.04904 mv High Y = 220.00002 mv Span = 220.04904mv



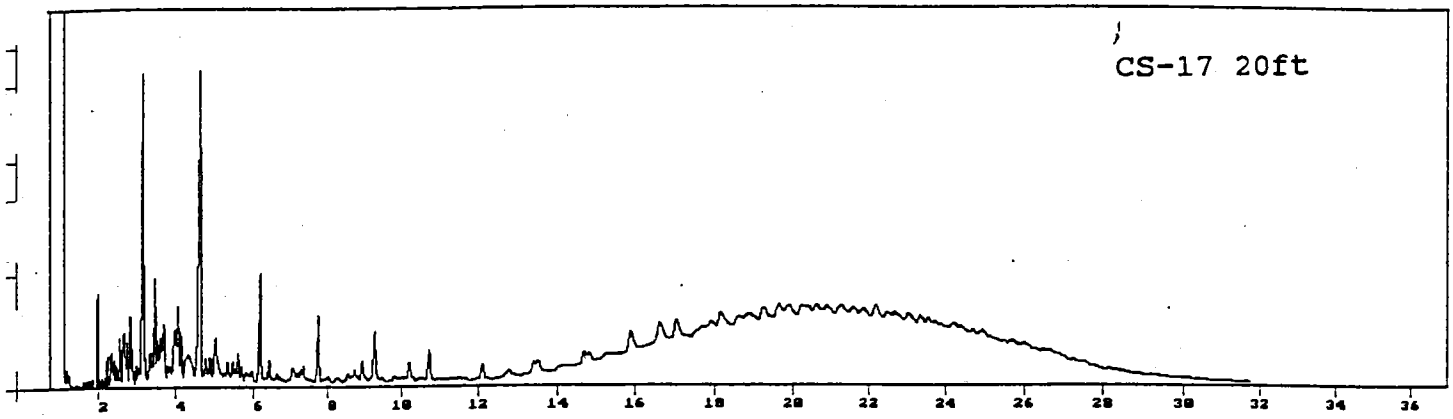
...ile=D:\cp\df\A0000018.99R from 0.00 to 37.00 min. Low Y = 0.12006 mv High Y = 20.00000 mv Span = 19.87994mv



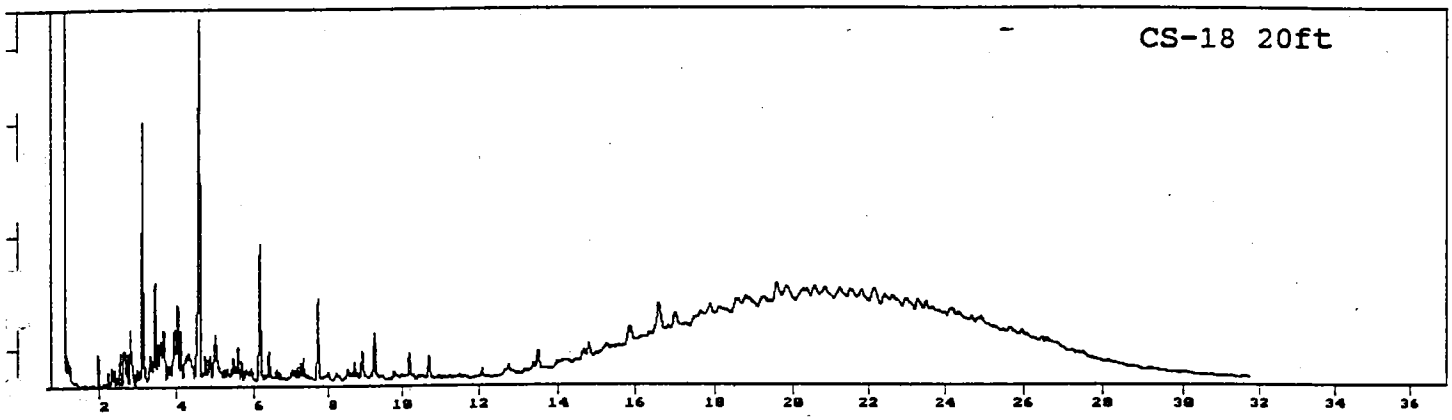
F...e=D:\cp\df\A0000019.00R from 0.00 to 37.00 min. Low Y = -0.71084 mv High Y = 220.00002 mv Span = 220.71086mv



