Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program

April 1999 Monitoring Report

Elliott Bay/Duwamish Restoration Program

Prepared for the
Elliott Bay/Duwamish Restoration Program Panel
by the
King County Department of Natural Resources

Panel Publication 22

August 1999

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by
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The Panel of Managers holds regularly scheduled meetings that are open to the public. Technical Working Group and committee meetings are scheduled on an as-needed basis, and are also open to the public. Meetings are generally held at the National Oceanic and Atmospheric Administration, National Marine Fisheries Service - Regional Directorate Conference Room, Building 1, 7600 Sand Point Way NE, Seattle. The Panel recommends that you contact the Administrative Director at the above phone number to confirm meeting schedules and locations. The panel also holds periodic special evening and weekend public information meetings and workshops.

General Schedule for Panel and Committee Meeting Dates

Panel: quarterly, first Thursday of January, April, July, October, 9:30 A.M. - 12:30 P.M.
Habitat Development Technical Working Group: third Thursday of every month, 9:30 A.M. - 12:30 P.M.
Sediment Remediation Technical Working Group: scheduled as needed.
Public Participation Committee: scheduled as needed.
Budget Committee: scheduled as needed.

Environmental Review of Specific Projects

Formal hearings and comment periods on appropriate environmental documents for proposed sediment remediation and habitat development projects will be observed. Please contact the Administrative Director for more information.

This information is available in accessible formats on request at (206) 296-0600 (voice) and 1-800-833-6388 (TTY/TDD users only).

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1 INTRODUCTION

This report presents the results of the first sampling event of a five-year monitoring program at the Norfolk combined sewer overflow (CSO) sediment remediation site. The purpose of the five-year program is to monitor sediment placed as backfill material at the site for potential recontamination from CSO and other discharges. The first sampling event occurred in April 1999, within the first month after completion of remedial activities, and was intended to collect baseline data on the chemical characteristics of the sediment used as backfill material. Included in this report are a project background, descriptions of sampling and analytical methodologies, analytical results, and a quality assurance review of the analytical data.

1.1 Project Background

Sediment remediation at the Norfolk CSO site was undertaken to partially fulfill sediment remediation requirements of a 1991 Consent Decree, which defined the terms of a natural resources damage agreement between King County (along with the City of Seattle) and federal, state, and tribal natural resources trustees. The Norfolk CSO site was chosen by the Elliott Bay/Duwamish Restoration Program (EBDRP) Panel as one of four sites prioritized for potential sediment remediation.

A site characterization and cleanup study was performed in 1994 and 1995, and the cleanup study report was issued in 1996 (EBDRP, 1996). Chemicals of concern at the site included mercury, 1,4-dichlorobenzene, bis(2-ethylhexyl) phthalate and polychlorinated biphenyls (PCBs), all present at concentrations exceeding State of Washington Sediment Management Standards (SMS) sediment chemical criteria values that define the cleanup screening levels. PCB "hot spot" concentrations at the site also exceeded Toxic Substances Control Act (TSCA) limits for hazardous waste disposal.

Site remediation began in early February 1999 and was completed by late March 1999. Remedial activities consisted of dredging and disposal of contaminated sediment and backfilling the dredged area to original grade with clean sediment from the Duwamish River Turning Basin. Contaminated sediments were removed from the site by mechanical dredge and dewatered on shore in a containment area first arranged to segregate batches about 50 cubic yards (cy) in size and later reconfigured to handle larger batches.

Sediment samples were collected daily from each 50-cy batch and analyzed for PCB concentrations to determine the appropriate disposal destination. Sediments with a PCB concentration greater than 45 parts per million (ppm) were transported to a Subtitle C landfill in Arlington, Oregon for disposal. Sediments with a PCB concentration less than 45 ppm were transported to a Subtitle D landfill in Bremerton, Washington for disposal.

A total of 5,190 cy of sediment was removed during the remediation, of which approximately 1,900 cy of sediment was transported to the Subtitle C landfill as hazardous waste. Sediment was generally removed to a depth of three feet, however, remediation in the PCB hot spot areas required removal of sediment up to nine feet in depth.

Confirmational testing subsequent to dredging activities indicated that, in some of the deepest dredged areas, sediments were left in place that contained PCB concentrations greater than SMS chemical criteria. Discussions with project oversight personnel from the EBDRP Panel and State of Washington Department of Ecology (Ecology) determined that, at a depth of nine feet below original grade, these PCB-contaminated sediments could be left in place.

Clean backfill sediment was obtained from the Duwamish River Turning Basin during normal, maintenance dredging operations by the Army Corps of Engineers (ACOE). Data collected by the Corps prior to maintenance dredging indicated that this material was suitable for use as backfill material (ACOE unpublished data, 1998). A sample was also collected from the Turning Basin sediment after it was placed on a barge and just prior to backfilling activities. Analytical results from this sample confirmed the suitability of the sediment as backfill material (King County unpublished data, 1999). No organic chemicals were detected in the sample and metals were detected at levels indicative of natural, area-wide crustal sediment concentrations. Approximately 6,700 cy of Turning Basin sediment was used to backfill the dredged area at the Norfolk CSO sediment remediation site. A site closure report was issued in August 1999 (EBDRP, 1999).

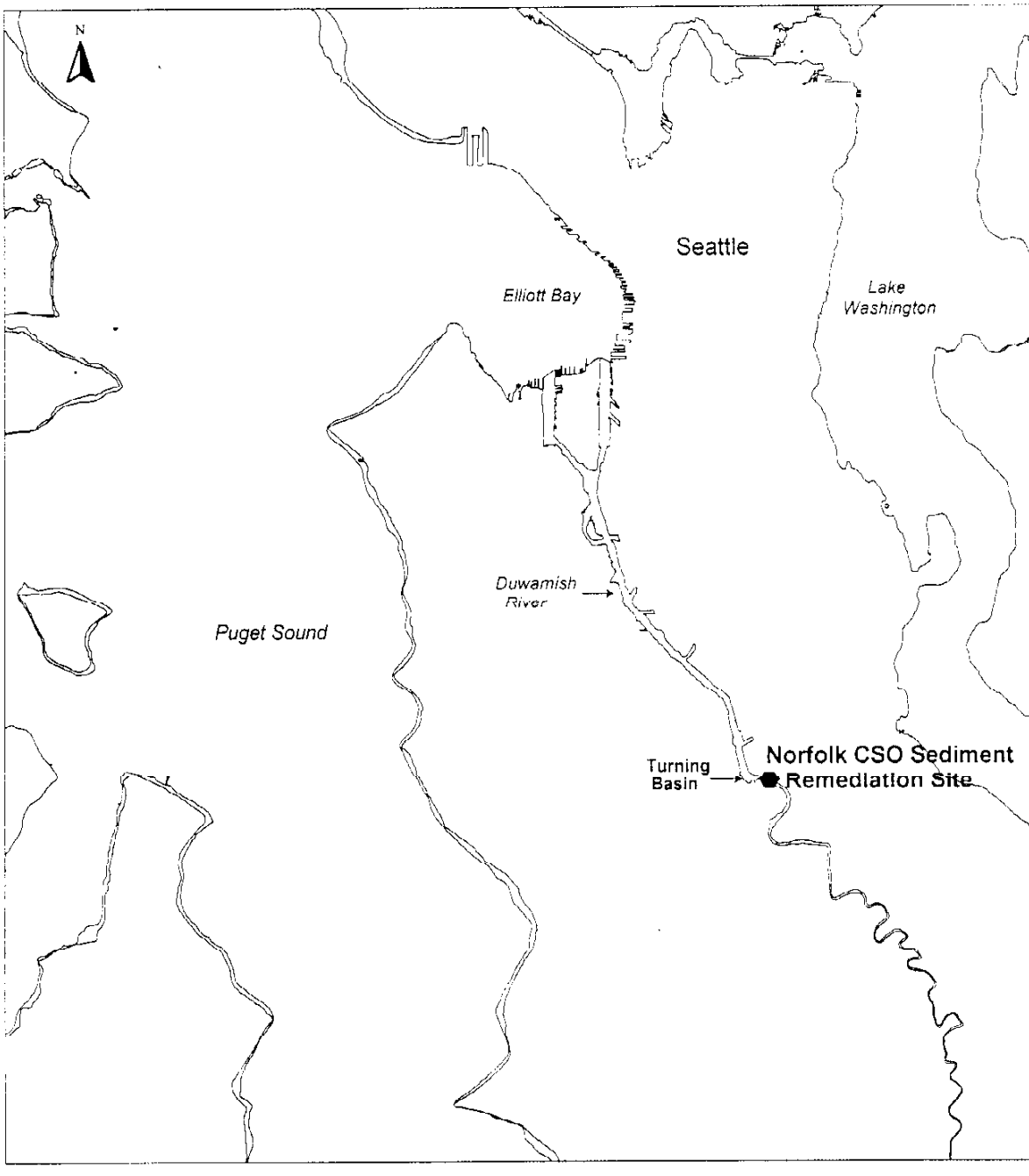
The site hydraulic permit, issued by the Washington State Department of Fish and Wildlife prior to remediation, requires that the site be monitored for a period of five years following remedial activities to evaluate possible recontamination of the backfill sediment as a result of continuing CSO or storm water discharges. To comply with this permit, a five-year monitoring plan was prepared which includes sampling and analysis of surficial sediments from four stations in the backfilled area. Analytical data will allow King County to evaluate the chemical characteristics of the sediment and assess possible recontamination over time. Monitoring activities will be performed in accordance with a sampling and analysis plan addendum prepared by King County (King County, 1999).

1.2 Site Description

The Norfolk CSO sediment remediation site is located in the Duwamish River, above the Turning Basin at approximately river kilometer (km) 10 in the City of Tukwila (Figure 1). The site is located upstream of the river reach maintained for commercial navigation and, as such, has maintained its natural channel as well as some riparian habitat (EBDRP, 1996). The shoreline is characterized by a steeply sloping, erosional bank maintained with large concrete riprap. The bank joins a gently sloping, intertidal mud shoreline that is completely exposed during extreme low tides.

The Norfolk CSO outfall originates at King County's Norfolk Street Regulator Station near South 102nd Street and East Marginal Way in Tukwila (EBDRP, 1996). The outfall structure has a flap gate over the 84-inch discharge pipe and a concrete splash plate that is exposed during normal low tides. The remediation site is located adjacent to the outfall structure and is characterized by exposed, intertidal mud habitat as well as subtidal riverbed. The intertidal zone has been channelized, both by the discharge of the Norfolk CSO and by a storm drain outfall that drains a Boeing Company parking lot adjacent to the CSO outfall.

FIGURE 1
SITE VICINITY MAP
NORFOLK CSO SEDIMENT REMEDIATION



2 SAMPLE COLLECTION

This section describes the post-backfill sampling activities conducted in April 1999 and a post-sampling site survey that was performed in June 1999. All sampling activities were conducted following guidance suggested in the Puget Sound Protocols (PSEP, 1996a and 1998).

2.1 Sample Locations and Station Positioning

Sampling locations were selected and coordinates determined prior to field activities. Sampling locations were selected to assess potential recontamination at the site and evaluate the chemical characteristics of the backfill material at the following locations:

- within the Norfolk CSO outfall channel, inshore of termination of the channel (NFK501);
- the terminus of the Norfolk CSO outfall channel (NFK502);
- the terminus of the Boeing storm drain outfall channel (NFK503); and
- upriver of both the CSO and storm drain outfall channels.

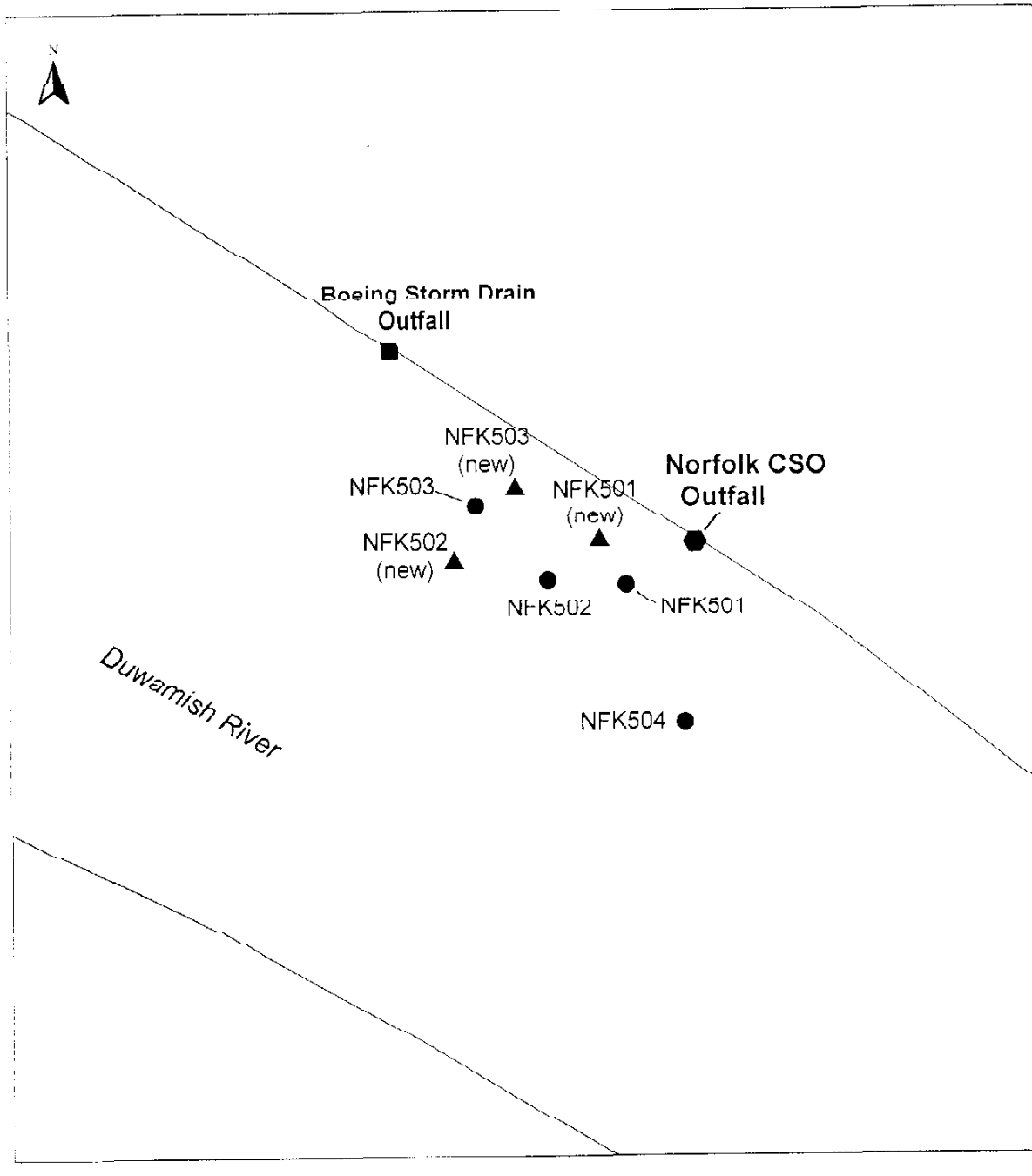
The prescribed station location coordinates are presented in Table 1 and sample locations are shown in Figure 2.

