5090
Ser 1843.1/6309
July 22, 1996

Mr. Ron Gervason
Regional Water Quality Control Board
2101 Webster Street, Suite 500
Oakland, California 94612

Subj: BORROW MATERIAL FOR LANDFILL COVERS, MOFFETT FEDERAL AIRFIELD

Dear Mr. Gervason:

The purpose of this letter is to document approval from the San Francisco Regional Water Quality Control Board (RWQCB) to use dredge material from the City of Palo Alto as a foundation layer for construction of landfill covers at Moffett Field. In addition, this letter formally requests authorization from the RWQCB to use the dredge material from the City of Palo Alto and the soils from an Under-Ground Storage Tank project at Moffett Federal Airfield (Moffett Field) as foundation, impermeable, and top soil layers for construction of landfill covers at Moffett Field.

Verbal approval to use the Palo Alto dredge material as a foundation layer was provided during a telephone conversation between yourself and Mr. Brian Werle (PRC, Navy's consultant) on June 26, 1996. Information regarding these material and their intended use is summarized below.

<u>City of Palo Alto Dredge Material</u>

The City of Palo Alto is conducting improvements and marsh land restoration at the Palo Alto harbor. The work includes removing dredge material from previous dredging operations. The city originally planned to use all of the soils for construction of a cover over its landfill. Samples were collected from the dredge material and submitted for chemical and physical analyses; the results of which are contained in two reports (HLA 1990 and PRA 1995). Based on this information, the city received authorization from RWQCB (Mr. John Robertson) to use the dredge material for construction of the foundation and impermeable layers for the landfill cover. The city's landfill, however, reached capacity and approximately 64,000 cubic yards (cy) of the dredge material were not used. The city is currently identifying disposal options for this material. If the remaining dredge material can be used at Moffett Field, the city will transport them to Moffett Field without cost to the Navy. This represents a significant cost savings to the Navy for closing its landfills, and to the city for disposal costs.

Based on RWQCB's prior approval to use the dredge material for the foundation and impermeable layers at the city's landfill, the Navy is requesting authorization to use the same dredge material for similar purposes (as foundation and impermeable layers for landfill covers). In addition, the Navy is seeking guidance on how some the dredge material may be utilized as a top layer cover for its landfills.

2876

Moffett Field Petroleum-Contaminated Soils

During late 1995, the Navy removed several underground fuel tanks (USTs) from the active fuel farm (known as Site 5). Approximately 7,500 cy of soil was removed from the UST excavations, placed on the Moffett Field biological treatment pad storage area, sampled, and analyzed for total petroleum hydrocarbons (TPH) and benzene, toluene, ethylbenzene, and xylene (BTEX). Two sampling events took place; the first when half of the soil was stock piled and the second when all of the soil was stock piled. Attachment A contains copies of the sample collection forms and data results. Data from the first sample event revealed elevated detections of TPH purgeable as gasoline and minor detections of BTEX. The second sample event revealed only minor detections of TPH and BTEX.

The Navy would like to use this soil to construct foundation layers for its landfill covers. Although the material contains some petroleum contamination, the material will be isolated by an impermeable layer and select fill layers. Placing the material under the impermeable layer also meets RWQCB low-risk guidance for petroleum sites (no free product, no affect to sensitive receptors, and no risk to human health or ecological receptors).

Please 1) confirm approval of the Palo Alto dredge material for use as a foundation layer; 2) respond to using the dredge material as a top layer, and 3) respond to the Navy's request to use the UST soils as a foundation layer.

Your response is much appreciated. If you have any questions or comments, please contact me (415) 244-2563 or Mr. Hubert Chan of my staff at (415) 244-2562.

Sincerely,

ORIGINAL SIGNED BY:
STEPHEN CHAO,
BRAC Environmental Coordinator

Attachment

References

Harding Lawson Associates (HLA). 1990. Results of Chemical and Physical Analyses on Sediment Samples Harbor Point Dredge Sediment Disposal Site, Palo Alto, California. November.

PRA Group (PRA). 1995. Sampling and Analysis of Dredge Sediment Palo Alto Landfill, Palo Alto, California. May.

Copy to:
Environmental Protection Agency (Attn: Michael Gill)
Department of Toxic Substances Control (Attn: Joseph Chou)
CA Integrated Waste Management Board (Attn: Tamara Zielinski)
National Aeronautics and Space Administration (Attn: Sandy Olliges)
PRC Environmental Management, Inc. (Attn: Brian Werle)
IT Corporation (Attn: Eric Monro)

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ATTACHMENT A

SITE 5 TREATMENT PAD SOIL DATA

SUMMARY REPORT
DREDGE SEDIMENT SAMPLING AND ANALYSIS
AND
REUSE EVALUATION

Background

Since the 1920's, dredging has occurred in the Palo Alto Harbor and associated channels in order to facilitate access and navigation. In 1981, the Army Corp of Engineers and the Bay Conservation and Development Commission (BCDC) approved a series of improvements to the harbor undertaken by the City of Palo Alto (City) which included dredging of the harbor, construction of various structures, and the restoration of several acres of marshlands in the adjoining areas. The marsh restoration project involved the excavation of 140,000 cubic yards of dredge spoils. Approximately 60,000 cubic yards of dredge sediment from the marsh restoration were deposited at the Palo Alto Landfill (Landfill). Rather than dispose of this material by landfilling, which would be costly or take up valuable landfill space, the City proposes to reuse it as low-permeability cap in final closure of its Landfill. Hence, the City undertook a series of studies, preliminary phase I and phase II sampling and analysis plans, to explore this possibility.

Phase I - Preliminary Sampling and Analysis Results Summary

In late 1990, the City's contractor Harding Lawson Associates (HLA), conducted a preliminary sampling and analysis of the dredge sediment to determine its engineering and chemical characteristics. The results of the engineering tests indicated that the material in the "CL" and "CH" classes of the Unified Soil Classification System could be used as low-permeability cap for the Landfill, having a permeability in the range of 10^{-7} to 10^{-8} centimeters per second (cm/sec), a maximum dry density of 97 pounds per cubic foot (pcf) at optimum moisture content of 23.6%, and with greater than 66% by weight passing a #200 sieve. Samples were chemically analyzed for the following constituents:

- Oil and Grease (O & G),
- Total Petroleum Hydrocarbons Diesel (TPH-D)
- Benzene, Clorobenzene, Toluene, Total Xylenes, and Ethylbenzene (BTXE),
- Total Metals - Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Mercury, Molybdenum, Nickel, Selenium, Silver, Thallium, Vanadium, and Zinc, and
- Polychlorinated Biphenyls (PCBs).