Chrom Perfect COMPARE Program output. Date = 12-09-1991 Time = 10:29:24
File=D:\cp\df\A0000019.01R from 0.00 to 37.00 min. Low Y = 2.39366 mv High Y = 280.00000 mv Span = 277.60635mv



e=D:\cp\df\A0000019.02R from 0.00 to 37.00 min. Low Y = 1.41411 mv High Y = 140.00000 mv Span = 138.58589mv

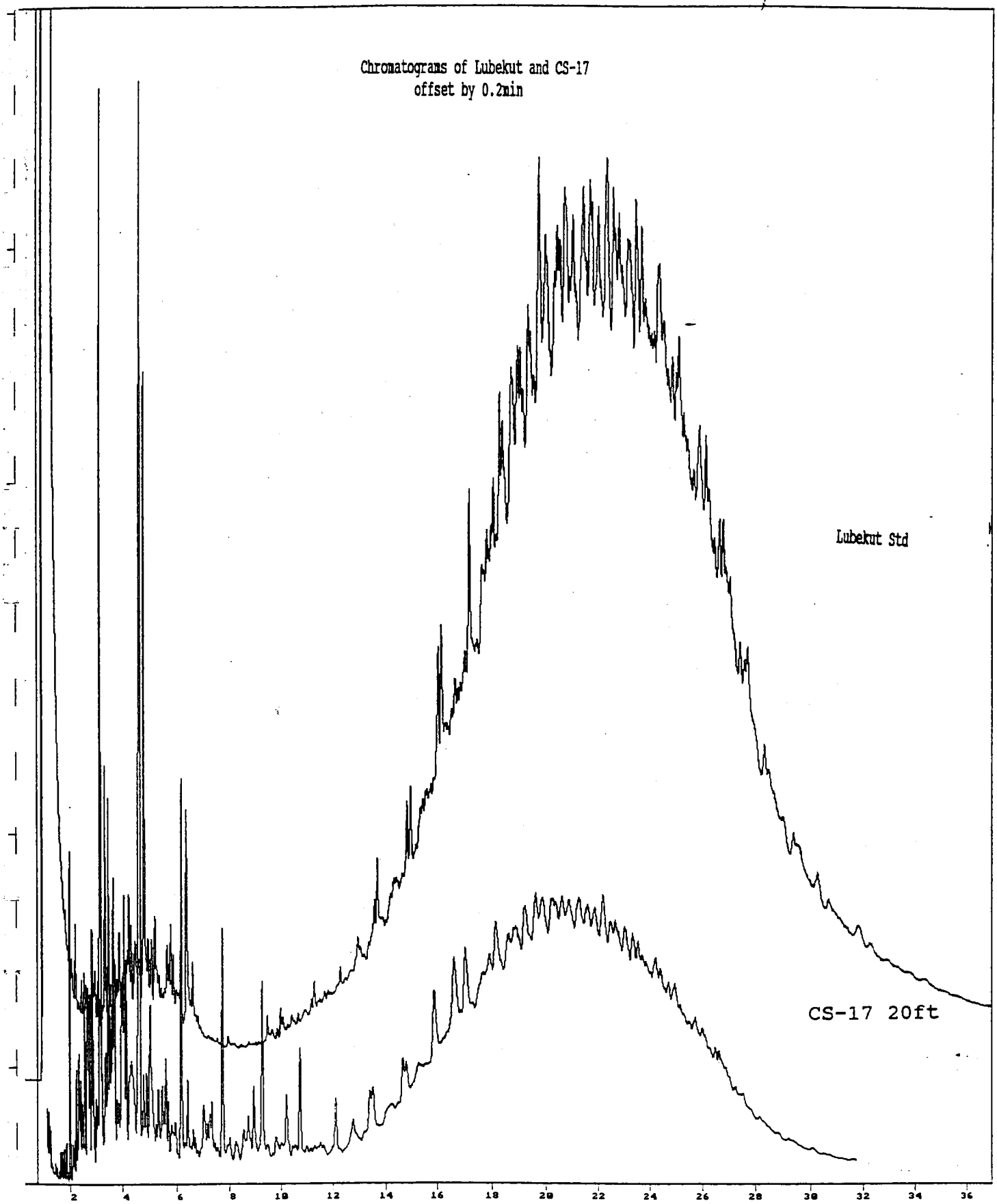


offset 0.2

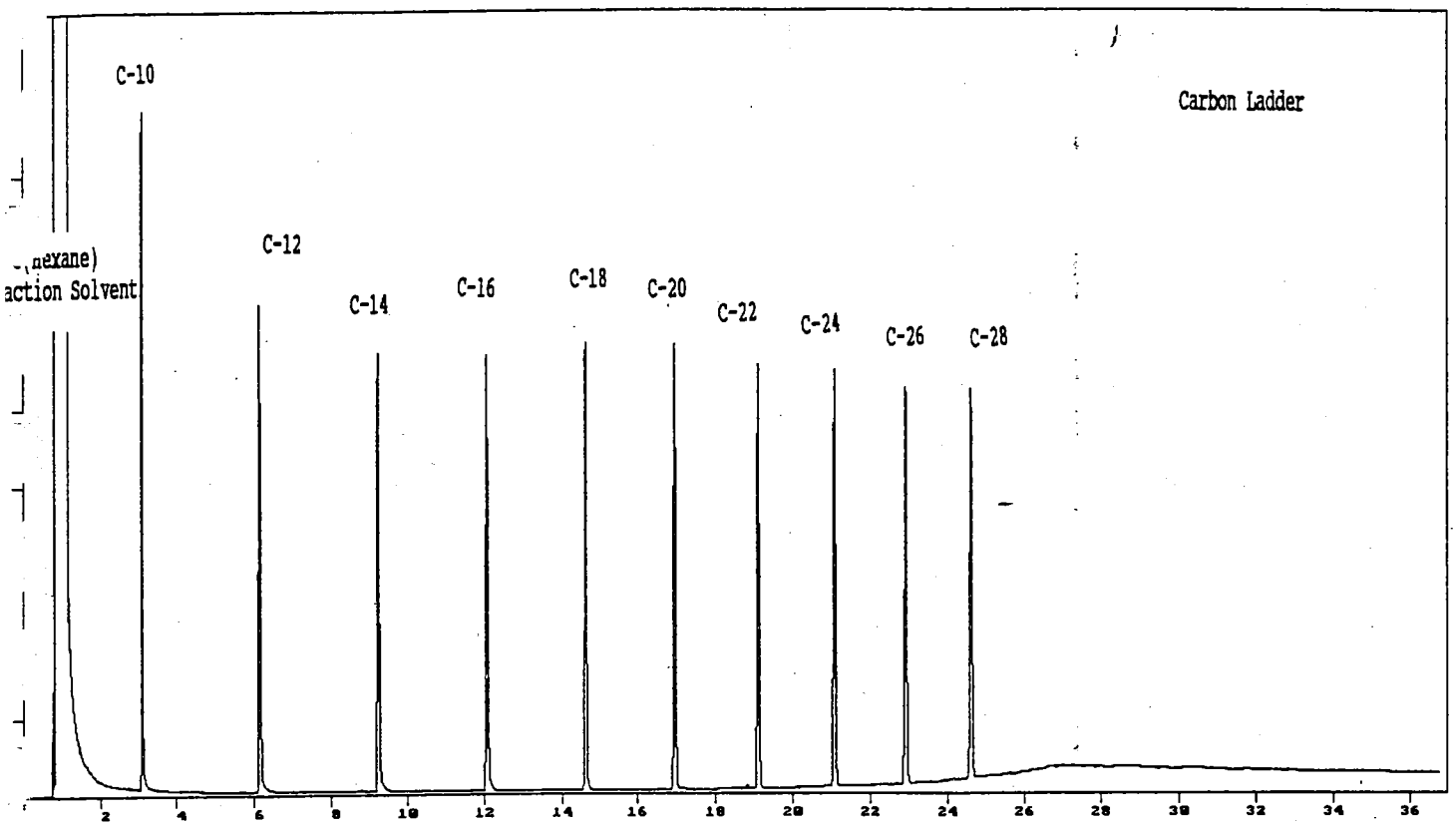
Chrom Perfect COMPARE Program output. Date = 12-09-1991 Time = 13:46:33