Table 1
Sample Location Coordinates
Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program
April 1999 Monitoring Data

Station Name	thing (NAD83)		Easting (NAD83)	
NFK501 Prescribed Station	190147		1278595	
NFK501 Grab 1		190147		1278594
NFK501 Grab 2		190153		1278586
NFK501 Grab 3		190149		1278592
NFK502 Prescribed Station	190150		1278560	
NFK502 Grab 1		190147		1278544
NFK502 Grab 2		190160		1278546
NFK502 Grab 3		190154		1278556
NFK503 Prescribed Station	190186		1278524	
NFK503 Grab 1		190193		1278518
NFK503 Grab 2		190194		1278521
NFK503 Grab 3		190196		1278521
NFK504 Prescribed Station	190080		1278625	
NFK504 Grab 1		190090		1278624
NFK504 Grab 2		190078		1278629
NFK504 Grab 3		190081		1278626

Notes
NAD83 - North American Datum, 1983

FIGURE 2
SITE MAP WITH SAMPLE LOCATIONS
NORFOLK CSO SEDIMENT REMEDIATION



Sample station locations were selected to monitor sediment quality in those areas with the greatest potential for recontamination; two stations in the Norfolk CSO channel and one station in the Boeing storm drain channel. The upriver station was selected to provide background or reference data. The station locations were selected based on information provided by site surveys performed prior to remediation. Samples were collected during the first sampling event from these locations. Subsequent visual observations showed the CSO channel had moved and a new survey of the CSO and storm drain channels indicated the need to move some of the stations for future sampling events. Further discussion of this issue can be found in Section 2.3.

Sediment grab samples were collected from the King County research vessel *Chinook*, which is equipped with a differential global positioning system (DGPS). Coordinates, presented in Table 1, were recorded using DGPS for each of the individual grabs as the sampler contacted the river bottom. The DGPS is a satellite-based navigation system that operates using a receiver to calculate ground position by triangulating scrambled data transmitted by a constellation of satellites operated by the Department of Defense (DOD). The ship-board "differential" receiver receives both the scrambled DOD signal and "corrected" signals originating from base stations operated by various agencies including the Coast Guard and King County. System software applies the differential correction and calculates a precise, real-time navigational position.

One composite sediment sample was obtained from each station and submitted for chemical analysis. Each sample was composited from three separate deployments of the grab sampler. The individual grab coordinates are included in Table 1.

2.2 Sample Collection and Handling

Four estuarine sediment samples were collected April 23, 1999 from the Norfolk CSO sediment remediation site. Samples were collected from the top 10 centimeters (cm) of sediment using a stainless steel, modified, 0.1 m^2 Van Veen grab sampler deployed from the *Chinook* via hydrowire. Water depth at the four sample stations ranged between 2 and 2.5 meters on an ebbing tide of approximately 6 feet (referenced to mean lower low water). Between 13 and 16 cm of sediment was recovered in each grab, allowing collection of a sample aliquot from the top 10 cm without sampling sediment that had touched the sides or bottom of the grab sampler. Field data are included in Appendix A.

Samples were comprised of sediment aliquots collected from three individual grabs at each station with an equal amount of material collected from each grab. A sediment aliquot from each grab was collected using a stainless-steel spoon, placed into a stainless-steel bowl, covered with foil, and placed into an ice-filled cooler between grab deployments. After collecting aliquots from three grabs, the sediment sample was thoroughly homogenized and sample aliquots split out into pre-labeled containers. Sample containers were supplied by the King County Environmental Laboratory and were pre-cleaned according to analytical specifications.

A set of sample compositing equipment was dedicated to each station, precluding the need for decontamination of the field gear. The Van Veen grab sampler was decontaminated between stations by scrubbing with a brush and river water followed by a thorough *in situ* rinsing.

Samples were stored in ice filled coolers from the time of collection until delivery to the King County Environmental Laboratory. Samples were delivered under chain-of-custody and were maintained as such throughout the analytical process. A copy of the chain-of-custody is included as part of the quality assurance review narrative found in Appendix B.

Samples were stored frozen (-18°C) by the laboratory until analysis with the exception of samples for particle size distribution (PSD) analysis. PSD samples were stored refrigerated at approximately 4°C. All analyses were conducted by the King County Environmental Laboratory with the exception of PSD, which was analyzed at AmTest, Inc., a subcontracted laboratory accredited by the State of Washington Department of Ecology (Ecology).

2.3 Post-Sampling Survey

After the first monitoring event, visual observation of the intertidal area during a low tide revealed that remedial activities at the site had significantly altered the flow course of both the Norfolk CSO and Boeing storm drain channels. The Norfolk CSO channel now angles downstream instead of going directly offshore and the two channels now intersect prior to the terminus of the CSO channel. In order to continue successfully monitoring the site for possible recontamination, a survey was performed to establish the positions of the new channels and to guide selection of possible sampling locations.

To determine the exact locations of the CSO and storm drain channels, a survey was performed on June 14, 1999 using a Total Station positioning system. The Total Station system consists of a combined theodolite and infrared distance measuring instrument and prism cluster. Five points were surveyed in each of the channels. Based on results of the survey, it was determined necessary to establish new position coordinates for stations NFK501, NFK502, and NFK503.

Old and new coordinates and station descriptions are presented in Table 2 and new station positions are shown in Figure 2. Future monitoring events will use the new stations; however, visual observations will continue during low tides to determine if the channels maintain these new courses. Site photographs, showing channelization at the site, are included in Appendix C.

Approximate distances between the locations sampled during the first event and the new, prescribed station locations are: NFK501 - 32 feet; NFK502 - 46 feet; and NFK503 - 24 feet. Given the fairly short distance between locations and short time period between the placement of the backfill material and the first sampling event, it is felt that the data from this event may still be used as baseline information to which data from subsequent monitoring events may be compared.

Table 2
New Sample Location Coordinates
Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program
April 1999 Monitoring Data

	Old Coordinates		New Coordinates		
Station Name and Old Description	**Northing**	**Easting**	**Northing**	**Easting**	**New Description**
NFK501 Norfolk CSO outfall channel inshore.	190150	1278610	190170	1278584	Norfolk CSO outfall channel prior to confluence with Boeing storm drain channel.
NFK502 End of Norfolk CSO outfall channel.	190150	1278560	190159	1278514	Delta of Norfolk CSO outfall channel after confluence with Boeing storm drain channel.
NFK503 End of Boeing storm drain channel.	190186	1278524	190195	1278544	Boeing storm drain channel prior to confluence with Norfolk CSO outfall channel.
NFK504 Upriver of CSO and storm drain channels.	190080	1278625	No Change	No Change	No Change

Notes
All coordinates in North American Datum, 1983 (NAD83).

3 SAMPLE ANALYSIS

Four estuarine sediment samples, collected from the Norfolk CSO sediment remediation site, were submitted for analysis of conventional, metal, and organic parameters. This section describes the type of analyses performed, as well as analytical methodologies used and the associated quality assurance/quality control (QA/QC) procedures followed. Unless otherwise specified, all analyses were performed by the King County Environmental Laboratory. Analyses were selected to allow comparison of sediment data to the SMS sediment chemical criteria found in Tables 1 and 3 of Chapter 173-204 WAC.

3.1 Conventionals

Conventional analyses included percent solids, total organic carbon (TOC), and PSD. Percent solids and TOC analyses were performed to provide data necessary to normalize sediment data to dry weight and organic carbon, respectively. TOC analysis will also allow evaluation of possible organic enrichment at the site over time. Both analyses were performed according to methodologies outlined in Standard Methods (APHA, 1998). Percent solids analysis was performed following SM 2540-G, gravimetric determination and TOC analysis was performed following SM 5310-B, high-temperature combustion with infrared spectroscopy. PSD analysis will allow evaluation of the gross physical characteristics of the backfill material and any changes imparted by sedimentation. PSD analysis was performed by AmTest, Inc. of Redmond, Washington according to method ASTM D422, a combination of sieve and hydrometer analyses.

3.2 Metals

Metal analyses included 13 priority pollutant metals, as well as the crustal metals aluminum, iron, and manganese (see Appendix A). SMS regulates eight of the metals included in this suite of analytes; arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc. Metal analysis will allow assessment of potential recontamination at the site over time. With the exception of mercury, all metal analyses were performed following EPA Method 3050A/6010B; strong-acid digestion with inductively coupled plasma optical emission spectroscopy. Mercury was analyzed according to EPA Method 245.5, cold vapor atomic absorption spectroscopy.

3.3 Organics

Organic analyses included base/neutral/acid extractable semivolatile compounds (BNAs) and polychlorinated biphenyls (PCBs) (see Appendix A). Organic analysis will also allow assessment of potential recontamination to the site over time, especially by PCBs and phthalates. BNA analysis was performed following EPA Method 8270 (SW-846), gas chromatography with mass spectroscopy (GC/MS). A separate extract of the sample was analyzed for chlorobenzene compounds using selected ion monitoring (SIM) to achieve the lower detection limits required to meet regulatory criteria for these compounds. PCBs were analyzed by EPA Method 8082 (SW 846), gas chromatography with electron capture detection (GC/ECD). This suite of analytes included all organic compounds regulated under SMS.

3.4 Quality Assurance/Quality Control

All analyses were performed following guidance recommended under Puget Sound Protocols (PSEP 1989, 1996b, and 1996c) including associated QC/QC practices. Laboratory QA/QC practices produced data of sufficient quality to pass QA1 review. Analytical data were reviewed following QA1 guidelines (Ecology, 1989) and flagged with data qualifiers where appropriate. A comprehensive report of analytical data, including qualifier flags is included as Appendix A. The QA1 review narrative is included as Appendix B.

4 ANALYTICAL RESULTS

This section discusses analytical results for the four estuarine sediment samples collected from the Norfolk CSO sediment remediation site and compares the data to sediment criteria specified under SMS (Ecology, 1995). Tables in this section summarize and compare the data to both Sediment Quality Standards (SQS) and Cleanup Screening Levels (CSL).

4.1 Particle Size Distribution

Particle size distribution (also known as grain size distribution) of the four samples is summarized in Table 3. Grain size distribution analysis indicates that the backfill material used during the Norfolk CSO sediment remediation project was comprised of a fairly even-grained homogeneous material. Between 83 and 90% of the grain size distribution of all four samples fell into only two phi sizes; medium to coarse-grained sand.

Table 3
Grain Size Distribution
Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program
April 1999 Monitoring Data

		Percent Distribution			
Phi Size	**Class**	**NFK 501**	**NFK502**	**NFK503**	**NFK504**
p-1.00	Gravel	0.8	0.4	0.4	0.4
p0.00	Sand	3.3	3.0	1.0	3.3
p+1.00	Sand	38	32	28	44
p+2.00	Sand	46	56	55	46
p+3.00	Sand	4.3	4.1	9.0	3.0
p+4.00	Sand	7.0	0.4	1.3	0.4
p+5.00	Silt	1.0	4.7	5.4	2.9

4.2 Conventionals

Conventional analytical results are presented in Table 4 and include percent solids, used to calculate dry-weight sediment concentrations of metal and organic data and total organic carbon (TOC), used to normalize certain organic parameters to organic carbon content.

Percent solids was consistent throughout the four samples, ranging from 76.9 to 77.6%. The organic carbon content was also fairly consistent among the four samples, although the sample collected from station NFK503 showed a slightly higher TOC value, possibly indicating a slight degree of organic enrichment as this station.

Table 4
Sediment Conventionals
Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program
April 1999 Monitoring Data

Conventionals	NFK 501	NFK502	NFK503	NFK504
Solids (%)	76.9	77.4	77.0	77.6
TOC (mg/Kg DW)	1,760	1,210	3,180	1,260

Notes
TOC - Total organic carbon.
mg/Kg DW - Milligrams per kilogram dry weight, based on percent solids analysis.

4.3 Metals

Sediment metal analytical results are summarized in Table 5. Metals data have been normalized to dry weight for comparison to SMS chemical criteria.

Arsenic, cadmium, and silver were either not detected or detected at concentrations just above the MDL in all samples. Reported concentrations of all metals (Appendix A) were at levels indicative of natural, area-wide crustal concentrations (Dexter et al, 1981). Metal concentrations and/or MDL values for those metals regulated under SMS were consistent over all samples and well below SQS chemical criteria.

Table 5
Sediment Metal Concentrations
Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program
April 1999 Monitoring Data

	Concentration (mg/Kg DW)					
Metal	NFK501	NFK502	NFK503	NFK504	SQS	CSL
Arsenic	<MDL (3.3)	3.7	<MDL (3.2)	3.5	57	93
Cadmium	0.20	0.21	<MDL (0.19)	0.21	5.1	6.7
Chromium	12.9	13.0	14.7	12.2	260	270
Copper	11.4	12.2	10.5	11.2	390	390
Lead	4.2	5.0	4.4	4.6	450	530
Mercury	0.055	0.089	0.066	0.072	0.41	0.59
Silver	<MDL (0.26)	<MDL (0.25)	<MDL (0.26)	<MDL (0.24)	6.1	6.1
Zinc	46	43.2	42.1	44.2	410	960

Notes
mg/Kg DW - Milligrams per kilogram dry weight, based on percent solids analysis.
<MDL (#) - Analyte not detected above the *method dection limit*. Value is parentheses is the numeric MDL.

4.4 Organics

Organic analytical results are summarized in Tables 6, 7, and 8. Data for ionic organic compounds have been normalized to dry weight for comparison to SMS sediment criteria and are presented in Table 6.

Ionic organic compounds were not detected in any of the samples and the associated MDL values for six of the seven compounds were below SMS sediment criteria (see Table 6). The MDL for 2,4-dimethylphenol (35 µg/Kg dry weight) exceeded the SQS and CSL (29 µg/Kg dry weight) for all samples. Method development at the King County Environmental Laboratory is attempting to lower the current MDL for this compound.