Analytical results are summarized in the report entitled Results of Chemical and Physical Analyses on Sediment Samples Harbor Point Dredge Sediment Disposal Site, Palo Alto, California, Harding Lawson, November 1990 (see Tables 1, 2, 3, and 4 of the report, Appendix A). HLA's conclusions concerning the chemical testing results indicated that the material appeared to be non-hazardous, however, they recommended a second phase of sampling to further evaluate the material.

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Phase II - Sampling and Analysis Plan Description and Results Summary

Following the HLA recommendation, the City conducted a second phase of sampling and analysis. The Phase II Sampling and Analysis Plan (SAP) incorporated the draft Testing Requirements for Disposal or Reuse of Dredged Sediment (Regional Water Quality Control Board [RWQCB], 11/18/94, Appendix B). In early 1995, a statistical evaluation of the preliminary chemical results was conducted to formulate a sampling strategy to undertake the second phase of sampling. The Phase II SAP was designed to collect a representative and statistically valid number of samples to accurately determine chemical constituent levels in the material and was implemented by the City's consultant, the PRA Group (Sampling and Analysis of Dredge Sediment, PRA Group, May, 1995; see Appendix C). The results of this second phase of sampling and chemical testing of the dredge sediment and an evaluation (i.e., a comparison to the RWQCB reuse limits for dredge sediment) are presented below.

Sampling Strategy and Number of Samples

A simple random sampling strategy, in accordance with *Test Methods for Evaluating Solid Waste: Physical Control Methods* (SW-846, 3rd edition, EPA, November, 1986), was used in the calculation of the number of samples to be collected for the second round sampling and analysis. Under the procedures for simple random sampling strategy, a statistical evaluation of the preliminary results was conducted, calculating the averages and coefficients of variation (CV) of each constituent of concern (COC). The statistically valid number of samples collected for each constituent at a 90% confidence level with a 15% tolerable error was calculated using the following equation:

$$\text{number of samples (n)} = \frac{z_p^2 \times CV^2}{d^2};$$

where z_p is taken from statistics tables for two-tailed limit, CV is the coefficient of variation (sample standard deviation divided by the average concentration), and d is the tolerable error. Applying this equation to the preliminary sampling results yielded the following number of samples for each constituent of concern.

Constituent	No. Samples	EPA Method
Oil & Grease	20	SM 5520 B&F
Total Extractable Petroleum Hydrocarbons(TPH)/TPH-Diesel	20	8015M
TTLC Metals	10	SW 6010/SW 7000
Chromium/Lead WET	8	Title 22, 66261.126
Chromium/Lead TCLP	8	40 CFR Part 260
PCBs	5	8080
LC_{50} 96 Hr Aquatic Toxicity	4	EPA-600/4-85-013

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Rationale for Analytical Constituents

With the exception of BTXE compounds, Phase II samples were analyzed for the same constituents previously analyzed during the Phase I preliminary sampling event because those constituents were considered to be the most likely contaminants in the material and to further evaluate the accuracy of previously analyzed constituent concentrations. BTXE compounds were not detected during the first round of sampling and were therefore eliminated from the analytical constituent list. The Phase II sediment samples were also analyzed for the following additional constituents.

- Soluble chromium and lead using the Waste Extraction Test (WET)
- Soluble chromium and lead using the Toxicity Characteristic Leaching Procedure (TCLP)
- Aquatic Toxicity

Soluble chromium and lead using the WET and TCLP procedures were added to the list of analyzed constituents because their total concentration levels were several times greater than their respective Title 22 Soluble Threshold Limit Concentrations (STLC) indicating a potential for elevated "leachable" concentrations. Aquatic toxicity analyses were added to assess the material's effect on the marine environment in the vicinity of the landfill.

Sample Assignment and Collection

The following systematic approach was used in the assignment and collection of samples. A grid of 20 equal portions (2 rows of 10 cells) was superimposed on the dredge sediment pile and divided into two, 6-foot high layers, creating 40 cells. The cells were numbered northwest to southeast, and top to bottom (for more details, see Appendix C, Sampling and Analysis of Dredge Sediment, PRA Group, May, 1995). A random number generator was used to determine which cells would be assigned for each constituent of concern.

Collection of soil samples was performed by the PRA Group on April 19, 1995, in accordance with EPA Manual SW-846. A backhoe was used to excavate a pit in each of the 40 sample cells. Excavation of the bottom of each pit was completed by hand in order to minimize cross-contamination of the pits by the backhoe bucket. Grab samples were obtained in new 2.0-inch diameter brass liners using a hand sampler with a sledge hammer. The soil samples were then sealed with teflon tape and plastic caps, and placed in an ice chest. All sampling equipment was cleaned prior to arrival at the site and between sampling points using the distilled water and detergent (Liquinox).

The soil samples were delivered under chain-of-custody procedures to BC Laboratories, Inc. (state certified), via the laboratory's courier. BC Laboratories uses EPA recommended test methods and quality assurance/quality control (QA/QC) protocols during analyses.

Summary of Phase II Analytical Results

The analytical results of the Phase II sampling event are summarized in Tables 1, 2, 3, 4, and 5.

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S-B Avg	7.2	51.3	
PRG Residential	0.38	30 (0.2)	
PRG Industrial	2.4	64	