File=D:\cp\df\A0000019.01R from 0.00 to 37.00 min. Low Y = 0.43247 mv High Y = 249.76581 mv Span = 249.33334mv CS-17

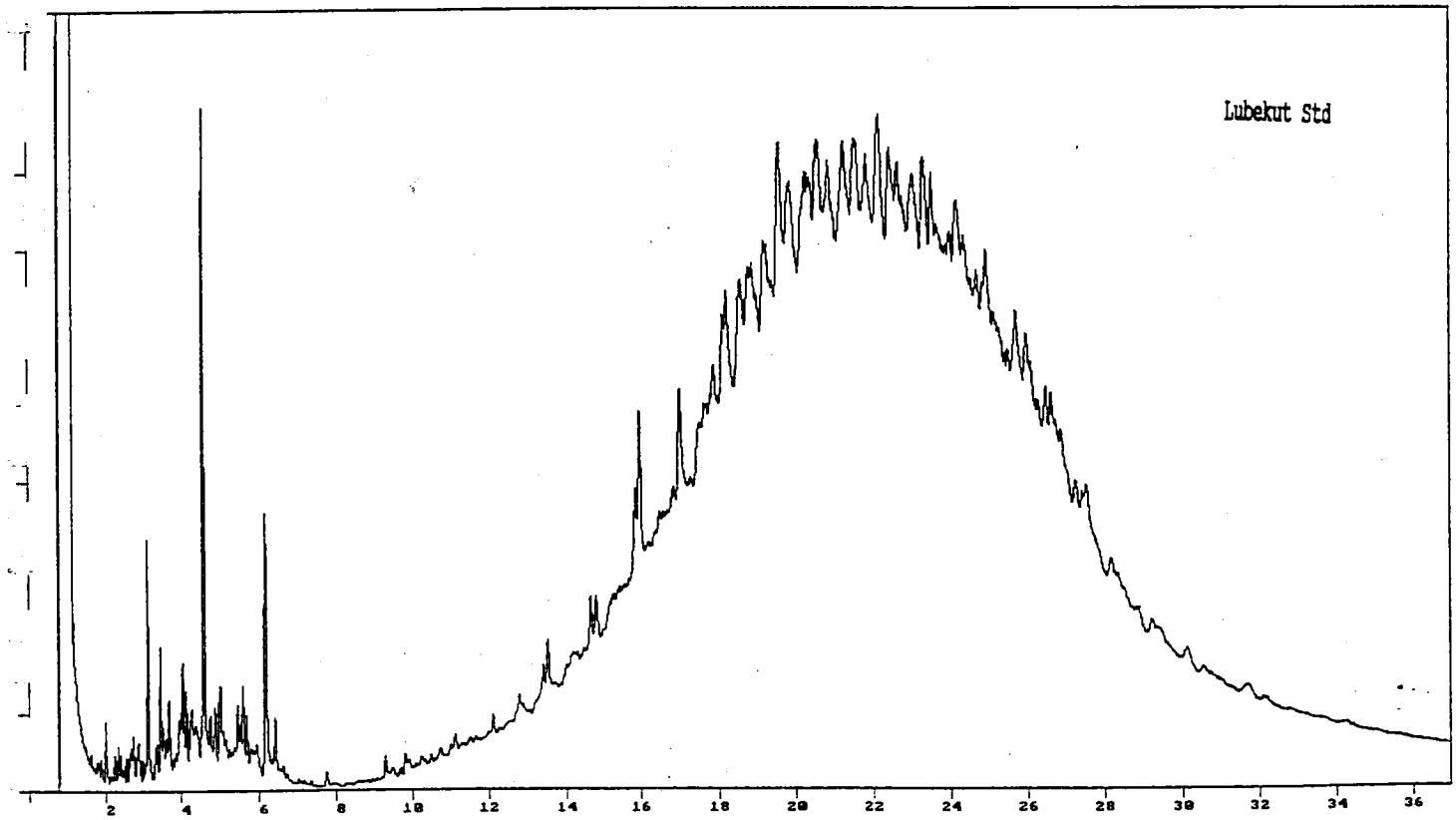
le=D:\cp\df\A0000019.65R from -0.20 to 36.80 min. Low Y = -1.38095 mv High Y = 15.47695 mv Span = 16.85790mv Lubekut