Table 6
Sediment Ionic Organic Concentrations
Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program
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	Concentration (µg/Kg DW)					
Ionic Organics	**NFK501**	**NFK502**	**NFK503**	**NFK504**	**SQS**	**CSL**
Benzoic Acid	<MDL (140)	<MDL (140)	<MDL (140)	<MDL (140)	650	650
Benzyl Alcohol	<MDL (35)	<MDL (35)	<MDL (35)	<MDL (35)	57	73
2,4-Dimethylphenol	<MDL (35)	<MDL (35)	<MDL (35)	<MDL (35)	29	29
2-Methylphenol	<MDL (35)	<MDL (35)	<MDL (35)	<MDL (35)	63	63
4-Methylphenol	<MDL (35)	<MDL (35)	<MDL (35)	<MDL (35)	670	670
Pentachlorophenol	<MDL (35)	<MDL (35)	<MDL (35)	<MDL (35)	360	690
Phenol	<MDL (140)	<MDL (140)	<MDL (140)	<MDL (140)	420	1,200

Notes
µg/Kg DW - Micrograms per kilogram dry weight, based on percent solids analysis.
<MDL (#) - Analyte not detected above the *method dection limit*. Value is parentheses is the numeric MDL.
Shaded Cell - MDL exceeds the SQS and/or CSL.

Data for non-ionic organic compounds have been normalized to organic carbon and are presented in Table 7 compared to the SQS and CSL.

Non-ionic organic compounds were not detected in the samples collected from NFK501 and NFK503. Benzo(g,h,i)perylene was detected in the samples collected from NFK502 and NFK 504 at concentrations of 62.6 and 56.0 mg/Kg organic carbon, respectively (Table 7). These concentrations exceed the SQS (31 mg/Kg organic carbon) but not the CSL (78 mg/Kg organic carbon). Hexachlorobenzene was detected in the sample collected from NFK502 at a concentration of 0.80 mg/Kg organic carbon (Table 7), which also exceeds the SQS (0.38 mg/Kg organic carbon) but not the CSL (2.3 mg/Kg organic carbon).

Organic carbon-normalized MDL values for 2-methylnaphthalene, dibenzo(a,h)anthracene, hexachlorobenzene, butyl benzyl phthalate, total PCBs, dibenzofuran, hexachlorobutadiene, and N-nitrosodiphenylamine exceeded the SQS and/or CSL for one or more samples (see Table 7).

Normalization to organic carbon can produce biased results, however, when the organic carbon content of the sample is very low (Ecology, 1992). When the organic carbon content of a sample is near 0.1 or 0.2% (1,000 to 2,000 ppm), even background concentrations of certain organic compounds can exceed the SQS or CSL. TOC concentrations in samples collected from NFK501, NFK502, and NFK504 were all below 0.2% and the TOC concentration in the sample collected from NFK503 was just above 0.3%.

For sediment with a TOC content less than 0.5% (5,000 ppm), Ecology recommends comparing dry weight-normalized, non-ionic organic data to Puget Sound lowest apparent effects thresholds and second lowest apparent lowest effects thresholds (LAET and 2LAET) (EPA, 1988) for a more appropriate evaluation of sediment quality relative to organic compounds (Ecology, 1992). Table 8 presents this comparison.

When comparing these data on a dry weight-normalized basis to the LAET and 2LAET (Table 8), the detected concentrations of benzo(g,h,i)perylene and hexachlorobenzene are well below their respective chemical criteria. Dry weight-normalized MDL values are also below the chemical criteria with the exception of hexachlorobutadiene and N-nitrosodiphenylamine (35 µg/Kg dry weight), which exceed the LAET (11 and 28 µg/Kg dry weight, respectively) but not the 2LAET (120 and 40 µg/Kg dry weight), respectively. The King County Environmental Laboratory is also working on method development to lower these two compounds.

The full list of organic chemicals (72 total) for which these samples were analyzed is included in Appendix A. Chemical criteria for twenty-five of these compounds have not been developed under SMS. It should be noted that these other organic compounds were also not detected in any of the samples.

Table 7
Sediment Non-Ionic Organic Concentrations (Organic Carbon Normalized)
Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program
April 1999 Monitoring Data

	Concentration (mg/Kg OC)					
	NFK501	NFK502	NFK503	NFK504		
Non-Ionic Organics	TOC 0.18%	TOC 0.12%	TOC 0.32%	TOC 0.13%	SQS	CSL
LPAHs						
Acenaphthene	<MDL (8.0)	<MDL (12)	<MDL (4.4)	<MDL (11)	16	57
Acenaphthylene	<MDL (12)	<MDL (17)	<MDL (6.6)	<MDL (17)	66	66
Anthracene	<MDL (12)	<MDL (17)	<MDL (6.6)	<MDL (17)	220	1,200
Fluorene	<MDL (12)	<MDL (17)	<MDL (6.6)	<MDL (17)	23	79
2-Methylnaphthalene	<MDL (32)	**<MDL (46)**	<MDL (18)	**<MDL (44)**	38	64
Naphthalene	<MDL (32)	<MDL (46)	<MDL (18)	<MDL (44)	99	170
Phenanthrene	11.9	<MDL (17)	<MDL (6.6)	<MDL (17)	100	480
Total LPAH	11.9	<MDL	<MDL	<MDL	370	780
HPAHs						
Benzo(a)anthracene	<MDL (12)	<MDL (17)	<MDL (6.6)	<MDL (17)	110	270
Benzo(a)pyrene	<MDL (20)	<MDL (29)	<MDL (11)	<MDL (28)	99	210
Benzofluoranthenes (Total)	<MDL (32)	<MDL (46)	<MDL (18)	<MDL (44)	230	450
Benzo(g,h,i)perylene	<MDL (20)	**62.6**	<MDL (11)	**56.0**	31	78
Chrysene	<MDL (12)	<MDL (17)	<MDL (6.6)	<MDL (17)	110	460
Dibenzo(a,h)anthracene	**<MDL (32)**	**<MDL (46)**	**<MDL (18)**	**<MDL (44)**	12	33
Fluoranthene	<MDL (12)	<MDL (17)	<MDL (6.6)	<MDL (17)	160	1,200
Indeno(1,2,3-c,d)pyrene	<MDL (20)	<MDL (29)	<MDL (11)	<MDL (28)	34	88
Pyrene	<MDL (12)	<MDL (17)	<MDL (6.6)	<MDL (17)	1,000	1,400
Total HPAH	<MDL	62.6	<MDL	56.0	960	5,300
Chlorobenzenes						
1,2-Dichlorobenzene	<MDL (0.51)	<MDL (0.74)	<MDL (0.28)	<MDL (0.71)	2.3	2.3
1,4-Dichlorobenzene	<MDL (0.51)	<MDL (0.74)	<MDL (0.28)	<MDL (0.71)	3.1	9
Hexachlorobenzene	**<MDL (0.51)**	**0.80**	<MDL (0.28)	**<MDL (0.71)**	0.38	2.3
1,2,4-Trichlorobenzene	<MDL (0.51)	<MDL (0.74)	<MDL (0.28)	<MDL (0.71)	0.81	1.8
Phthalates						
Bis(2-ethylhexyl) Phthalate	<MDL (12)	<MDL (17)	<MDL (6.6)	<MDL (17)	47	78
Butyl Benzyl Phthalate	**<MDL (12)**	**<MDL (17)**	**<MDL (6.6)**	**<MDL (17)**	4.9	64
Di-N-butyl Phthalate	<MDL (20)	<MDL (29)	<MDL (11)	<MDL (28)	220	1,700
Di-N-octyl Phthalate	<MDL (12)	<MDL (17)	<MDL (6.6)	<MDL (17)	58	4,500
Diethyl Phthalate	<MDL (20)	<MDL (29)	<MDL (11)	<MDL (28)	61	110
Dimethyl Phthalate	<MDL (8.0)	<MDL (12)	<MDL (4.4)	<MDL (11)	53	53
Miscellaneous Compounds						
Dibenzofuran	**<MDL (20)**	**<MDL (29)**	<MDL (11)	**<MDL (28)**	15	58
Hexachlorobutadiene	**<MDL (20)**	**<MDL (29)**	**<MDL (11)**	**<MDL (28)**	3.9	6.2
N-Nitrosodiphenylamine	**<MDL (20)**	**<MDL (29)**	<MDL (11)	**<MDL (28)**	11	11
PCBs						
Total PCBs	**<MDL (13)**	**<MDL (18)**	<MDL (6.9)	**<MDL (17)**	12	65

Notes

mg/Kg OC - Milligrams per kilogram organic carbon, based on total organic carbon analysis.

<MDL (#) - Analyte not detected above the *method dection limit* . Value is parentheses is the numeric MDL.

Shaded Cell - Detected concentration or MDL exceeds the SQS and/or CSL.

Table 8
Sediment Non-Ionic Organic Concentrations (Dry Weight Normalized)
Norfolk CSO Sediment Remediation Project
Five-Year Monitoring Program
April 1999 Monitoring Data

	Concentration (µg/Kg DW)					
Non-Ionic Organics	**NFK501**	**NFK502**	**NFK503**	**NFK504**	**LAET**	**2LAET**
LPAHs						
Acenaphthene	<MDL (14)	<MDL (14)	<MDL (14)	<MDL (14)	500	730
Acenaphthylene	<MDL (21)	<MDL (21)	<MDL (21)	<MDL (21)	1,300	1,300
Anthracene	<MDL (21)	<MDL (21)	<MDL (21)	<MDL (21)	960	4,400
Fluorene	<MDL (21)	<MDL (21)	<MDL (21)	<MDL (21)	540	1,000
2-Methylnaphthalene	<MDL (56)	<MDL (56)	<MDL (56)	<MDL (55)	670	1,400
Naphthalene	<MDL (56)	<MDL (56)	<MDL (56)	<MDL (55)	2,100	2,400
Phenanthrene	21	<MDL (21)	<MDL (21)	<MDL (21)	1,500	5,400
Total LPAH	21	<MDL	<MDL	<MDL	5,200	13,000
HPAHs						
Benzo(a)anthracene	<MDL (21)	<MDL (21)	<MDL (21)	<MDL (21)	1,300	1,600
Benzo(a)pyrene	<MDL (35)	<MDL (35)	<MDL (35)	<MDL (35)	1,600	3,000
Benzofluoranthenes (Total)	<MDL (56)	<MDL (56)	<MDL (56)	<MDL (55)	3,200	3,600
Benzo(g,h,i)perylene	<MDL (35)	75.7	<MDL (35)	70.5	670	720
Chrysene	<MDL (21)	<MDL (21)	<MDL (21)	<MDL (21)	1,400	2,800
Dibenzo(a,h)anthracene	<MDL (56)	<MDL (56)	<MDL (56)	<MDL (55)	230	540
Fluoranthene	<MDL (21)	<MDL (21)	<MDL (21)	<MDL (21)	1,700	2,500
Indeno(1,2,3-c,d)pyrene	<MDL (35)	<MDL (35)	<MDL (35)	<MDL (35)	600	690
Pyrene	<MDL (21)	<MDL (21)	<MDL (21)	<MDL (21)	2,600	3,300
Total HPAH	<MDL	75.7	<MDL	70.5	12,000	17,000
Chlorobenzenes						
1,2-Dichlorobenzene	<MDL (0.90)	<MDL (0.89)	<MDL (0.90)	<MDL (0.89)	35	50
1,4-Dichlorobenzene	<MDL (0.90)	0.97	<MDL (0.90)	<MDL (0.89)	110	120
Hexachlorobenzene	<MDL (0.90)	<MDL (0.89)	<MDL (0.90)	<MDL (0.89)	22	70
1,2,4-Trichlorobenzene	<MDL (0.90)	<MDL (0.89)	<MDL (0.90)	<MDL (0.89)	31	51
Phthalates						
Bis(2-ethylhexyl) Phthalate	<MDL (21)	<MDL (21)	<MDL (21)	<MDL (21)	1,300	1,900
Butyl Benzyl Phthalate	<MDL (21)	<MDL (21)	<MDL (21)	<MDL (21)	63	470
Di-N-butyl Phthalate	<MDL (35)	<MDL (35)	<MDL (35)	<MDL (35)	1,400	5,100
Di-N-octyl Phthalate	<MDL (21)	<MDL (21)	<MDL (21)	<MDL (21)	420	2,100
Diethyl Phthalate	<MDL (35)	<MDL (35)	<MDL (35)	<MDL (35)	48	73
Dimethyl Phthalate	<MDL (14)	<MDL (14)	<MDL (14)	<MDL (14)	71	160
Miscellaneous Compounds						
Dibenzofuran	<MDL (35)	<MDL (35)	<MDL (35)	<MDL (35)	540	700
Hexachlorobutadiene	**<MDL (35)**	**<MDL (35)**	**<MDL (35)**	**<MDL (35)**	11	120
N-Nitrosodiphenylamine	**<MDL (35)**	**<MDL (35)**	**<MDL (35)**	**<MDL (35)**	28	40
PCBs						
Total PCBs	<MDL (22)	<MDL (22)	<MDL (22)	<MDL (22)	130	1,000

Notes

µg/Kg DW - Micrograms per kilogram dry weight, based on percent solids analysis.

<MDL (#) - Analyte not detected above the *method dection limit* . Value is parentheses is the numeric MDL.

Shaded Cell - MDL exceeds the LAET and/or 2LAET.

5 FUTURE MONITORING

Sampling and analysis completed in April 1999 was performed to establish baseline sediment conditions of the backfill surface material shortly after placement at the Norfolk remediation site. The next two sampling events will occur in October 1999, at the end of the first dry season and in April 2000, at the end of the first wet season. These next two sampling events will help to evaluate any differences in chemical characteristics of surface sediments after varying flow regimes. During monitoring years two through five, samples will be collected and analyzed on an annual basis, in April of each year. Station locations will remain the same unless discharge channels change over the course of the monitoring period.

Future monitoring events will include collection of two discrete samples from each of the four established locations. One sample will be collected from the top two cm of sediment and analyzed to evaluate the chemical characteristics of recently deposited material. Another sample will be collected from the top ten cm to evaluate the chemical characteristics of the sediment over the entire biologically active zone. The five-year monitoring schedule is shown below.

- April 1999 - Establish baseline conditions (4 stations, 1 sample at each).
- October 1999 - End of first dry season (4 stations, 2 samples at each).
- April 2000 - End of first wet season and year one (4 stations, 2 samples at each).
- April 2001 - Year two monitoring event (4 stations, 2 samples at each).
- April 2002 - Year three monitoring event (4 stations, 2 samples at each).
- April 2003 - Year four monitoring event (4 stations, 2 samples at each).
- April 2004 - Year five (final) monitoring event (4 stations, 2 samples at each).