TABLE 1

Dredge Sediment Analysis Results

TTLC Metals Analyses

Unit = mg/kg wet weight, unless specified

Sample Number	Antimony Sb	Arsenic As	Barium Ba	Beryllium Be	Cadmium Cd	Chromium Cr	Cobalt Co	Copper Cu	Lead Pb	Mercury Hg	Molybdenum Mo	Nickel Ni	Selenium Se	Silver Ag	Thallium Tl	Vanadium V	Zinc Zn
7-1	nd	4.0	58	nd	nd	65	11	42	18	0.42	nd	57	0.75	nd	nd	46	84
8-2	nd	3.0	54	nd	nd	61	9.8	62	23	0.36	nd	54	0.66	nd	nd	38	92
9-3	nd	5.0	59	nd	nd	58	10	38	18	0.27	nd	51	nd	nd	nd	38	78
11-3	nd	6.1	62	nd	0.58	72	11	52	23	0.41	nd	59	nd	1.3	nd	46	96
15-1	nd	6.2	55	nd	nd	67	9.9	45	23	0.38	nd	55	nd	1.3	nd	43	87
17-2	nd	6.2	48	nd	nd	64	10	44	20	0.39	nd	59	nd	nd	nd	41	86
24-1	nd	5.0	52	nd	nd	58	11	32	15	0.39	nd	57	nd	nd	nd	39	70
31-2	nd	4.0	58	nd	nd	73	11	102	28	0.40	nd	61	0.5	2.2	nd	44	125
38-2	nd	4.2	54	nd	nd	74	12	67	30	0.42	nd	59	nd	2.0	nd	42	106
40-1	nd	4.0	74	nd	nd	67	11	49	26	0.22	nd	57	nd	1.6	nd	43	92
PQL (mg/kg)	5.0	0.5	0.5	0.5	0.5	0.5	2.5	0.5	2.5	0.2	2.5	2.5	0.5	1.0	5.0	0.5	2.5
STLC (mg/l)	15.0	5.0	100	0.75	1.0	5.0	80	25	5.0	0.2	350	20	1.0	5.0	7.0	24	250
10xSTLC (mg/l)	150	50	1000	7.5	10.0	50	800	250	50	2.0	3500	200	10	50	70	240	2500
TTLC (mg/kg)	500	500	1000	75	100	2500	8000	2500	1000	20	3500	2000	100	500	700	2400	5000

TLC = Total Threshold Concentration Limit
g/kg, mg/l = milligram per kilogram, milligram per liter
f = not detected above PQL
= not analyzed
QL = Practical Quantitation Limit
TLC = Soluble Threshold Limit Concentration
xSTLC = Rule of thumb states that if total concentration analysis levels exceeds this limit, the WET test should be conducted.
ET tests for chromium and lead were conducted on samples.

TABLE 2

Dredge Sediment Analysis Results

Solubility Analyses

Unit = mg/l

Sample Number	WET Chromium Cr	WET Lead Pb	TCLP Chromium Cr	TCLP Lead Pb
7-2	0.55	0.73	nd	nd
12-3	0.46	0.72	nd	nd
13-3	0.31	0.65	nd	nd
14-2	0.37	nd	nd	nd
15-2	0.60	0.80	nd	nd
17-3	0.51	0.63	nd	nd
22-3	0.65	0.83	nd	nd
33-2	0.58	0.75	nd	nd
PQL (WET)	0.1	0.5		
STLC	5.0	5.0		
PQL (TCLP)			0.1	0.5
TCLP Limit			5.0	5.0

WET = Waste Extraction Test
TCLP = Toxicity Characteristic Leaching Procedure
PQL = Practical Quantitation Limit
STLC = Soluble Threshold Limit Concentration
nd = Not detected above the PQL

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TABLE 3

Dredge Sediment Analysis Results

Oil & Grease and Total Petroleum Hydrocarbon Analyses (TPH)

Unit = mg/kg

?

Sample Number	Oil & Grease	TPH	Sample Number	TPH-Diesel
1-1	220	200	1-2	nd
2-1	30	nd	4-1	nd
9-1	28	nd	5-1	nd
10-1	74	110	8-1	nd
11-1	nd	nd	9-2	nd
12-1	62	nd	10-2	nd
13-1	82	nd	11-2	nd
20-1	74	nd	12-2	nd
21-1	50	nd	13-2	nd
22-1	36	nd	14-1	nd
27-1	40	90	17-1	nd
28-1	50	nd	19-1	nd
29-1	62	nd	21-2	nd
31-1	46	nd	22-2	nd
32-1	70	nd	26-1	nd
33-1	50	nd	27-2	nd
34-1	nd	nd	30-1	nd
35-1	48	nd	36-2	nd
36-1	180	49	37-1	nd
39-1	38	nd	38-1	nd
PQL	20	20	PQL	10

PQL = Practical Quantitation Limit
nd = Not detected above the PQL
na = not analyzed

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TABLE 4

Dredge Sediment Analysis Results

PCB Analyses

Unit = mg/kg

Sample Number	PCB-1016	PCB-1221	PCB-1232	PCB-1242	PCB-1248	PCB-1254	PCB-1260	PCB SUM
7-2	nd	nd	nd	nd	nd	nd	nd	nd
12-3	nd	nd	nd	nd	nd	nd	nd	nd
13-3	nd	nd	nd	nd	nd	nd	nd	nd
14-2	nd	nd	nd	nd	nd	nd	nd	nd
15-2	nd	nd	nd	nd	nd	nd	nd	nd
17-3	nd	nd	nd	nd	nd	nd	nd	nd
22-3	nd	nd	nd	nd	nd	nd	nd	nd
33-2	nd	nd	nd	nd	nd	nd	nd	nd
PQL	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.07
TTLC	50	50	50	50	50	50	50	50

PQL = Practical Quantitation Limit
TTLC = Total Threshold Limit Concentration
nd = Not detected above the PQL

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TABLE 5

Dredge Sediment Analysis Results

96-Hour Aquatic Toxicity Analyses

Sample Number	Fathead Minnow Hazardous Waste Screen Bioassay
11-5	Passed (1)
32-2	Passed (2)
36-4	Passed (2)
39-2	Passed (2)

1. One (1) out of 20 fish dead for 96-hour duration at 750 milligram per liter concentration.

2. Zero (0) out of 20 fish dead for 96-hour duration at 750 milligram per liter concentration.

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Evaluation of Reuse of Material and Conclusions

According to the draft Testing Requirements for Disposal or Reuse of Dredged Sediment (Regional Water Quality Control Board [RWQCB], 11/18/94, Appendix B), dredge sediment designated for reuse as low-permeability cap for final cover must pass the following tests:

- Moisture - minimum 50% solids and no free liquids
- Permeability - $\leq 10^{-7}$ cm/sec
- Soil Type - SC, CL, or CH with $\geq$ 30% pass No. 200 sieve
- Bulk Chemistry - Meet ambient/background levels - between ranges of values found in San Francisco Estuary Regional Monitoring Program for Trace Substances

Table 6 presents a comparison of Phase I and II analytical results with the range of concentrations levels for constituents of concern (COCs) from analyzed dredge sediment of the San Francisco Estuary found in the reports entitled *San Francisco Estuary Regional Monitoring Program Results for Trace Substances* (1993 Annual Report) and *San Francisco Bay Pilot Regional Monitoring Program* (RWQCB, 1993).