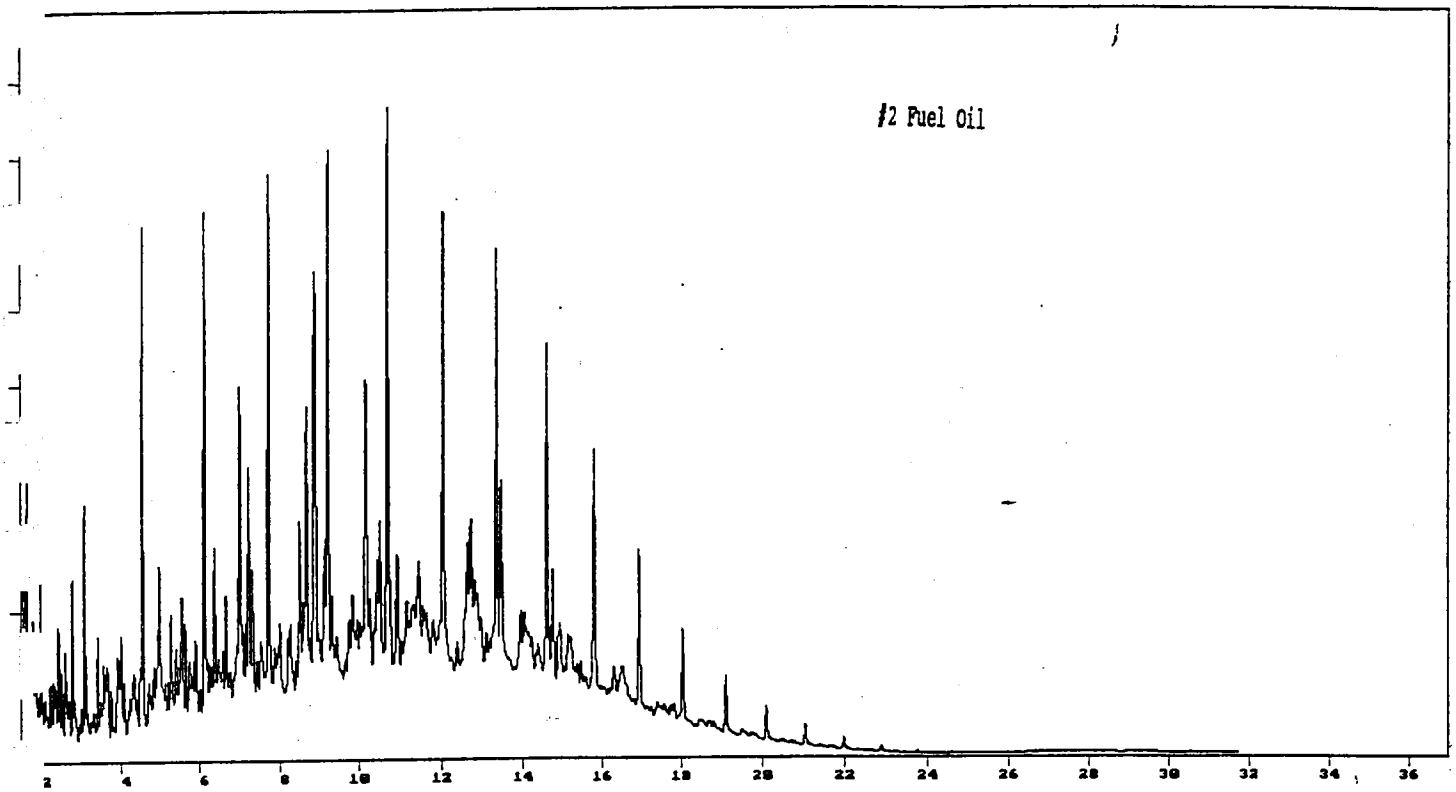
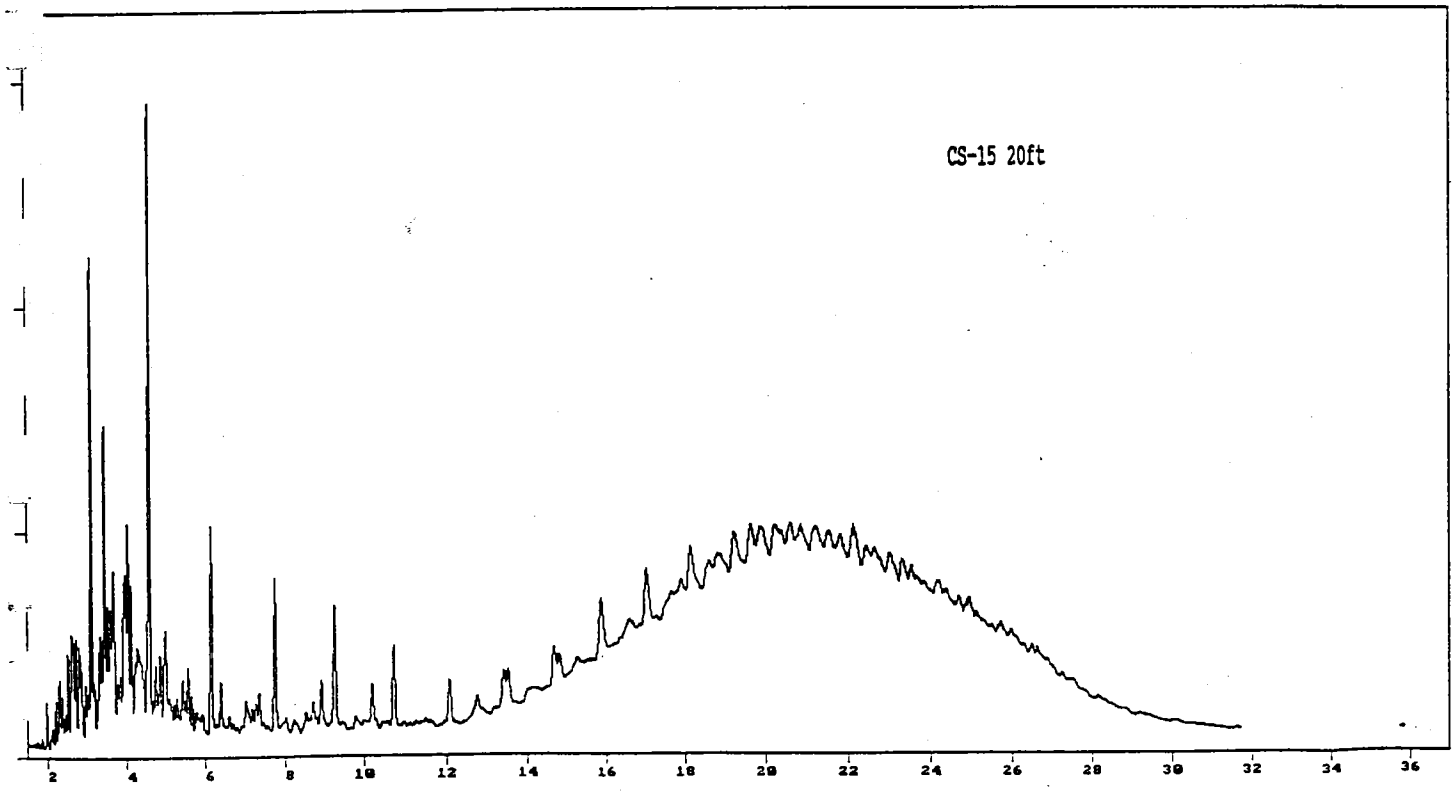
Chrom Perfect COMPARE Program output. Date = 12-13-1991 Time = 11:15:43
File=D:\cp\df\A0000019.08R from 0.00 to 37.00 min. Low Y = 0.06241 mv High Y = 30.01517 mv Span = 29.95277mv



e=D:\cp\df\A0000019.14R from 0.00 to 37.00 min. Low Y = 0.52847 mv High Y = 35.64568 mv Span = 35.11722mv



Chrom Perfect COMPARE Program output. Date = 12-09-1991 Time = 15:02:45
File=D:\cp\df\A0000018.91R from 1.50 to 37.00 min. Low Y = 0.33876 mv High Y = 19.11706 mv Span = 18.77829mv



File=D:\cp\df\A0000018.98R from 1.50 to 37.00 min. Low Y = -1.55667 mv High Y = 191.50674 mv Span = 193.06342mv