6 SUMMARY AND CONCLUSIONS

Four estuarine sediment samples were collected in April 1999 from the Norfolk CSO sediment remediation site within a month after completion of remedial activities. Samples were collected from the surface of backfill material placed at the site and analyzed to establish a baseline chemical characterization of the material. Analytes included sediment conventionals along with metal and organic parameters required under SMS criteria. Station locations were established based on the location of the CSO and storm drain flow channels that existed prior to remediation. Visual observation of the intertidal area and a survey of the flow channels after sample collection resulted in relocation of three stations to meet project objectives.

Based on sample analytical results, the baseline conditions of the backfill material can be characterized by:

- a fairly even-grained, medium to coarse sand with high percent solids and low organic carbon content;
- metals concentrations that are well below the SQS sediment criteria; and
- a lack of organic chemicals with the exception of trace amounts of hexachlorobenzene (one site) and benzo(g,h,i)perylene (two sites), that were well below the LAET sediment criteria (dry-weight normalized).

7 REFERENCES

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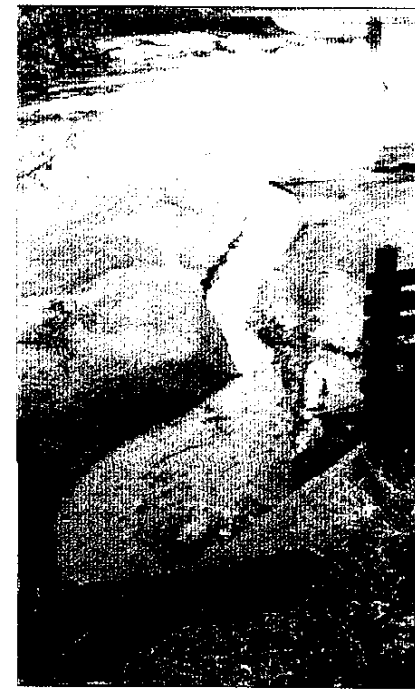
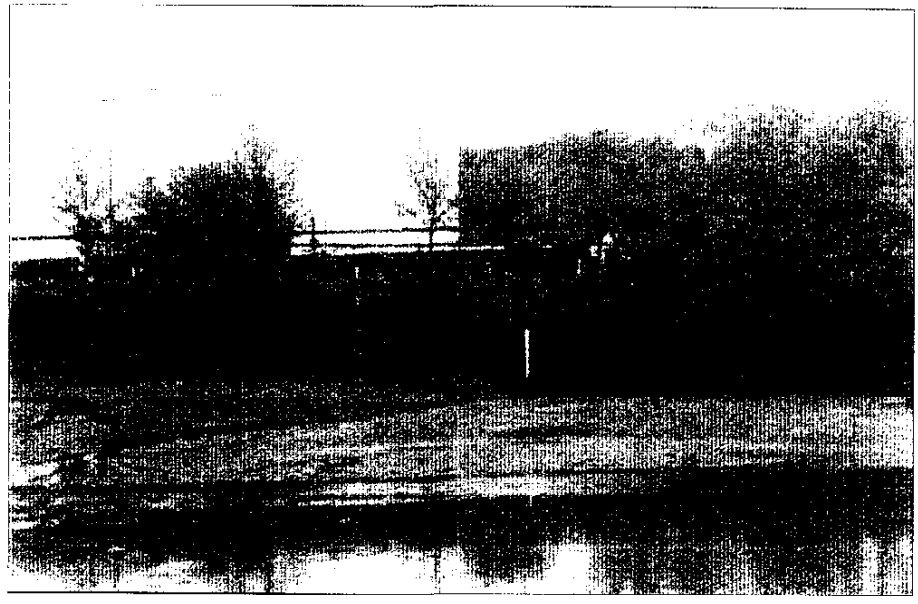
Norfolk CSO outfall at a moderate low tide.



Norfolk CSO outfall at a very low tide, showing channelization.



Norfolk CSO outfall and channel from west side of the Duwamish River. Note the Boeing storm drain channel at the left.

King County Environmental Lab Analytical Report

PROJECT: 423056-160	Locator:	NFK501				Locator:	NFK502				Locator	NFK503				Locator:	NFK504			
	Client Loc:	Norfolk CSO outfall channel, inshore				Client Loc:	End of Norfolk CSO outfall channel				Client Loc:	End of Boeing storm drain channel				Client Loc:	Upriver of CSO & storm drain channe			
	Sampled:	Apr 23, 1999				Sampled:	Apr 23, 1999				Samped:	Apr 23, 1999				Samplec:	Apr 23, 1999			
	Lab ID:	L15421-1				Lab ID:	L15421-2				Lab ID	L15421-3				Lab ID:	L15421-4			
	Matrix:	SALTWTRSED				Matrix:	SALTWTRSED				Matrix	SALTWTRSED				Matrix:	SALTWTRSED			
	% Solids:	76.9				% Solids:	77.4				% Solids:	77				% Solids:	77.6			
Parameters	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Vaue	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units
			- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis		
COMBINED LABS																				
M=CV ASTM D422																				
p+0.00 *	3.3		0.1		%	3		0.1		%	1		0.1		%	3.3		0.1		%
p+1.00 *	38		0.1		%	32		0.1		%	28		0.1		%	44		0.1		%
p+10.0 *		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%
p+10.0(more than) *		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%
p+2.00 *	46		0.1		%	56		0.1		%	55		0.1		%	46		0.1		%
p+3.00 *	4.3		0.1		%	4.1		0.1		%	9		0.1		%	3		0.1		%
p+4.00 *	7		0.1		%	0.4		0.1		%	1.3		0.1		%	0.4		0.1		%
p+5.00 *	1		0.1		%	4.7		0.1		%	5.4		0.1		%	2.9		0.1		%
p+6.00 *		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%
p+7.00 *		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%
p+8.00 *		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%
p+9.00 *		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%
p-1.00 *	0.8	E	0.1		%	0.4	E	0.1		%	0.4	E	0.1		%	0.4	E	0.1		%
p-2.00 *		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%
p-2.00(less than) *		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%		<MDL	0.1		%
M=CV SM2540-G (03-01-001-001)																				
Total Solids *	76.9		0.005	0.01	%	77.4		0.005	0.01	%	77		0.005	0.01	%	77.6		0.005	0.01	%
M=CV SM5310-B (03-04-001-000)																				
Total Organic Carbon	1760		6.5	13	mg/Kg	1210		6.5	12.9	mg/Kg	3180		6.5	13	mg/Kg	1250		6.4	12.9	mg/Kg
M=ES NONE																				
Sample Depth *	2				m	2.5				m	2.5				m	2.3				m
Sample Start Time *	1300				hr	1334				hr	1354				hr	1423				h
Sampling Method	26000				none	26000				none	26000				none	26000				none
Sediment Sampling Depth *	13				cm	14				cm	15				cm	16				cm
Sediment Type	30N30				none	30N30				none	30N30				none	30N30				none
Tidal Condition	E				none	E				none	E				none	E				none
Tide Height *	7.6				ft	7				ft	6.2				ft	5.6				ft
M=MT EPA 245.5 (06-01-004-001)																				
Mercury, Total, CVAA	0.055	<RDL	0.026	0.259	mg/Kg	0.089	<RDL	0.026	0.257	mg/Kg	0.066	<RDL	0.026	0.26	mg/Kg	0.072	<RDL	0.026	0.254	mg/Kg
M=MT EPA3050A/6010B (03-20-004-002)																				
Aluminum, Total, ICP	9770	L	6.5	32.5	mg/Kg	9730	L	6.2	31.3	mg/Kg	9420	L	6.4	31.8	mg/Kg	9330	L	6.2	30.7	mg/Kg
Arsenic, Total, ICP		<MDL	3.3	16.3	mg/Kg	3.7	<RDL	3.1	15.6	mg/Kg		<MDL	3.2	16	mg/Kg	3.5	<RDL	3.1	15.3	mg/Kg
Beryllium, Total, ICP	0.11	<RDL	0.065	0.325	mg/Kg	0.14	<RDL	0.062	0.313	mg/Kg	0.11	<RDL	0.064	0.318	mg/Kg	0.12	<RDL	0.062	0.307	mg/Kg
Cadmium, Total, ICP	0.2	<RDL,L	0.2	0.977	mg/Kg	0.21	<RDL,L	0.19	0.938	mg/Kg		<MDL,L	0.19	0.955	mg/Kg	0.21	<RDL,L	0.18	0.921	mg/Kg
Chromium, Total, ICP	12.9		0.33	1.63	mg/Kg	13		0.31	1.56	mg/Kg	14.7		0.32	1.6	mg/Kg	12.2		0.31	1.53	mg/Kg
Copper, Total, ICP	11.4		0.26	1.3	mg/Kg	12.2		0.25	1.25	mg/Kg	10.5		0.26	1.27	mg/Kg	11.2		0.24	1.23	mg/Kg
Iron, Total, ICP	18900	B	3.3	16.3	mg/Kg	19800	B	3.2	31.3	mg/Kg	17700	B	3.2	16	mg/Kg	18300	B	3.1	15.3	mg/Kg
Lead, Total, ICP	4.2	<RDL	2	9.77	mg/Kg	5	<RDL	1.9	9.38	mg/Kg	4.4	<RDL	1.9	9.55	mg/Kg	4.6	<RDL	1.8	9.21	mg/Kg
Manganese, Total, ICP	263	G	0.13	0.651	mg/Kg	226	G	0.13	0.625	mg/Kg	242	G	0.13	0.636	mg/Kg	237	G	0.12	0.615	mg/Kg
Nickel, Total, ICP	12.7		1.3	6.51	mg/Kg	12.9		1.3	6.25	mg/Kg	12.6		1.3	6.36	mg/Kg	12.9		1.2	6.15	mg/Kg
Selenium, Total, ICP		<MDL	3.3	16.3	mg/Kg		<MDL	3.1	15.6	mg/Kg		<MDL	3.2	16	mg/Kg		<MDL	3.1	15.3	mg/Kg
Silver, Total, ICP		<MDL	0.26	1.3	mg/Kg		<MDL	0.25	1.25	mg/Kg		<MDL	0.26	1.27	mg/Kg		<MDL	0.24	1.23	mg/Kg
Thallium, Total, ICP		<MDL	13	65.1	mg/Kg		<MDL	13	62.5	mg/Kg		<MDL	13	63.6	mg/Kg		<MDL	12	61.5	mg/Kg
Zinc, Total, ICP	46		0.33	1.63	mg/Kg	43.2		0.31	1.56	mg/Kg	42.1		0.32	1.6	mg/Kg	44.2		0.31	1.53	mg/Kg