Comparison and review of the physical and chemical results indicates the following:

- Levels of constituents of concern in the dredge sediment are non-hazardous.
- The moisture, permeability, and soil type are acceptable for use as low permeability cap for final landfill cover in accordance with the draft Testing Requirements for Disposal or Reuse of Dredged Sediment, RWQCB, 11/18/94.
- The Palo Alto dredge sediment meets ambient/background levels for bulk chemistry in accordance with the draft testing requirements. Average Palo Alto dredge sediment concentration levels of COCs are within ranges measured in the San Francisco Estuary and less than those measured in the most recent sampling of bay sediment in the vicinity of the Dumbarton Bridge (within one mile of the Palo Alto Harbor and Landfill).

Based on the above results and studies, the Palo Alto dredge sediment is acceptable for use as low-permeability material and can be disposed of (used) at the Palo Alto Landfill.

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Table 6

Comparison of Phase I & II Analytical Results to San Francisco Estuary Regional Monitoring Program Results for Trace Substances

Units: mg/kg (ppm) unless specified

Testing Parameters	Required Levels[1]		San Francisco Estuary Range[2]	Sample BA30[3] Dumbarton Bridge	Phase I Sampling Results Average
Moisture	> 50% solids no free liquid		NA[4]	NA	Material Dewatered
Permeability	< 10^{-6} cm/sec		NA	NA	< 10^{-7} cm/sec
Soil Type	SC,CL, or CH & > 30% pass #200 sieve		NA	NA	CH, CL > 90% pass #200 sieve
Bulk Chemistry	Hazardous Levels[5] TTLC	STLC			Phase II Sampling Results Average[6]
Arsenic	500	5.0	4.2 - 29.4	13.14	4.8
Cadmium	100	0.75	0.12 - 0.74	0.04	0.28
Chromium	2500	5.0	61 - 87	94.6	66
Copper	2500	25	22 - 124	45.5	53
Lead	1000	5.0	8 - 110	35	22
Mercury	20	0.2	0.031 - 0.472	0.402	0.37
Nickel	2000	20	62 - 90	91.6	57
Zinc	5000	250	77 - 137	136.7	92
Oil & Grease	NA	NA	NA	NA	63
TPH	NA	NA	NA	46	31
TPH-Diesel	NA	NA	NA	NA	ND[7]
PCBs	50	5.0	0.006 - 0.14	0.0026	ND
Aquatic Toxicity	LC_{50} < 500 mg/l		NA	NA	Passed (see Table 5)

1. Reuse requirements for low-permeability cap from draft Testing Requirements for Disposal or Reuse of Dredged Sediment, RWQCB, Nov., 1994.
2,3. Dredge sediment sample results from San Francisco Estuary Regional Monitoring Program Results for Trace Substances (1993 Annual Report) and San Francisco Bay Pilot Regional Monitoring Program (RWQCB, 1993).
4. Not available.
5. Title 22 Hazardous Waste Levels, 66261.24.
6. Average of dredge sediment analytical results from Sampling & Analysis of Dredge Sediment, Palo Alto Landfill, PRA Group, May 1995. Not detected values taken as half the practical quantitation limit.
7. Not detected.

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Phase I (Harding Lawson Associate)

Table 1. Test Pit and Sampling Details

Test Pit Numbers	Total Depth of Test Pit (feet)	Thickness of Dredge Material (feet)	Sampling Depths (feet)	Nature of Sediment	Type of Analyses
T-1	14.5	13.5	2.0	Dredgings	Physical
			4.0	Dredgings	Chemical
			14.0	Native	Physical
T-2	11.5	?	5.0	Dredgings	Chemical
			7.0	Dredgings	Physical
			11.0	Dredgings	Physical
T-3	11.5	?	2.0	Dredgings	Chemical
			4.0	Dredgings	Physical
			8.0	Dredgings	Physical
			11.0	Dredgings	Physical
T-4	14.0	13.0	3.0	Dredgings	Physical
			5.0	Dredgings	Chemical
T-5	15.5	12.0	3.0	Dredgings	Physical
			6.0	Dredgings	Chemical
			9.0	Dredgings	Physical
			15.0	Native	Physical
T-6	14.0	12.0	6.0	Dredgings	Physical
			9.0	Dredgings	Chemical
			13.5	Native	Physical
T-7	15.5	12.5	3.0	Dredgings	Physical
			5.0	Dredgings	Physical
			15.0	Native	Chemical
T-8	14.5	13.0	3.0	Dredgings	Chemical
			5.0	Dredgings	Physical
			7.0	Dredgings	Physical

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Table 2. Results of the Chemical Analyses on Sediment Samples for Organic Constituents and PCBs (Concentrations in parts per million (ppm)).

TEST PIT NUMBER	SAMPLE DEPTH (FEET)	BENZENE	CHLORO-BENZENES	ETHYL-BENZENE	TOLUENE	TOTAL XYLENES	TPH DIESEL FUEL	TOTAL OIL AND GREASE	PCB
T-1	4.0	ND	ND	ND	ND	ND	9.6	170	ND(0.01)
T-2	5.0	ND	ND	ND	ND	ND	4.7	ND	--
T-3	2.0	ND	ND	ND	ND	ND	11	200	--
T-4	5.0	ND	ND	ND	ND	ND	ND	250	--
T-5	6.0	ND	ND	ND	ND	ND	ND	240	ND
T-6	9.0	ND	ND	ND	ND	ND	ND	390	ND
T-7	15.0*	ND	ND	ND	ND	ND	43	270	--
T-8	3.0	ND	ND	ND	ND	ND	8.5	260	--
TEST METHOD		8020	8020	8020	8020	8020	3550/8015	5520E&F	8080
DL		0.05	0.05	0.05	0.06	0.2	3.0	50	0.005
DLSW		0.7	NA	NA	100	NA	NA	NA	0.000079

* = NATIVE MATERIAL, ALL OTHER SAMPLES ARE OF DREDGE MATEIAL
-- = NOT TESTED
ND = BELOW ANALYTICAL DETECTION LIMIT
DL = ANALYTICAL DETECTION LIMIT UNLESS INDICATED IN PARENTHESES
DLSW = MAXIMUM DESIGNATED LEVELS TO PROTECT SURFACE WATER
NA = NOT AVAILABLE

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Table 3. Results of the Chemical Analyses on Sediment Samples for Heav

TEST PIT NUMBER	SAMPLE DEPTH (FEET)	ANTIMONY (Sb)	ARSENIC (As)	BARIUM (Ba)	BERYLLIUM (Be)	CADMIUM (Cd)	CHROMIUM (Cr)	COBALT (Co)	COPPER (Cu)
T-1	4.0	2.2	8.8	ND	0.5	ND	87	13	61
T-2	5.0	2.3	8.8	ND	0.5	ND	97	13	51
T-3	2.0	0.58	7.7	ND	ND	ND	83	13	54
T-4	5.0	1.2	15	ND	ND	ND	85	12	40
T-5	6.0	0.96	13	ND	0.5	ND	91	13	36
T-6	9.0	0.91	12	ND	ND	ND	80	11	34
T-7	15.0*	2.6	9.5	ND	ND	ND	79	12	29
T-8	3.0	1.8	7.0	ND	ND	ND	100	13	58
TEST METHOD		7040	7061	7080	7090	7130	7190	219.1	7210
DL		0.07	0.008	30	0.4	0.5	8.0	2.0	2.0
TTLC		500	500	10,000	75	100	500	8000	2500
STLC		15	5.0	100	0.75	1.0	5.0	80	25
DLSW		1460	0.022	NA	NA	5.5	980	NA	540

* = NATIVE MATERIAL
ND = BELOW ANALYTICAL DETECTION LIMIT
DL = ANALYTICAL DETECTION LIMIT UNLESS LISTED IN PARENTHESES
TTLC = TOTAL THRESHOLD LIMIT CONCENTRATION (mg/kg)
STLC = SOLUBLE THRESHOLD LIMIT CONCENTRATION (mg/l)
DLSW = MAXIMUM DESIGNATED LEVELS TO PROTECT SURFACE WATER
NA = NOT AVAILABLE

031801P3/L5

y Metals (Concentrations in parts per million [ppm]).

LEAD (Pb)	MERCURY (Hg)	MOLYBDENUM (Mo)	NICKEL (Ni)	SELENIUM (Se)	SILVER (Ag)	THALLIUM (Tl)	VANADIUM (V)	ZINC (Zn)
41	0.74	ND	67	0.26	ND	0.10	45	110
35	0.66	ND	67	0.54	ND	0.13	55	110
39	0.50	ND	71	0.37	ND	0.05	44	110
26	0.60	ND	63	0.30	ND	0.08	48	97
27	0.79	ND	74	0.17	ND	ND	60	110
18	0.50	ND	59	0.33	ND	0.13	54	83
21	0.31	ND	63	0.39	ND	0.10	53	85
39	0.53	ND	69	0.32	ND	0.15	48	110
7420	7471	246.1	7520	7741	7760	7840	7910	7950
2.0	0.001	50	2.0	0.03	2.0	0.04	8.0	0.3
1000	20	3500	2000	100	500	700	2400	5000
5.0	0.2	350	20	1.0	5.0	7.0	24	250
0.5	0.12	NA	134	50	1.2	130	NA	4900

ENVIRONMENTAL CHEMICAL CORPORATION

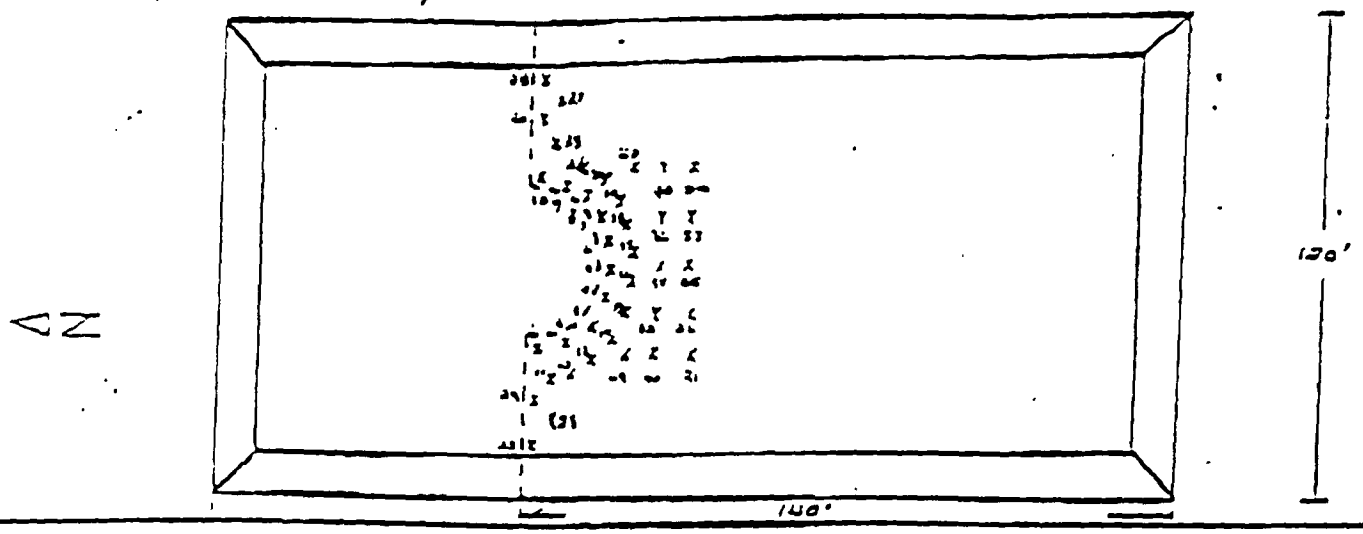
SAMPLE SOURCE: [illegible]

[illegible]

SAMPLE DATE 10.18.95 TIME [illegible]

SAMPLING METHODOLOGY [illegible]

DIAGRAM (IF APPLICABLE): CSP 001-040 X - [illegible] NOTE: NOT TO SCALE



SAMPLE AMOUNT: 7" x 6"

SAMPLE CONTAINER: BRASS SLEEVE

SAMPLE TAG: DATE: 10-18-95 TIME: 1540 - 1604

SAMPLE LOCATION: CONTAMINATED STOCKPILE 001-040

SAMPLE NUMBER: CSP 001 - 040

ANALYSIS REQUIRED: TPH D (5015) [illegible] (5030) TPH C (5020)

SAMPLE NAME (PRINT): KURT HESS

SAMPLER SIGNATURE: [signature] DATE: 10-18-95

certify that the above sample(s) was/were taken by my direction and in my presence.