King County Environmental Lab Analytical Report

PROJECT: 423056-160	Locator:	NFK501				Locator:	NFK502				Locator:	NFK503				Locator:	NFK504			
	Client Loc:	Norfolk CSO outfall channel, inshore				Client Loc:	End of Norfolk CSO outfall channel				Client Loc:	End of Boeing storm drain channel				Client Loc:	Upriver of CSO & storm drain channel			
	Sampled:	Apr 23, 1999				Sampled:	Apr 23, 1999				Sampled:	Apr 23, 1999				Sampled:	Apr 23, 1999			
	Lab ID:	L15421-1				Lab ID:	L15421-2				Lab ID:	L15421-3				Lab ID:	L15421-4			
	Matrix:	SALTWTRSED				Matrix:	SALTWTRSED				Matrix:	SALTWTRSED				Matrix:	SALTWTRSED			
	% Solids:	76.9				% Solids:	77.4				% Solids:	77				% Solids:	77.6			
Parameters	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units
			- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis		
COMBINED LABS																				
M=OR EPA 3550B/8082 (73-03-002)																				
Aroclor 1016		<MDL	22	43.3	ug/Kg		<MDL	22	43	ug/Kg		<MDL	22	43.2	ug/Kg		<MDL	22	42.9	ug/Kg
Aroclor 1221		<MDL	22	43.3	ug/Kg		<MDL	22	43	ug/Kg		<MDL	22	43.2	ug/Kg		<MDL	22	42.9	ug/Kg
Aroclor 1232		<MDL	22	43.3	ug/Kg		<MDL	22	43	ug/Kg		<MDL	22	43.2	ug/Kg		<MDL	22	42.9	ug/Kg
Aroclor 1242		<MDL	22	43.3	ug/Kg		<MDL	22	43	ug/Kg		<MDL	22	43.2	ug/Kg		<MDL	22	42.9	ug/Kg
Aroclor 1248		<MDL	22	43.3	ug/Kg		<MDL	22	43	ug/Kg		<MDL	22	43.2	ug/Kg		<MDL	22	42.9	ug/Kg
Aroclor 1254		<MDL	22	43.3	ug/Kg		<MDL	22	43	ug/Kg		<MDL	22	43.2	ug/Kg		<MDL	22	42.9	ug/Kg
Aroclor 1260		<MDL	22	43.3	ug/Kg		<MDL	22	43	ug/Kg		<MDL	22	43.2	ug/Kg		<MDL	22	42.9	ug/Kg
M=OR EPA 3550B/8270C (7-3-01-004)																				
1,2-Diphenylhydrazine		<MDL	69	139	ug/Kg		<MDL	68	138	ug/Kg		<MDL	69	139	ug/Kg		<MDL	68	138	ug/Kg
2,4,5-Trichlorophenol		<MDL,G	140	277	ug/Kg		<MDL,G	140	275	ug/Kg		<MDL,G	140	277	ug/Kg		<MDL,G	140	274	ug/Kg
2,4,6-Trichlorophenol		<MDL,G	140	277	ug/Kg		<MDL,G	140	275	ug/Kg		<MDL,G	140	277	ug/Kg		<MDL,G	140	274	ug/Kg
2,4-Dichlorophenol		<MDL,G	35	69.3	ug/Kg		<MDL,G	35	68.9	ug/Kg		<MDL,G	35	69.2	ug/Kg		<MDL,G	35	68.7	ug/Kg
2,4-Dimethylphenol		<MDL,G,X	35	69.3	ug/Kg		<MDL,G,X	35	68.9	ug/Kg		<MDL,G,X	35	69.2	ug/Kg		<MDL,G,X	35	68.7	ug/Kg
2,4-Dinitrophenol		<MDL,G	69	139	ug/Kg		<MDL,G	68	138	ug/Kg		<MDL,G	69	139	ug/Kg		<MDL,G	68	138	ug/Kg
2,4-Dinitrotoluene		<MDL	14	27.7	ug/Kg		<MDL	14	27.5	ug/Kg		<MDL	14	27.7	ug/Kg		<MDL	14	27.4	ug/Kg
2,6-Dinitrotoluene		<MDL	14	27.7	ug/Kg		<MDL	14	27.5	ug/Kg		<MDL	14	27.7	ug/Kg		<MDL	14	27.4	ug/Kg
2-Chloronaphthalene		<MDL	21	34.7	ug/Kg		<MDL	21	34.5	ug/Kg		<MDL	21	34.7	ug/Kg		<MDL	21	34.4	ug/Kg
2-Chlorophenol		<MDL,G	69	139	ug/Kg		<MDL,G	68	138	ug/Kg		<MDL,G	69	139	ug/Kg		<MDL,G	68	138	ug/Kg
2-Methynaphthalene		<MDL,G	56	104	ug/Kg		<MDL,G	56	103	ug/Kg		<MDL,G	56	104	ug/Kg		<MDL,G	55	103	ug/Kg
2-Methyphenol		<MDL,G	35	69.3	ug/Kg		<MDL,G	35	68.9	ug/Kg		<MDL,G	35	69.2	ug/Kg		<MDL,G	35	68.7	ug/Kg
2-Nitroaniline		<MDL	140	208	ug/Kg		<MDL	140	207	ug/Kg		<MDL	140	208	ug/Kg		<MDL	140	206	ug/Kg
2-Nitrophenol		<MDL,G	35	69.3	ug/Kg		<MDL,G	35	68.9	ug/Kg		<MDL,G	35	69.2	ug/Kg		<MDL,G	35	68.7	ug/Kg
3,3'-Dichlorobenzidine		<MDL,X	35	69.3	ug/Kg		<MDL,X	35	68.9	ug/Kg		<MDL,X	35	69.2	ug/Kg		<MDL,X	35	68.7	ug/Kg
3-Nitroaniline		<MDL,G	140	208	ug/Kg		<MDL,G	140	207	ug/Kg		<MDL,G	140	208	ug/Kg		<MDL,G	140	206	ug/Kg
4,6-Dinitro-O-Cresol		<MDL,G	69	139	ug/Kg		<MDL,G	68	138	ug/Kg		<MDL,G	69	139	ug/Kg		<MDL,G	68	138	ug/Kg
4-Bromophenyl Phenyl Ether		<MDL	14	20.8	ug/Kg		<MDL	14	20.7	ug/Kg		<MDL	14	20.8	ug/Kg		<MDL	14	20.6	ug/Kg
4-Chloro-3-Methylphenol		<MDL,G	69	139	ug/Kg		<MDL,G	68	138	ug/Kg		<MDL,G	69	139	ug/Kg		<MDL,G	68	138	ug/Kg
4-Chloroaniline		<MDL,G	69	139	ug/Kg		<MDL,G	68	138	ug/Kg		<MDL,G	69	139	ug/Kg		<MDL,G	68	138	ug/Kg
4-Chlorophenyl Phenyl Ether		<MDL	21	34.7	ug/Kg		<MDL	21	34.5	ug/Kg		<MDL	21	34.7	ug/Kg		<MDL	21	34.4	ug/Kg
4-Methyphenol		<MDL,G	35	69.3	ug/Kg		<MDL,G	35	68.9	ug/Kg		<MDL,G	35	69.2	ug/Kg		<MDL,G	35	68.7	ug/Kg
4-Nitroaniline		<MDL,G	140	208	ug/Kg		<MDL,G	140	207	ug/Kg		<MDL,G	140	208	ug/Kg		<MDL,G	140	206	ug/Kg
4-Nitrophenol		<MDL,G	69	139	ug/Kg		<MDL,G	68	138	ug/Kg		<MDL,G	69	139	ug/Kg		<MDL,G	68	138	ug/Kg
Acenaphthene		<MDL	14	27.7	ug/Kg		<MDL	14	27.5	ug/Kg		<MDL	14	27.7	ug/Kg		<MDL	14	27.4	ug/Kg
Acenaphthylene		<MDL	21	34.7	ug/Kg		<MDL	21	34.5	ug/Kg		<MDL	21	34.7	ug/Kg		<MDL	21	34.4	ug/Kg
Aniline		<MDL,X	69	139	ug/Kg		<MDL,X	68	138	ug/Kg		<MDL,X	69	139	ug/Kg		<MDL,X	68	138	ug/Kg
Anthracene		<MDL,G	21	34.7	ug/Kg		<MDL,G	21	34.5	ug/Kg		<MDL,G	21	34.7	ug/Kg		<MDL,G	21	34.4	ug/Kg
Benzidine		<MDL,X	830	1660	ug/Kg		<MDL,X	830	1650	ug/Kg		<MDL,X	830	1660	ug/Kg		<MDL,X	820	1650	ug/Kg
Benzo(a)anthracene		<MDL,G	21	34.7	ug/Kg		<MDL,G	21	34.5	ug/Kg		<MDL,G	21	34.7	ug/Kg		<MDL,G	21	34.4	ug/Kg
Benzo(a)pyrene		<MDL,G	35	69.3	ug/Kg		<MDL,G	35	68.9	ug/Kg		<MDL,G	35	69.2	ug/Kg		<MDL,G	35	68.7	ug/Kg
Benzo(b)fluoranthene		<MDL	56	104	ug/Kg		<MDL	56	103	ug/Kg		<MDL	56	104	ug/Kg		<MDL	55	103	ug/Kg
Benzo(g,h,i)perylene		<MDL,G	35	69.3	ug/Kg	75.7	G	35	68.9	ug/Kg		<MDL,G	35	69.2	ug/Kg	70.5	G	35	68.7	ug/Kg
Benzo(k)fluoranthene		<MDL	56	104	ug/Kg		<MDL	56	103	ug/Kg		<MDL	56	104	ug/Kg		<MDL	55	103	ug/Kg
Benzoic Acid		<MDL,G	140	208	ug/Kg		<MDL,G	140	207	ug/Kg		<MDL,G	140	208	ug/Kg		<MDL,G	140	206	ug/Kg
Benzyl Alcohol		<MDL,G	35	69.3	ug/Kg		<MDL,G	35	68.9	ug/Kg		<MDL,G	35	69.2	ug/Kg		<MDL,G	35	68.7	ug/Kg

King County Environmental Lab Analytical Report

PROJECT: 423056-160

Locator:	NFK501	NFK502	NFK503	NFK504
Client Loc:	Norfolk CSO outfall channel irshore	Endof Norfolk CSO outfall channel	End of Boeing storm drain channel	Upriver of CSO & storm drain channel
Sampled:	Apr 23, 1999	Apr 23, 1999	Apr 23, 1999	Apr 23, 1999
Lab ID:	L15421-1	L15421-2	L15421-3	L15421-4
Matrix:	SALTWTRSED	SALTWTRSED	SALTWTRSED	SALTWTRSED
% Solids:	76.9	77.4	77	77.6

Parameters	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units
			- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis					- Dry Weight Basis		
COMBINED LABS																				
Benzyl Butyl Phthalate		<MDL	21	34.7	ug/Kg		<MDL	21	34.5	ug/Kg		<MDL	21	34.7	ug/Kg		<MDL	21	34.4	ug/Kg
Bis(2-Chloroethoxy)Nethane		<MDL,G	35	69.3	ug/Kg		<MDL,G	35	68.9	ug/Kg		<MDL,G	35	69.2	ug/Kg		<MDL,G	35	68.7	ug/Kg
Bis(2-Chloroethyl)Ether		<MDL,G	21	34.7	ug/Kg		<MDL,G	21	34.5	ug/Kg		<MDL,G	21	34.7	ug/Kg		<MDL,G	21	34.4	ug/Kg
Bis(2-Chloroisopropy)Ether		<MDL,G	69	139	ug/Kg		<MDL,G	68	138	ug/Kg		<MDL,G	69	139	ug/Kg		<MDL,G	68	138	ug/Kg
Bis(2-Ethylhexyl)Phthalate		<MDL	21	34.7	ug/Kg		<MDL	21	34.5	ug/Kg		<MDL	21	34.7	ug/Kg		<MDL	21	34.4	ug/Kg
Caffeine		<MDL	6.9	34.7	ug/Kg		<MDL	6.8	34.5	ug/Kg		<MDL	6.9	34.7	ug/Kg		<MDL	6.8	34.4	ug/Kg
Carbazole		<MDL	35	69.3	ug/Kg		<MDL	35	68.9	ug/Kg		<MDL	35	69.2	ug/Kg		<MDL	35	68.7	ug/Kg
Chrysene		<MDL	21	34.7	ug/Kg		<MDL	21	34.5	ug/Kg		<MDL	21	34.7	ug/Kg		<MDL	21	34.4	ug/Kg
Coprostanol		<MDL,G	350	693	ug/Kg		<MDL,G	350	689	ug/Kg		<MDL,G	350	692	ug/Kg		<MDL,G	350	687	ug/Kg
Dibenzc(a,h)anthracene		<MDL,G	56	104	ug/Kg		<MDL,G	56	103	ug/Kg		<MDL,G	56	104	ug/Kg		<MDL,G	55	103	ug/Kg
Dibenzofuran		<MDL	35	69.3	ug/Kg		<MDL	35	68.9	ug/Kg		<MDL	35	69.2	ug/Kg		<MDL	35	68.7	ug/Kg
Diethyl Phthalate		<MDL	35	69.3	ug/Kg		<MDL	35	68.9	ug/Kg		<MDL	35	69.2	ug/Kg		<MDL	35	68.7	ug/Kg
Dimethyl Phthalate		<MDL	14	20.8	ug/Kg		<MDL	14	20.7	ug/Kg		<MDL	14	20.8	ug/Kg		<MDL	14	20.6	ug/Kg
Di-N-Butyl Phthalate		<MDL	35	69.3	ug/Kg		<MDL	35	68.9	ug/Kg		<MDL	35	69.2	ug/Kg		<MDL	35	68.7	ug/Kg
Di-N-Octyl Phthalate		<MDL	21	34.7	ug/Kg		<MDL	21	34.5	ug/Kg		<MDL	21	34.7	ug/Kg		<MDL	21	34.4	ug/Kg
Fluoranthene		<MDL,G	21	41.6	ug/Kg		<MDL,G	21	41.3	ug/Kg		<MDL,G	21	41.6	ug/Kg		<MDL,G	21	41.2	ug/Kg
Fluorene		<MDL,G	21	34.7	ug/Kg		<MDL,G	21	34.5	ug/Kg		<MDL,G	21	34.7	ug/Kg		<MDL,G	21	34.4	ug/Kg
Hexachlorobutadiene		<MDL,G	35	69.3	ug/Kg		<MDL,G	35	68.9	ug/Kg		<MDL,G	35	69.2	ug/Kg		<MDL,G	35	68.7	ug/Kg
Hexachlorocyclopentadiene		<MDL,G	35	69.3	ug/Kg		<MDL,G	35	68.9	ug/Kg		<MDL,G	35	69.2	ug/Kg		<MDL,G	35	68.7	ug/Kg
Hexachloroethane		<MDL,G	35	69.3	ug/Kg		<MDL,G	35	68.9	ug/Kg		<MDL,G	35	69.2	ug/Kg		<MDL,G	35	68.7	ug/Kg
Indeno(1,2,3-Cd)Pyrene		<MDL,G	35	69.3	ug/Kg		<MDL,G	35	68.9	ug/Kg		<MDL,G	35	69.2	ug/Kg		<MDL,G	35	68.7	ug/Kg
Isophorone		<MDL,G	35	69.3	ug/Kg		<MDL,G	35	68.9	ug/Kg		<MDL,G	35	69.2	ug/Kg		<MDL,G	35	68.7	ug/Kg
Naphthalene		<MDL,G	56	104	ug/Kg		<MDL,G	56	103	ug/Kg		<MDL,G	56	104	ug/Kg		<MDL,G	55	103	ug/Kg
Nitrobenzene		<MDL,G	35	69.3	ug/Kg		<MDL,G	35	68.9	ug/Kg		<MDL,G	35	69.2	ug/Kg		<MDL,G	35	68.7	ug/Kg
N-Nitrosodimethylamine		<MDL	140	208	ug/Kg		<MDL	140	207	ug/Kg		<MDL	140	208	ug/Kg		<MDL	140	206	ug/Kg
N-Nitrosodi-N-Propylamine		<MDL,G	35	69.3	ug/Kg		<MDL,G	35	68.9	ug/Kg		<MDL,G	35	69.2	ug/Kg		<MDL,G	35	68.7	ug/Kg
N-Nitrosodiphenylamine		<MDL	35	69.3	ug/Kg		<MDL	35	68.9	ug/Kg		<MDL	35	69.2	ug/Kg		<MDL	35	68.7	ug/Kg
Pentachlorophenol		<MDL,G	35	69.3	ug/Kg		<MDL,G	35	68.9	ug/Kg		<MDL,G	35	69.2	ug/Kg		<MDL,G	35	68.7	ug/Kg
Phenanthrene	21	<RDL,G	21	34.7	ug/Kg		<MDL,G	21	34.5	ug/Kg		<MDL,G	21	34.7	ug/Kg		<MDL,G	21	34.4	ug/Kg
Phenol		<MDL,G	140	208	ug/Kg		<MDL,G	140	207	ug/Kg		<MDL,G	140	208	ug/Kg		<MDL,G	140	206	ug/Kg
Pyrene		<MDL,G	21	34.7	ug/Kg		<MDL,G	21	34.5	ug/Kg		<MDL,G	21	34.7	ug/Kg		<MDL,G	21	34.4	ug/Kg
M=OR EPA3550B/8270C SIM(7-3-01-004)																				
1,2,4-Trichlorobenzene		<MDL,G	0.9	1.73	ug/Kg		<MDL,G	0.89	1.72	ug/Kg		<MDL,G	0.9	1.73	ug/Kg		<MDL,G	0.89	1.71	ug/Kg
1,2-Dichlorobenzene		<MDL,G	0.9	1.73	ug/Kg		<MDL,G	0.89	1.72	ug/Kg		<MDL,G	0.9	1.73	ug/Kg		<MDL,G	0.89	1.71	ug/Kg
1,3-Dichlorobenzene		<MDL,G	0.9	1.73	ug/Kg		<MDL,G	0.89	1.72	ug/Kg		<MDL,G	0.9	1.73	ug/Kg		<MDL,G	0.89	1.71	ug/Kg
1,4-Dichlorobenzene		<MDL,G	0.9	1.73	ug/Kg		<MDL,G	0.89	1.72	ug/Kg		<MDL,G	0.9	1.73	ug/Kg		<MDL,G	0.89	1.71	ug/Kg
Hexachlorobenzene		<MDL,G	0.9	1.73	ug/Kg	0.97	<RDL,G	0.89	1.72	ug/Kg		<MDL,G	0.9	1.73	ug/Kg		<MDL,G	0.89	1.71	ug/Kg

* Not converted to dry weight bass for this parameter

KING COUNTY ENVIRONMENTAL LABORATORY
QUALITY ASSURANCE REVIEW

for

ESTUARINE SEDIMENT ANALYTICAL DATA

NORFOLK CSO SEDIMENT REMEDIATION PROJECT
FIVE-YEAR MONITORING PROGRAM
APRIL 1999 MONITORING EVENT

August 11, 1999

King County Environmental Laboratory
322 West Ewing Street
Seattle, Washington 98119-1507
(206) 684-2300

KING COUNTY ENVIRONMENTAL LABORATORY
QUALITY ASSURANCE REVIEW

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NORFOLK CSO SEDIMENT REMEDIATION PROJECT
FIVE-YEAR MONITORING PROGRAM
APRIL 1999 MONITORING EVENT

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August 18, 1999

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INTRODUCTION

This quality assurance (QA) review accompanies data submitted in connection with estuarine sediment sampling and analysis conducted by the King County Environmental Laboratory (KC Lab) for the Norfolk Combined Sewer Overflow (CSO) Sediment Remediation Project. The QA review is organized into the four sections listed below.