NAME (PRINT): [illegible] TITLE: QC

SIGNATURE: [signature] DATE: 11-8-95

WITNESS NAME (PRINT): Tim Holman TITLE:

SIGNATURE: [signature] DATE: 11-8-95

CONTAMINATED SOIL PILES
SOUTH FUEL FARM TANK REMOVALS
SOIL SAMPLE RESULTS

Sample No.	TPH-D (mg/kg)	TPH-G (mg/kg)	Benzene (ug/kg)	Ethylbenzene (ug/kg)	Toluene (ug/kg)	Xylenes (ug/kg)
CSP-001	1340	343	62.0	202	U(15.0)	61.1
-002	92.4	56.7	U(13.6)	U(13.6)	U(13.6)	U(13.6)
-003	BDL(10)	6.4	23.7	7.2	U(13.6)	U(13.6)
-004	182	8.3	31.3	70.3	11.6J	9.6J
-005	1170	262	72.8	152	168	52.8
-006	256	9.3	108	15.8	8.2J	18.3
-007	21.7	6.7	16.3	12.4	4.1	U(7.5)
-008	518	318	292	57.3	U(15.0)	37.5
-009	131	35.3	270J	194J	U(357)	U(357)
-010	288	20.6	11.9	35.5	18.1	29.3
-011	70.9	161	277	389	14.6	48.9
-012	398	1030	810	575J	U(714)	U(714)
-013	375	561	401	565	35.8	106
-014	184	751	3920	5350	U(3660)	U(3660)
-015	129	543	19.3	U(8.8)	15.7	15.2
-016	217	417	94.1	77.3	9.0	24.2
-017	43.3	114	192	532	25.1	171
-018	120	644	386	439	9.6J	56.7
-019	83.6	567	452	302	10.J	42.0
-020	163	541	247	155	12.9	78.7
-021	180	805	379	307	U(15.0)	U(15.0)
-022	83.3	1200	U(1360)	3800	U(1360)	U(1360)
-023	51.7	0.74	5.2J	14.9	U(8.3)	U(8.3)
-024	33.7	116	U(10.7)	25.7	U(10.7)	25.0
-025	185	595	30.9	214	U(15.0)	U(15.0)
-026	138	102	U(13.6)	187	U(13.6)	106
-027	128	383	U(12.5)	101	U(12.5)	U(12.5)
-028	101	505	U(1500)	1750	U(1500)	2660
-029	98.9	585	U(1500)	2580	U(1500)	2880
-030	77.5	190	99.7	340	U(15.0)	U(15.0)
-031	248	217	265	271	U(13.6)	U(13.6)
-032	66.1	167	U(10.7)	15.3	U(10.7)	16.9
-033	61.5	700	U(1500)	2390	U(1500)	3910
-034	24.2	286	U(11.5)	69.0	U(11.5)	82.5
-035	14.7	714	U(1360)	2340	U(1360)	3430
-036	221	745	U(1360)	2350	U(1360)	3270
-037	14.1	421	U(1430)	1480	U(1430)	1940
-038	172	160	U(13.6)	28.1	U(13.6)	33.9
-039	78.4	538	U(1430)	1920	U(1430)	2480
-040	608	590	48.6	88.6	U(15.0)	63.1

[illegible]
CORPORATION

SAMPLE SOURCE: South Fuel Farm - Moffett Federal Airfield

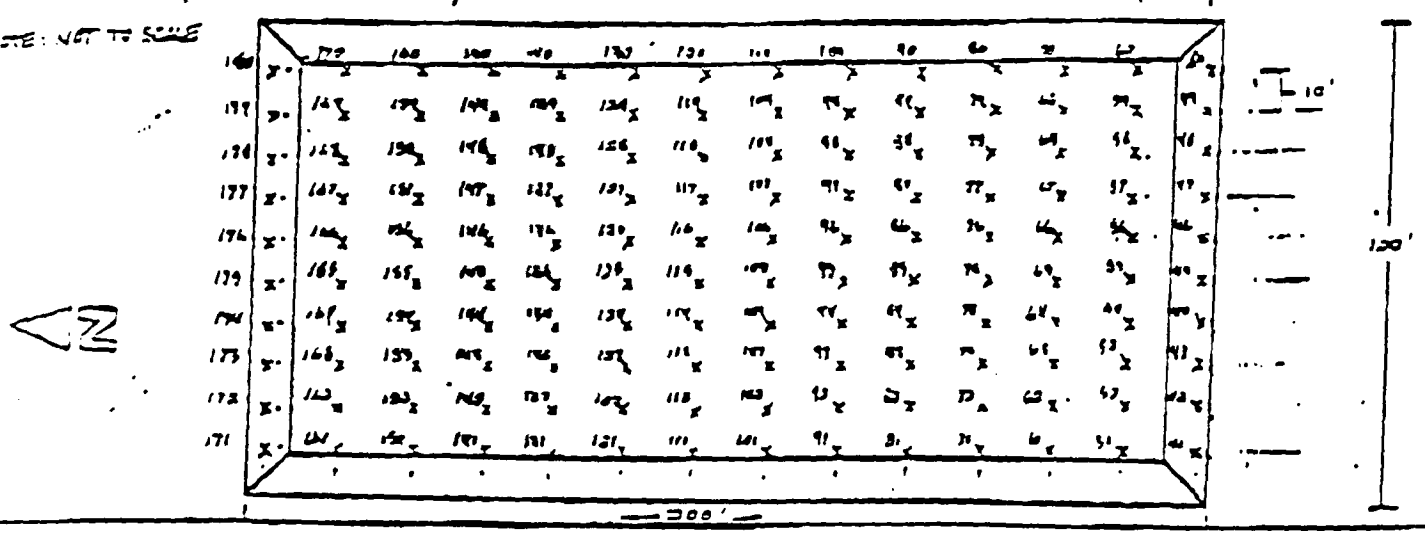
Contract # N62474-92-D-2242-0003

SAMPLE DATE 11-6-95 - 11-8-95 TIME See attached forms

SAMPLING METHODOLOGY AMS Core Sampler

DIAGRAM (IF APPLICABLE): CSP 041-180 X - SAMPLE LOCATION

NOTE: NOT TO SCALE



SAMPLE AMOUNT: 2" x 6" Brass

SAMPLE CONTAINER: Brass Sleeve

SAMPLE TAG: DATE: 11-6-95 – 11-8-95 TIME: See attached forms.

SAMPLE LOCATION: Contaminated Stockpile 041-180

SAMPLE NUMBER: CSP 041-180

ANALYSIS REQUIRED: TPH D (8015) BETX (8020) TPH G (8020)

SAMPLE NAME (PRINT): Kurt Hess

SAMPLER SIGNATURE: [signature] DATE: 11.8.95

certify that the above sample(s) was/were
aken by my direction and in my presence.

NAME (PRINT): Lee Holman TITLE: Q.C.