- General Comments
- Conventional Analyses
- Metal Chemistry
- Organic Chemistry

An overview of the approach used for the QA review is detailed in the *General Comments* section. Additional information specific to each analysis is included in the appropriate analytical section.

This QA review has been primarily conducted in accordance with guidelines established through the Puget Sound Dredged Disposal Analysis (PSDDA) program, outlined in *Puget Sound Dredged Disposal Analysis Guidance Manual, Data Quality Evaluation for Proposed Dredged Material Disposal Projects*. Other approaches incorporated in the QA review have been established through collaboration between the King County Environmental Laboratory (KC Laboratory) and the Washington State Department of Ecology (Ecology) Sediment Management Unit.

GENERAL COMMENTS

Scope of Samples Submitted
This QA review is associated with estuarine sediment samples collected in April 1999 as part of the Norfolk CSO Sediment Remediation Project. The five-year monitoring program is designed to monitor the backfill material at the remediation site for possible re-contamination from the Norfolk CSO or other adjacent outfalls.

Except where noted in the subcontracting sections of this QA review, all analyses have been conducted by the KC Lab. Sediment analytical data are reported with associated data qualifiers and have undergone QA1 review, as summarized in this narrative report.

Completeness
Completeness has been evaluated for this data submission and QA review by considering the following criteria:

- Comparing reported data to the planned project analyses summarized in Table 1.
- Compliance with storage conditions and holding times.
- Frequency of analysis of the complete set of quality control (QC) samples outlined in Table 2.

Subcontracted Analyses
Analyses that have been subcontracted and the issues associated with these subcontracted analyses are noted in this narrative.

Methods
Analytical methods are noted in the applicable analytical sections of this QA review.

Target Lists
The reported target lists have been compared to the target analytes listed in *Table 1 - Marine Sediment Quality Standards Chemical Criteria* and *Table 3 - Puget Sound Marine Sediment Cleanup Screening Levels Chemical Criteria* contained in Chapter 173-204 WAC. Target lists may also be compared to the PSDDA *Chemicals of Concern* list, if applicable.

Detection Limits
The KC Laboratory distinguishes between the reporting detection limit (RDL) and the method detection limit (MDL).

- The RDL is defined as *the minimum concentration of a chemical constituent that can be reliably quantified.*
- The MDL is defined as *the minimum concentration of a chemical constituent that can be detected.*

Some subcontracted laboratory data are available with an MDL only, in accordance with the subcontracting laboratory policies. All analytical data are reported with a numeric result and/or detection limit(s).

Storage Conditions and Holding Times
Storage conditions and holding times have been evaluated using guidelines established during the Third Annual PSDDA Review Meeting. The approach used to evaluate Total Organic Carbon for holding time has been established between the KC Laboratory and Ecology during previous QA1 review efforts.

Method Blanks
Method blank results have been used to evaluate the possible laboratory contamination of samples. Method blank results have been reviewed for the presence of analytes detected at or greater than the MDL.

Standard Reference Materials and Check Standards
Standard reference material (SRM) or check standard recoveries have been used to evaluate possible low or high analytical bias on a batch-specific basis. SRM or check standard analysis is included with metal, organic and selected conventional parameters (see Table 2). Standard reference materials are purchased from outside agencies and generally have a certified analyte value. Check standards are generally prepared by the analytical laboratory as part of overall quality control.

Matrix Spikes
Matrix spike recoveries have been used to evaluate possible low or high analytical bias on a matrix and batch-specific basis. Matrix spikes are analyzed with metal, organic and selected conventional parameters (see Table 2).

Laboratory Replicate Samples
Replicate analysis (laboratory duplicates or triplicates) is used as an indicator of method precision and is used to qualify data on an analyte and batch-specific basis. Not all replicate data are used, however, as an indicator for data qualification. Only sets of replicate results that include at least one result significantly greater than the RDL (or the MDL if no RDL is present) are considered for data qualification. These guidelines have been used to account for the fact that precision obtained near the detection limit is not representative of precision obtained throughout the entire analytical range.

Surrogates
Surrogate recoveries have been used to evaluate possible low or high analytical bias on a sample-specific basis. Surrogates are analyzed for organic parameters with the exception of methyl mercury.

Data Qualifiers
The data qualification system used for this data submission is presented in Table 3. These data qualifiers address situations that require qualification and generally conform to QA1 guidance. The KC Laboratory qualifiers indicating <MDL and <RDL have been used as replacements for the *T* and *U* qualifier flags specified under QA1 guidance. Changes made to SRM data qualification have been discussed with and approved by the Sediment Management Unit of Ecology.

Units and Significant Figures
Data have been reported in accordance with laboratory policy at the time of data generation. When an RDL and MDL are reported, data have been reported to three significant figures above the RDL and two significant figures equal to or below the RDL. Data with only an MDL have been reported to two significant figures. PSD results are reported to three significant figures.

CONVENTIONAL ANALYSES

Completeness
Conventional data are reported for samples L15421-1 through L15421-4 (Table 1). These samples were analyzed for total organic carbon (TOC), total solids, and particle size distribution (PSD) in association with the complete set of QC samples outlined in Table 2.

Subcontracted Analyses
PSD analysis was subcontracted to AmTest, Inc. in Redmond, Washington.

Methods
PSD analysis was performed in accordance with ASTM and Puget Sound Protocols methodologies (*Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound* - page 9 - PSEP, 1986). TOC analysis was performed in accordance with Standard Method (SM)5310-B. Total solids analysis was performed in accordance with SM2540-G.

Detection Limits, Units and Significant Figures
For analyses performed at the KC Laboratory, data are reported in accordance with laboratory policy at the time the data were generated. A positive result and/or MDL and RDL have been reported for all conventional parameters analyzed by the KC Laboratory. Data are reported to three significant figures for results greater than the RDL and two significant figures for results equal to or less than the RDL. For results reported with less than two or three significant figures, significant zeroes are implied. This may not apply to subcontracted data.

Storage Conditions and Holding Times
Sample storage conditions and holding times have been evaluated using guidelines established during the Third Annual PSDDA Review Meeting. The criteria used to evaluate storage conditions and holding times for conventional analyses are listed in the table below.

Parameter	Holding Time at 4°C	Holding Time at -18°C
Particle Size Distribution	6 Months	Not Recommended
Solids	14 Days	6 Months
Total Organic Carbon	14 Days	6 Months

Sample storage conditions and holding times were met for all samples in this data submission.

Method Blanks
Method blanks were analyzed in connection with total solids and TOC analyses. All method blanks results were less than the MDL.

Standard Reference Material (SRM)
An SRM (Buffalo River Sediment) was analyzed in connection with TOC analysis. The percent recovery for the SRM analysis was within the 80 to 120% QC limits.

Matrix Spikes
Matrix spikes are not analyzed in connection with any of these conventional parameters.

Laboratory Replicate Samples
Laboratory triplicate samples were analyzed for all conventional parameters. The percent relative standard deviations (%RSD) for all triplicate sample results were less than or equal to the 20% QC limit. The overall %RSD for PSD was less than 20%.

METAL CHEMISTRY

Completeness
Metal chemistry data are reported for samples L15421-1 through L15421-4 (Table 1). These samples were analyzed for mercury and other metals in association with the complete set of QC samples outlined in Table 2.

Methods
Mercury analysis was performed in accordance with EPA Method 7471. Analysis for other metals was performed in accordance with EPA Method 3050A/6010B.

Target List
The reported target list includes all metals specified in *Table 1- Marine Sediment Quality Standards Chemical Criteria* and *Table 3- Puget Sound Marine Sediment Cleanup Screening levels Chemical Criteria* contained in Chapter 173-204 WAC. Additional metals have been reported as available.

Detection Limits, Units and Significant Figures
For analyses performed at the KC Laboratory, data are reported in accordance with laboratory policy at the time the data were generated. A positive result and/or MDL and RDL have been reported for all metals parameters analyzed by the KC Laboratory. Data are reported to three significant figures for results greater than the RDL and two significant figures for results equal to or less than the RDL. For results reported with less than two or three significant figures, significant zeroes are implied.

Storage Conditions and Holding Times
Sample storage conditions and holding times have been evaluated using guidelines established during the Third Annual PSDDA Review Meeting. The criteria used to evaluate storage conditions and holding times for metals analyses are listed in the table below.

Parameter	Holding Time at 4°C	Holding Time at -18°C
Mercury	Not Recommended	28 Days
Other Metals	6 Months	2 Years

Sample storage conditions and holding times were met for all samples in this data submission.

Method Blanks
All metals method blanks results were less than the MDL with the exception of iron. All sample results for iron which are less than 10x the method blank have been qualified with a *B* flag.

Standard Reference Material (SRM)
The SRM analyzed in association with samples included in this data submission is PACS 1 certified by the National Research Council of Canada (NRCC). This SRM does not contain silver. An SRM recovery less than the QC limit of 80% has not been used to qualify data because the digestion technique used for sample analysis is different from the technique used during analysis to determine the SRM values. Only SRM recoveries greater than 120% will be used to qualify data.

All metals SRM recoveries were less than the QC limit of 120% with the exception of cadmium. The reported cadmium SRM recovery was 148%. Associated cadmium sample results have been qualified with an *L* flag.

Matrix Spikes

All matrix spike recoveries were within the 75 to 125% QC limits with the exception of aluminum and manganese. The reported aluminum matrix spike recovery was 171% and the reported manganese matrix spike recovery was 55%. Associated sample results for these metals have been qualified with an *L* or a *G* flag, respectively.

Laboratory Replicate Samples

The relative percent differences (RPDs) for laboratory duplicate sample results for all metals were less than or equal to the QC limit of 20%. RPd was not calculated if either one or both of the results was <MDL.

ORGANIC CHEMISTRY

Completeness

Organic chemistry data are reported for samples L15421-1 through L15421-4 (Table 1). These samples were analyzed for base/neutral/acid semivolatile organic compounds (BNAs), chlorobenzenes and polychlorinated biphenyls (PCBs) in association with the complete set of QC samples outlined in Table 2.

Methods

BNA analysis was performed in accordance with EPA Method 8270. A portion of the BNA extract was analyzed by selected ion monitoring (SIM) to attain lower detection limits for chlorobenzene compounds. PCB analysis was performed in accordance with EPA Method 8082.

Target List

The reported BNA target list includes all compounds specified in *Table 1 - Marine Sediment Quality Standards Chemical Criteria* and *Table 3 - Puget Sound Marine Sediment Cleanup Screening Levels Chemical Criteria* contained in Chapter 173-204 WAC with the exception of benzo(j)fluoranthene. The KC Laboratory has verified that analytical conditions are sufficient to calculate a total benzofluoranthene result using the reported *b* and *k* isomers.

The reported chlorobenzene target list includes, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2,4-trichlorobenzene, and hexachlorobenzene.

Reported PCB data include Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260.

Detection Limits, Units and Significant Figures

For analyses performed at the KC Laboratory, data are reported in accordance with laboratory policy at the time the data were generated. A positive result and/or MDL and RDL have been reported for all organic parameters analyzed by the KC Laboratory. Data are reported to three significant figures for results greater than the RDL and two significant figures for results equal to or less than the RDL. For results reported with less than two or three significant figures, significant zeroes are implied.

Storage Conditions and Holding Times

Sample storage conditions and holding times have been evaluated using guidelines established during the Third Annual PSDDA Review Meeting. The criteria used to evaluate storage conditions and holding times for organics analyses are listed in the table below.

Parameter	Holding Time at 4°C	Holding Time at -18°C
BNAs & Chlorobenzenes	14 Days to Extract 40 Days to Analyze	1 Year to Extract 40 Days to Analyze
PCBs	14 Days to Extract 40 Days to Analyze	1 Year to Extract 40 Days to Analyze

Sample storage conditions and holding times were met for all samples in this data submission.

Method Blanks

All BNA, chlorobenzene, and PCB method blank results were less than the MDL.

Surrogate Recoveries

BNA sample data are qualified when the average surrogate recovery for either or both the acid and base/neutral fractions are outside the 50 to 150% QC limits. Average base/neutral fraction surrogate recoveries were within QC limits for all samples in this data submission. The average acid surrogate fraction recoveries were outside the 50 to 150% QC limits for all samples. Associated acid fraction BNA sample results have been qualified with a *G* flag.

Chlorobenzene sample data are qualified when the single surrogate recovery is outside QC limits. All Chlorobenzene surrogate recoveries were below the 50 to 150% QC limits for all samples in this data submission with the exception of the blank spike duplicate.

PCB sample data are qualified when both surrogate recoveries are outside the 50 to 150% QC limits. At least one PCB surrogate recovery was within QC limits for all samples in this data submission.

Standard Reference Material (SRM)

The sediment SRM analyzed in association with the reported BNA results is 1941a, certified by the National Institute of Standards and Technology (NIST). SRM 1941a contains a partial list of compounds for BNA analysis. BNA results for all samples in this data submission have been qualified based on the SRM recoveries outside the 80 to 120% QC limits, summarized in the following table.

Compound	% Recovery	Flag
Naphthalene	19	G
Fluorene	21	G
Phenanthrene	69	G
Anthracene	65	G
Fluoranthene	66	G
Pyrene	72	G
Benzo(a)anthracene	69	G
Benzo(a)pyrene	59	G
Indeno(1,2,3-c,d)pyrene	41	G
Dibenzo(a,h)anthracene	60	G
Benzo(g,h,i)perylene	25	G

The sediment SRM analyzed in association with the reported PCB results is HS-2, certified by the NRCC. SRM HS-2 contains Aroclor 1254. The SRM recovery for Aroclor 1254 was within the 80 to 120% QC limits.

A sediment SRM is not available for chlorobenzene compounds.