IGNATURE: [signature] DATE: 11-8-95

ESS NAME (PRINT): Nathan Holman TITLE:

IGNATURE: [signature] DATE: 11.8.95

CONTAMINATED SOIL PILES
SOUTH FUEL FARM TANK REMOVALS
SOIL SAMPLE RESULTS

Sample No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CSP-041	60.1	BDL(0.05)	U(2.8)	U(2.8)	U(2.8)	U(2.8)
-042	41.8	3.0	U(2.6)	152	U(2.6)	81.1
-043	BDL(10)	21.5	U(2.4)	86.2	U(2.4)	25.0
-044	28.1	4.9	U(2.6)	U(2.6)	U(2.6)	9.7
-045	19.5	0.097	U(2.3)	U(2.3)	U(2.3)	U(2.3)
-046	89.1	0.22	U(3.0)	U(3.0)	U(3.0)	U(3.0)
-047	46.8	5.3	U(2.8)	U(2.8)	U(2.8)	U(2.8)
-048	31.1	1.1	U(2.8)	28.2	U(2.8)	62.6
-049	25.9	2.6	U(2.9)	145	U(2.9)	112
-050	113	0.078	U(2.7)	U(2.7)	U(2.7)	U(2.7)
-051	30.2	29.0	U(15.0)	261	U(15.0)	183
-052	BDL(10)	0.10	U(3.0)	U(3.0)	U(3.0)	U(3.0)
-053	14.6	BDL(0.05)	U(2.8)	U(2.8)	U(2.8)	U(2.8)
-054	43.5	BDL(0.05)	U(2.8)	U(2.8)	U(2.8)	U(2.8)
-055	10.8	BDL(0.05)	U(2.7)	U(2.7)	U(2.7)	U(2.7)
-056	17.6	0.072	U(3.0)	U(3.0)	U(3.0)	U(3.0)
-057	44.4	0.068	U(2.8)	U(2.8)	U(2.8)	U(2.8)
-058	BDL(10)	0.050	U(3.0)	U(3.0)	U(3.0)	U(3.0)
-059	21.9	9.2	U(3.0)	U(3.0)	U(3.0)	U(3.0)
-060	13.4	0.21	U(2.9)	U(2.9)	U(2.9)	U(2.9)
-061	BDL(10)	0.62	U(3.0)	2.1	U(3.0)	5.8
-062	BDL(10)	0.70	U(3.0)	U(3.0)	U(3.0)	U(3.0)
-063	33.2	0.067	U(2.8)	U(2.8)	U(2.8)	U(2.8)
-064	BDL(10)	0.20	U(3.0)	U(3.0)	U(3.0)	U(3.0)
-065	BDL(10)	0.39	U(2.8)	1.7	U(2.8)	2.0
-066	BDL(10)	BDL(0.05)	U(3.0)	U(3.0)	U(3.0)	U(3.0)
-067	13.4	BDL(0.05)	U(2.8)	U(2.8)	U(2.8)	U(2.8)
-068	17.3	0.13	U(2.9)	U(2.9)	U(2.9)	U(2.9)
-069	18.4	0.12	U(3.0)	U(3.0)	U(3.0)	U(3.0)
-070	BDL(10)	0.20	U(2.8)	U(2.8)	U(2.8)	U(2.8)
-071	50.5	BDL(0.05)	U(2.7)	U(2.7)	U(2.7)	U(2.7)
-072	BDL(10)	0.31	U(2.7)	U(2.7)	U(2.7)	U(2.7)
-073	69.2	1.1	U(2.8)	3.7	U(2.8)	3.5
-074	10.7	0.71	U(2.7)	U(2.7)	U(2.7)	4.6
-075	BDL(10)	2.8	U(2.7)	5.9	U(2.7)	5.8
-076	58.3	2.9	U(2.7)	7.4	U(2.7)	8.8
-077	96.5	1.3	U(2.7)	U(2.7)	U(2.7)	U(2.7)
-078	37.1	0.12	U(2.8)	U(2.8)	U(2.8)	U(2.8)
-079	34.9	0.51	U(2.7)	U(2.7)	U(2.7)	U(2.7)
-080	66.3	0.80	U(2.8)	U(2.8)	U(2.8)	U(2.8)
-081	10.8	0.39	U(2.5)	U(2.5)	U(2.5)	U(2.5)
-082	46.3	0.29	U(2.4)	U(2.4)	U(2.4)	U(2.4)
-083	138	2.1	U(2.8)	4.7	U(2.8)	4.7