Matrix Spikes

BNA results for all samples in this data submission have been qualified based on the matrix spike recoveries outside the 50 to 150% QC limits, summarized in the following table.

Compound	% Recovery	Flag
Phenol	33	G
Bis(2-Chloroethyl)ether	34	G
2-Chlorophenol	38	G
Bis(2-Chloroisopropyl)ether	34	G
N-Nitrosodi-N-Propylamine	45	G
Hexachloroethane	44	G
Nitrobenzene	46	G
Isophorone	31	G
2-Nitrophenol	43	G
2,4-Dimethylphenol	3	X
Bis(2-chloroethoxy)methane	46	G
2,4-Dichlorophenol	49	G
Naphthalene	47	G
Hexachlorobutadiene	45	G
Hexachlorocyclopentadiene	26	G
Benzidine	0	X
3,3'-Dichlorobenzidine	0	X
Aniline	0	X
Benzyl Alcohol	22	G
2-Methylphenol	30	G
4-Methylphenol	31	G
4-Chloroaniline	20	G
2-Methylnaphthlene	49	G
3-Nitroaniline	34	G
4-Nitroaniline	39	G
Coprostanol	44	G

Chlorobenzene results for all samples in this data submission have been qualified based on the matrix spike recoveries outside the 50 to 150% QC limits, summarized in the following table.

Compound	% Recovery	Flag
1,3-Dichlorobenzene	49	G
1,4-Dichlorobenzene	48	G
1,2,4-Trichlorobenzene	43	G

Aroclor 1260 is used as the spiking compound for PCB analysis. The Aroclor 1260 matrix spike recovery was within the 50 to 150% QC limits.

Laboratory Replicate Samples

The RPDs for all BNA, chlorobenzene, and PCB laboratory duplicate sample results were less than or equal to the 100% QC limit.

TABLE 1
NORFOLK SEDIMENT BACKFILL MONITORING PROJECT
MARINE SEDIMENT SAMPLE INVENTORY

Sample	Locator	PSD	Solids	TOC	Metals	ClrBenz	BNAs	PCBs	Comments
L15421-1	NF<501	X	X	X	X	X	X	X	0 to 10cm sample
L15421-2	NF<502	X	X	X	X	X	X	X	0 to 10cm sample
L15421-3	NF<503	X	X	X	X	X	X	X	0 to 10cm sample
L15421-4	NF<504	X	X	X	X	X	X	X	0 to 10cm sample

TABLE 2
QC SAMPLE FREQUENCY FOR SEDIMENT CHEMICAL AND PHYSICAL PARAMETERS

Parameter	Method Blank	Duplicate	Triplicate	Matrix Spike	SRM or Check Standard	Surrogates
PSD	No	10% of samples	10% of samples	No	No	No
Total Solids	1 per QC batch	5% minimum, 1 per QC batch	5% minimum, 1 per QC batch	No	No	No
TOC	1 per QC batch	5% minimum, 1 per QC batch	5% minimum, 1 per QC batch	No	1 per QC batch	No
Metals	1 per QC batch	5% minimum, 1 per QC batch	No	5% minimum, 1 per QC batch	1 per QC batch	No
BNAs	1 per QC batch	5% minimum, 1 per QC batch	No	5% minimum, 1 per QC batch	1 per QC batch	Yes
Chlorobenzenes	1 per QC batch	5% minimum, 1 per QC batch	No	5% minimum, 1 per QC batch	No	Yes
PCBs	1 per QC batch	5% minimum, 1 per QC batch	No	5% minimum, 1 per QC batch	1 per QC batch	Yes

TABLE 3
SUMMARY OF SEDIMENT DATA QUALIFIERS

Condition to Qualify	King County Data Qualifier	Organics QC Limits	Metals QC Limits	Conventionals QC Limits	Comment
very low matrix spike recovery	X	< 10 %	< 10 %	< 10 %	
low matrix spike recovery	G	< 50%	< 75%	< 75%	
high matrix spike recovery	L	> 150%	>125%	>125%	
low SRM recovery	G	< 80%*	NA	< 80%*	
high SRM recovery	L	>120%*	>120%*	>120%*	
high duplicate RPD	E	>100 %	>20%	> 20 %	use duplicate as routine QC for organics
high triplicate RSD	E	NA	NA	> 20 %	use triplicate as routine CC for conventionals
less than the reporting detection limit	< RDL	NA	NA	NA	
less than the method detection limit	< MDL	NA	NA	NA	
contamination reported in blank	B	> MDL	> MDL	> MDL	
very biased data, based on surrogate recoveries	X	all fraction surrogates are <10%	NA	NA	use average surrogate recovery for BNA
biased data, based on low surrogate recoveries	G	all fraction surrogates are < 50%	NA	NA	use average surrogate recovery for BNA
biased data, based on high surrogate recoveries	L	all fraction surrogates are >150%	NA	NA	use average surrogate recovery for BNA
estimate based on presumptive evidence	J# used to indicate the presence of TICs	NA	NA	NA	TICs - Tentatively Identified Compounds
rejected, unusable for all purposes	R	NA	NA	NA	
a sample handling criteria has been exceeded	H	NA	NA	NA	includes container, preservation, hold time, sampling technique

*Note that PSDDA guidance uses a 95% confidence window for this parameter/qualification.

CONVENTIONAL ANALYSES QC DATA

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 06/15/1999 12:20
Run ID: R29943 Workgroup: WG42878 (TOC Sediment)

SRM:WG42878-1 Matrix: OTHR SOLID Listtype: CVTOC Method: SM5310-B (03-04-002-000) Project: PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	SRM Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Total Organic Carbon	5	10	mg/Kg		33480	32600	97		80-120			

MB:WG42878-2 Matrix: BLANK WTR Listtype: CVTOC Method: SM5310-B (03-04-001-000) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Qual
Total Organic Carbon	.5	1	mg/L	<MDL	

LD:WG42878-3 IT:WG42878-4 L15421-1 Matrix: SALTWTRSED Listtype: CVTOC Method: SM5310-B (03-04-002-000) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	LD Value	% Rec.	Qual	Limits	Truevalue	LT Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Total Organic Carbon	5	10	mg/Kg	1050		1310					1220				5		35

SRM:WG42878-5 Matrix: OTHR SOLID Listtype: CVTOC Method: SM5310-B (03-04-002-000) Project: PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	SRM Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Total Organic Carbon	5	10	mg/Kg		33480	32800	98		80-120			

MB:WG42878-6 Matrix: BLANK WTR Listtype: CVTOC Method: SM5310-B (03-04-001-000) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Qual
Total Organic Carbon	.5	1	mg/L	<MDL	

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 06/15/1999 12:20
Run ID: R29552 Workgroup: WG42906 (tots)

MB:WG42906-1 Matrix: BLANK WTR Listtype: CVTOTS Method: SM2540-B (03-01-007-001) Project 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Qual
Total Solids	.5	1	mg/L	<MDL	

LD:WG42906-2 LT:W342906-3 L15421-4 Matrix: SALTWTRSED Listtype: CVTOTS Method: SM2540-G (03-01-007-001) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	LD Value	% Rec.	Qual	Limits	Truevalue	LT Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Total Solids	.005	.01	%	77.6		77.8					78.5				1		15

Sediment Particle Size Distribution QC data

Particle size					Average	SD	%RSD	Ave %RSD
-2	<0.1	<0.1	<0.1		#DIV/0!	#DIV/0!	#DIV/0!	
-1	0.4	0.4	0.1		0.3	0.173205	57.73503	
0	1	1.1	1.3		1.133333	0.152753	13.47816	
+1	28	24.8	26.9		26.56667	1.625833	6.119824	
+2	55	56.2	56.9		56.03333	0.960902	1.714876	
+3	9	8.5	9.2		8.9	0.360555	4.051181	
+4	1.3	1.3	1.4		1.333333	0.057735	4.330127	
+5	5.4	7.7	4		5.7	1.868154	32.77463	17.17198
+6	<0.1	<0.1	<0.1		#DIV/0!	#DIV/0!	#DIV/0!	
+7	<0.1	<0.1	<0.1		#DIV/0!	#DIV/0!	#DIV/0!	
+8	<0.1	<0.1	<0.1		#DIV/0!	#DIV/0!	#DIV/0!	
+9	<0.1	<0.1	<0.1		#DIV/0!	#DIV/0!	#DIV/0!	
+10	<0.1	<0.1	<0.1		#DIV/0!	#DIV/0!	#DIV/0!	
>+10	<0.1	<0.1	<0.1		#DIV/0!	#DIV/0!	#DIV/0!	

AMTEST LABORATORIES

AmTest Inc.
14603 N.E. 87th St.
Redmond, WA
98052
Tel: 425 885 1664
Fax: 425 883 3495

May 4 1999

King County WPCD Env. Lab.
Subcontracting Dept. MS-LAB
322 West Ewing Street
Seattle, WA 98119-1507
Attention: Fritz Grothkopp

Dear Fritz Grothkopp:

Enclosed please find the analytical data for your project.

The following is a cross correlation of client and laboratory identifications for your convenience.

CLIENT ID	MATRIX	AM TEST ID	TEST
L15421-1	Sediment	99-A006406	CONV, GR SIZE,
L15421-2	Sediment	99-A006407	CONV, GR SIZE,
L15421-3	Sediment	99-A006408	CONV, GR SIZE,
L15421-4	Sediment	99-A006409	CONV, GR SIZE,

Your four (4) samples were received on Monday, April 26 1999. This was a total of 72 hours (3 days) after sample collection (4/23/99). At the time of receipt, the samples were logged in and properly maintained prior to their subsequent analyses.

The analytical procedures used at Am Test are well documented, and are typically derived from the protocols of the EPA, USDA, FDA or the Army Corps of Engineers.

Following the analytical data you will find the QC results and "Methodology Report". This table includes information relative to the detection limits, analyses dates and method references.

Please note that the detection limits that are listed in the body of the report refer to the Method Detection Limits (MDL's), as opposed to Practical Quantitation Limits (PQL's).

If you should have any questions pertaining to the data package, please feel free to contact me.

Sincerely,

Mark A. Fugiel
General Manager

Project #: 423056-160
PO Number: 108677

BACT = Bacteriological
CONV = Conventionals
MET = Metals
ORG = Organics

AMTEST LABORATORIES

AmTest Inc.
14603 N.E. 87th St.
Redmond, WA
98052
Tel: 425 885 1664
Fax: 425 883 3495

ANALYSIS REPORT

King County WPCD Env. Lab.
Subcontracting Dept. MS-LAB
322 West Ewing Street
Seattle, WA 98119-1507
Attention: Fritz Grothkopp

Date Received: 4/26/99
Date Reported: 5/ 6/99

Project #: 423056-160
PO Number: 108677

SEDIMENT SAMPLES

AM TEST Identification Number	99-A006406
Client Identification	L15421-1
Sampling Date	4/23/99

PARAMETER	RESULT	Q	D.L.

Conventionals

GRAIN SIZE DISTRIBUTION

PHI	OPENING (MM)	% RETENTION	
	4.75	< 0.1	gravel
-2	4.00	< 0.1	
-1	2.00	0.80	
0	1.00	3.30	
+1	0.50	37.9	sand
+2	0.25	45.7	
+3	0.125	4.30	
+4	0.063	7.00	
+5	0.032	1.00	
+6	0.016	< 0.1	silt
+7	0.008	< 0.1	
+8	0.004	< 0.1	
+9	0.002	< 0.1	
+10	0.001	< 0.1	clay
>+10	<0.001	< 0.1	

Analysis by Tyler Screens and Hydrometer (ASTM D-422)

AMTEST

ANALYSIS REPORT

King County WPCD Env. Lab.
Subcontracting Dept. MS-LAB
322 West Ewing Street
Seattle, WA 98119-1507
Attention: Fritz Grothkopp

Date Received: 4/26/99
Date Reported: 5/ 6/99

Project #: 423056-160
PO Number: 108677

SEDIMENT SAMPLES

AM TEST Identification Number	99-A006407
Client Identification	L15421-2
Sampling Date	4/23/99

PARAMETER	RESULT	Q	D.L.

Conventionals

GRAIN SIZE DISTRIBUTION

PHI	OPENING (MM)	% RETENTION	
	4.75	< 0.1	gravel
-2	4.00	< 0.1	
-1	2.00	0.40	
0	1.00	3.00	
+1	0.50	31.8	sand
+2	0.25	55.6	
+3	0.125	4.10	
+4	0.063	0.40	
+5	0.032	4.70	
+6	0.016	< 0.1	silt
+7	0.008	< 0.1	
+8	0.004	< 0.1	
+9	0.002	< 0.1	
+10	0.001	< 0.1	clay
>+10	<0.001	< 0.1	

Analysis by Tyler Screens and Hydrometer (ASTM D-422)

AM TEST

ANALYSIS REPORT

King County WPCD Env. Lab.
Subcontracting Dept. MS-LAB
322 West Ewing Street
Seattle, WA 98119-1507
Attention: Fritz Grothkopp

Date Received: 4/26/99
Date Reported: 5/ 6/99

Project #: 423056-160
PO Number: 108677

SEDIMENT SAMPLES

AM TEST Identification Number	99-A006408
Client Identification	L15421-3
Sampling Date	4/23/99

PARAMETER	RESULT	Q	D.L.

Conventionals

GRAIN SIZE DISTRIBUTION

PHI	OPENING (MM)	% RETENTION	
	4.75	< 0.1	gravel
-2	4.00	< 0.1	
-1	2.00	0.40	
0	1.00	1.00	
+1	0.50	28.0	sand
+2	0.25	55.0	
+3	0.125	9.00	
+4	0.063	1.30	
+5	0.032	5.40	
+6	0.016	< 0.1	silt
+7	0.008	< 0.1	
+8	0.004	< 0.1	
+9	0.002	< 0.1	
+10	0.001	< 0.1	clay
>+10	<0.001	< 0.1	

Analysis by Tyler Screens and Hydrometer (ASTM D 422)

AMTEST

ANALYSIS REPORT

King County WPCD Env. Lab.
Subcontracting Dept. MS-LAB
322 West Ewing Street
Seattle, WA 98119-1507
Attention: Fritz Grothkopp

Date Received: 4/26/99
Date Reported: 5/ 6/99

Project #: 423056-160
PO Number: 108677

SEDIMENT SAMPLES

AM TEST Identification Number	99-A006409
Client Identification	L15421-4
Sampling Date	4/23/99

PARAMETER	RESULT	Q	D.L.