Sample No.	[illegible] (mg/kg)	[illegible] (mg/kg)	[illegible] (mg/kg)	[illegible] (mg/kg)	[illegible] (mg/kg)	[illegible] (mg/kg)
CSP-084	90.5	0.51	U(2.9)	U(2.9)	U(2.9)	U(2.9)
-085	25.8	1.0	U(2.8)	2.2J	U(2.8)	1.9J
-086	84.5	11.8	U(13.6)	40.4	U(13.6)	36.4
-087	BDL(10)	4.9	U(3.0)	8.3	U(3.0)	6.4
-088	50.8	1.5	U(2.7)	U(2.7)	U(2.7)	U(2.7)
-089	25.5	0.25	U(3.0)	U(3.0)	U(3.0)	U(3.0)
-090	19.6	0.39	U(2.9)	U(2.9)	U(2.9)	U(2.9)
-091	36.2	0.20	U(3.0)	U(3.0)	U(3.0)	U(3.0)
-092	11.5	0.20	U(3.0)	U(3.0)	U(3.0)	U(3.0)
-093	28.9	0.085	U(2.7)	U(2.7)	U(2.7)	U(2.7)
-094	68.1	3.4	U(11.5)	U(11.5)	U(11.5)	U(11.5)
-095	BDL(10)	BDL(0.05)	U(3.0)	U(3.0)	U(3.0)	U(3.0)
-096	41.9	BDL(0.05)	U(2.9)	U(2.9)	U(2.9)	U(2.9)
-097	13.3	0.49	U(2.9)	U(2.9)	U(2.9)	U(2.9)
-098	15.5	1.1	U(2.7)	U(2.7)	U(2.7)	U(2.7)
-099	16.9	0.21	U(2.9)	U(2.9)	U(2.9)	U(2.9)
-100	39.3	1.4	U(3.0)	2.2J	U(3.0)	4.3
-101	173	BDL(0.05)	U(2.9)	U(2.9)	U(2.9)	U(2.9)
-102	66.7	0.097	U(2.9)	U(2.9)	U(2.9)	U(2.9)
-103	22.9	0.23	U(3.0)	U(3.0)	U(3.0)	U(3.0)
-104	BDL(10)	BDL(0.05)	U(3.0)	U(3.0)	U(3.0)	U(3.0)
-105	37.1	BDL(0.05)	U(2.8)	U(2.8)	U(2.8)	U(2.8)
-106	20.5	2.6	U(2.7)	3.7	U(2.7)	4.4
-107	24.0	BDL(0.05)	U(2.8)	U(2.8)	U(2.8)	U(2.8)
-108	21.6	BDL(0.05)	U(2.7)	U(2.7)	U(2.7)	U(2.7)
-109	56.7	0.68	U(2.7)	U(2.7)	U(2.7)	U(2.7)
-110	17.2	1.6	U(3.0)	U(3.0)	U(3.0)	U(3.0)
-111	59.3	BDL(0.05)	U(2.8)	U(2.8)	U(2.8)	U(2.8)
-112	27.9	0.31	U(2.7)	U(2.7)	U(2.7)	U(2.7)
-113	44.6	1.2	U(3.0)	U(3.0)	U(3.0)	6.3
-114	132	0.30	U(3.0)	1.7J	U(3.0)	U(3.0)
-115	10.8	0.30	U(2.8)	U(2.8)	U(2.8)	1.4J
-116	159	0.70	U(2.9)	U(2.9)	U(2.9)	U(2.9)
-117	27.5	3.1	92.3	459	422	201
-118	58.0	0.19	U(2.8)	U(2.8)	U(2.8)	U(2.8)
-119	143	0.074	U(2.9)	U(2.9)	U(2.9)	U(2.9)
-120	BDL(10)	0.057	U(2.8)	U(2.8)	U(2.8)	U(2.8)
-121	118	0.11	U(2.7)	U(2.7)	U(2.7)	U(2.7)
-122	14.3	0.75	U(2.8)	U(2.8)	U(2.8)	U(2.8)
-123	63.4	0.21	U(2.8)	U(2.8)	U(2.8)	U(2.8)
-124	84.0	0.24	U(2.8)	U(2.8)	U(2.8)	2.0J
-125	21.0	17.2	3.6	31.4	U(2.6)	32.4
-126	115	0.68	1.6	3.5	U(2.8)	4.1
-127	44.0	2.9	U(2.4)	7.7	U(2.4)	15.8
-128	21.0	23.5	227	216	U(7.9)	U(7.9)
-129	44.9	5.1	3.6	13.2	U(2.6)	9.3
-130	235	0.41	2.8J	U(2.6)	U(2.6)	U(2.6)

Sample No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CSP-131	BDL(10)	9.4	U(13.6)	37.5	U(13.6)	39.4
-132	111	137	1993	509	U(227)	380
-133	97.4	488	796	2530	U(208)	1290
-134	107	269	2173	1120	U(221)	1440
-135	211	6.8	U(2.9)	21.6	U(2.9)	26.5
-136	171	6.2	4.0	31.5	U(2.8)	14.0
-137	240	22.7	35.5	209	U(15.0)	19.2
-138	15.7	2.1	U(2.7)	7.7	U(2.7)	13.3
-139	205	2.5	U(2.6)	12.0	U(2.6)	22.2
-140	216	14.5	U(6.5)	48.3	U(6.5)	83.8
-141	285	0.78	U(2.8)	U(2.8)	U(2.8)	2.4J
-142	76.2	17.3	U(2.6)	28.1	U(2.6)	49.3
-143	45.9	0.57	U(2.9)	U(2.9)	U(2.9)	U(2.9)
-144	15.6	0.52	U(2.5)	U(2.5)	U(2.5)	5.4
-145	24.7	3.4	U(2.8)	6.4	U(2.8)	13.5
-146	70.0	2.9	U(2.5)	9.4	U(2.5)	16.7
-147	117	24.6	33.9	271	U(5.2)	30.9
-148	58.6	7.5	U(2.9)	15.1	U(2.9)	30.5
-149	83.6	9.6	2.7	52.7	U(2.6)	35.2
-150	546	4.2	U(3.0)	7.4	U(3.0)	12.5
-151	169	3.7	U(2.8)	15.1	U(2.8)	4.0
-152	54.4	5.4	5.6	24.4	U(2.9)	6.4
-153	118	7.5	U(2.4)	13.7	U(2.4)	29.1
-154	293	10.6	11.4	62.2	U(10.7)	35.0
-155	75.0	1.3	U(10.7)	7.5J	U(10.7)	U(10.7)
-156	144	1.3	U(3.0)	4.1	U(3.0)	3.9
-157	267	0.49	U(9.4)	U(9.4)	U(9.4)	U(9.4)
-158	106	0.21	U(2.9)	U(2.9)	U(2.9)	U(2.9)
-159	22.4	BDL(0.05)	U(2.9)	U(2.9)	U(2.9)	U(2.9)
-160	94.8	1.9	U(3.0)	7.1	U(3.0)	13.3
-161	133	BDL(0.05)	U(2.6)	U(2.6)	U(2.6)	U(2.6)
-162	84.0	6.3	U(12.5)	11.7J	U(12.5)	20.5
-163	215	29.3	U(11.5)	163	U(11.5)	75.8
-164	72.6	BDL(0.05)	U(3.0)	U(3.0)	U(3.0)	U(3.0)
-165	130	9.5	U(6.3)	35.0	U(6.3)	63.8
-166	63.1	BDL(0.05)	U(3.0)	U(3.0)	U(3.0)	U(3.0)
-167	BDL(10)	BDL(0.05)	U(2.8)	U(2.8)	U(2.8)	U(2.8)
-168	88.0	0.063	U(2.7)	U(2.7)	U(2.7)	U(2.7)
-169	85.8	18.2	U(15.0)	87.6	U(15.0)	39.2
-170	173	10.7	U(13.6)	33.6	U(13.6)	14.6
-171	152	19.8	U(11.5)	156	U(11.5)	83.1
-172	92.7	20.6	U(10.7)	87.9	U(10.7)	34.8
-173	127	0.18	U(2.7)	1.8	U(2.7)	3.2
-174	41.4	23.5	16.9	306	U(11.5)	25.8
-175	14.4	BDL(0.05)	U(2.7)	U(2.7)	U(2.7)	U(2.7)
-176	166	BDL(0.05)	U(3.0)	U(3.0)	U(3.0)	U(3.0)
-177	77.5	0.91	U(2.9)	U(2.9)	U(2.9)	4.3

Sample No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CSP-178	87.8	0.37	U(2.8)	U(2.8)	U(2.8)	U(2.8)
-179	161	1.5	U(2.8)	5.6	U(2.8)	7.3
-180	77.7	11.2	U(15.0)	24.6	U(15.0)	25.2