Conventionals

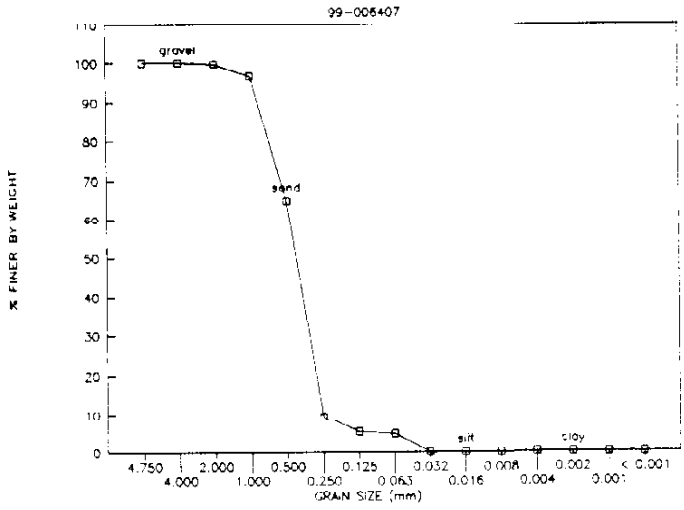
GRAIN SIZE DISTRIBUTION

PHI	OPENING (MM)	% RETENTION	
	4.75	< 0.1	gravel
-2	4.00	< 0.1	
-1	2.00	0.40	
0	1.00	3.30	
+1	0.50	44.4	sand
+2	0.25	45.7	
+3	0.125	3.00	
+4	0.063	0.40	
+5	0.032	2.90	
+6	0.016	< 0.1	silt
+7	0.008	< 0.1	
+8	0.004	< 0.1	
+9	0.002	< 0.1	
+10	0.001	< 0.1	clay
>+10	<0.001	< 0.1	

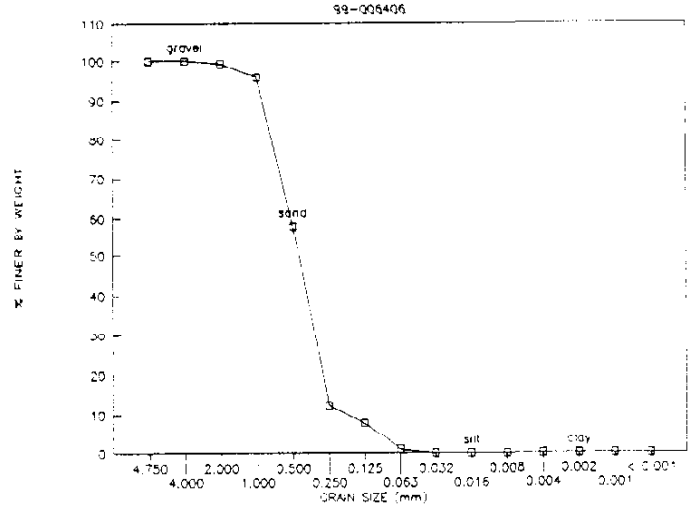
Analysis by Tyler Screens and Hydrometer (ASTM D-422)

AMTEST

GRAIN SIZE DISTRIBUTION



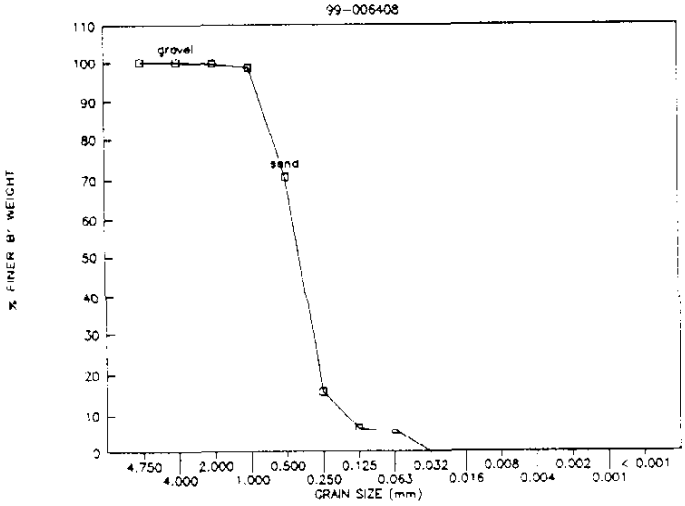
GRAIN SIZE DISTRIBUTION



AMTEST

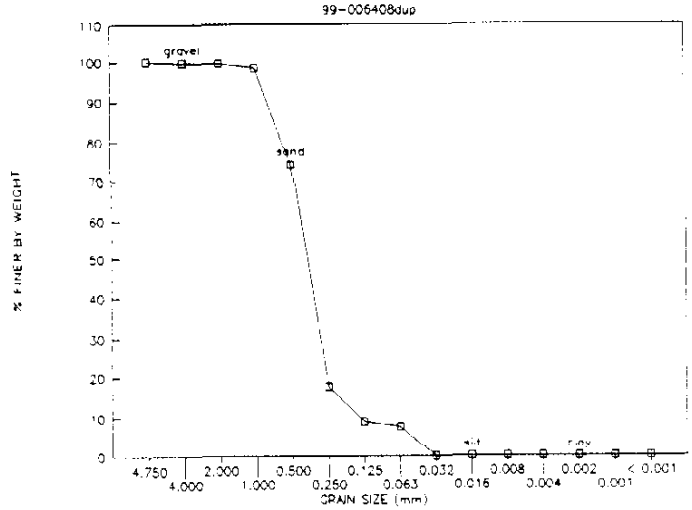
GRAIN SIZE DISTRIBUTION

99-006408



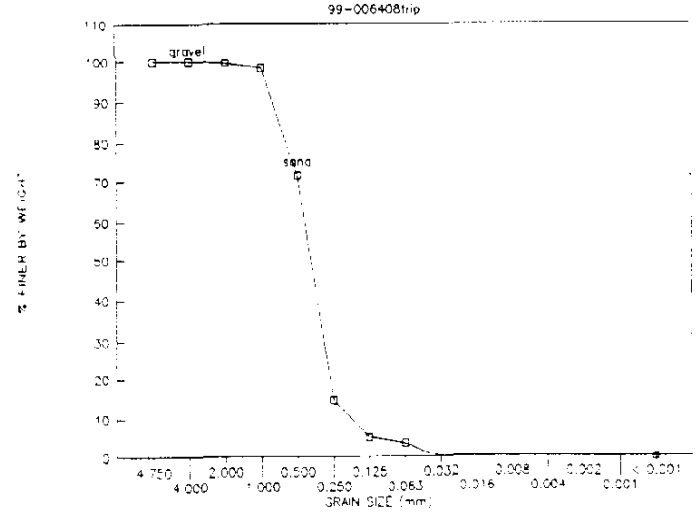
GRAIN SIZE DISTRIBUTION

99-006408dup



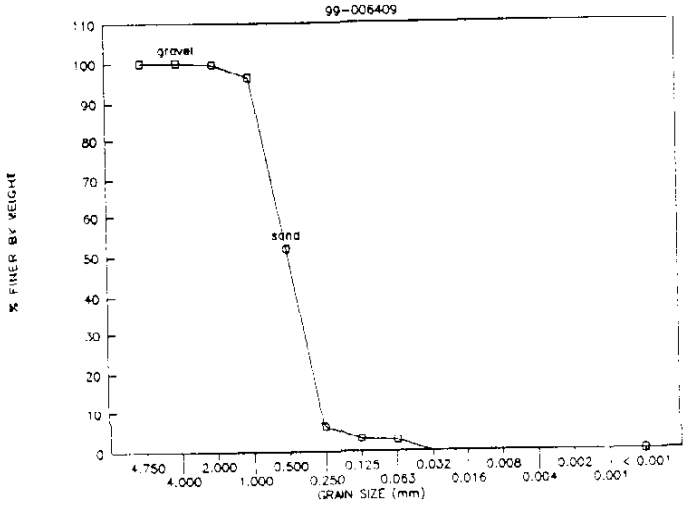
GRAIN SIZE DISTRIBUTION

99-006408trip



AMTEST

GRAIN SIZE DISTRIBUTION



AMTEST

Quality Control Summary

PSD

QC for 9916512

99-A006406
99-A006407
99-A006408
99-A006409

DUPLICATES

	Sample Value	Duplicate Value	RPD
9-A006408 DUP:	< 0.1	< 0.1	
9-A006408 DUP: - 2	< 0.1	< 0.1	
9-A006408 DUP: - 2	< 0.1	0.30	
9-A006408 DUP: - 1	< 0.1	< 0.1	
9-A006408 DUP: - 1	0.60	0.10	120
A006408 DUP: 0	0.40	0.40	0.00
-A006408 DUP: 0	1.00	1.10	9.5
-A006408 DUP: - 1	1.00	1.30	26.
-A006408 DUP: + 1	28.0	34.0	19.
A006408 DUP: + 2	28.0	26.9	4.0
A006408 DUP: + 2	55.0	56.2	2.2
A006408 DUP: + 3	55.0	56.9	3.4
A006408 DUP: + 3	9.00	8.50	5.7
A006408 DUP: + 4	9.00	9.20	2.2
A006408 DUP: + 4	1.30	1.30	0.00
A006408 DUP: + 5	1.30	1.40	7.4
006408 DUP: + 5	5.40	7.70	35.
006408 DUP: + 6	5.40	4.30	30.
06408 DUP: + 6	< 0.1	< 0.1	
06408 DUP: + 7	< 0.1	< 0.1	
06408 DUP: + 7	< 0.1	< 0.1	
6408 DUP: + 8	< 0.1	< 0.1	
06408 DUP: + 8	< 0.1	< 0.1	
6408 DUP: + 9	< 0.1	< 0.1	
06408 DUP: + 9	< 0.1	< 0.1	
6408 DUP: + 10	< 0.1	< 0.1	
06408 DUP: + 10	< 0.1	< 0.1	
6408 DUP: > +10	< 0.1	< 0.1	
6408 DUP: > +10	< 0.1	< 0.1	

phi size	-1	0	5
	0.4	1	5.4
	0.1	1.1	7.7
	0.4	1.3	4
MEAN	0.3	1.133333	5.7
Standard Dev	0.173205	0.152753	1.868154
%RSD	57.73503	13.47816	32.77463

METAL CHEMISTRY QC DATA

SUMMARY OF QA REVIEW METALS

PARAMETER: Ag,Al,As,Be,Cr,Cu,Cd,Fe,Mn,Ni,Pb,Se,Tl,Zn-ICP; Hg-CVAA

COMPLETENESS: L15421-1 TO 4

qc results not available to qualify the following samples
N/A
data have been qualified with:
samples reported without associated method blank
N/A
data have been qualified with:
samples reported without associated matrix spike
N/A
data have been qualified with:
samples reported without associated replicates
N/A
data have been qualified with:
samples reported without associated SRM
N/A
data have been qualified with:

samples reported with selected QC samples from outside data submission
N/A

samples reported without complete target list
N/A
indicate metals not included

UNITS AND SIGNIFICANT FIGURES

list all samples not reported in ppm dry weight
N/A

HOLD CONDITIONS:

criteria used to determine hold conditions: Mercury: 28 days from sample collection
list all samples which exceed hold time
N/A
data have been qualified with:

METHOD BLANK:

list all metals detected in the method blanks
Fe = 0.11 mg/L: All sample values more than 10X the blank concentration
data have been qualified with: "B"

DETECTION LIMITS:

where MDL and RDL are not reported, the MDL RDL reported DL is a:
N/A

MATRIX SPIKE:

indicate recovery problems observed < 75% and > 125%, indicate any qualifiers used
Aluminum = 171%; "L" - Indigenous sample concentration much higher than the spike concentration (4X rule).
Manganese = 55%; "G" - Indigenous sample concentration much higher than the spike concentration (4X rule).

SRM

indicate recovery of <80% and >120% and qualifier used
Cadmium = 148%; "L" - Typical recovery by this method
Chromium = 49%; no qualifier; Typical recovery by this method
Manganese = 57%; no qualifier; Typical recovery by this method
Nickel = 79%; no qualifier; Typical recovery by this method
Arsenic = 79%; no qualifier; Typical recovery by this method
Selenium = 0%; no qualifier; Certified value below detection limit

REPLICATES:

indicate RPD's >20%

MARINE SEDIMENT Q.C. DATA

Marine Sediments ICP Q.C. Results
For Samples: L15421-1/2/3/4
Collect Date: 23-Apr-99
Prep Date: 30-Apr-99
Date of Analysis: 02-Jun-99
Analyst: Sean McRae

ELEMENT	DUPLICATE SAMPLE #: WG42979-4 L15421-1 BACKGROUND mg/Kg	REPLICATE mg/Kg	RPD	QUALIFIER	ELEMENT SPIKED	SPIKE ADDED mg/L	SPIKED BLANK mg/L	SPIKED SAMPLE mg/Kg	PERCENT RECOVERY	QUALIFIER	DETECTION LIMIT mg/Kg	METHOD CODE
						SPIKE SAMPLE #: WG42979-5						
Ag	<MDL	<MDL			Ag	1.2	1.15	56.6	94		0.2	16-02-004
Al	7510	7350	2		Al	12	11.4	8530	17	L	5	16-02-004
As	<MDL	<MDL			As	4	3.75	187	94		2.5	16-02-004
Ba					Ba							16-02-004
Be	0.088	0.091			Be	0.4	0.373	18.7	93		0.05	16-02-004
Ca					Ca							16-02-004
Cd	0.15	<MDL			Cd	1.2	1.12	55.5	92		0.15	16-02-004
Cr	9.94	9.97	0		Cr	1.2	1.13	65.2	92		0.25	16-02-004
Cu	8.73	9.4	7		Cu	1.2	1.14	66.1	96		0.2	16-02-004
Fe	14500	14600	1		Fe	50	45.6	16500	80		2.5	16-02-004
K					K							16-02-004
Mg					Mg							16-02-004
Mn	202	198	2		Mn	0.8	0.756	224	55	G	0.1	16-02-004
Mo					Mo							16-02-004
Na					Na							16-02-004
Ni	9.79	9.58	2		Ni	1.2	1.13	65.1	92		1	16-02-004
Pb	3.2	4.2			Pb	4	3.7	185	91		1.5	16-02-004
Sb					Sb							16-02-004
Se	<MDL	<MDL			Se	2	1.91	92.9	93		2.5	16-02-004
TL	<MDL	<MDL			TL	4	3.74	185	93		10	16-02-004
Zn	35.4	35.6	1		Zn	1.2	1.11	87.3	86		0.25	16-02-004

Marine Sediments CVAA-Hg Q.C. Results
For Samples: L15421-1/2/3/4
Collect Date: 23-Apr-99
Prep Date: 30-Apr-99
Date of Analysis: 03-May-99
Analyst: Kevin Cummings

ELEMENT	DUPLICATE SAMPLE #: WG42491-4 L15421-1 BACKGROUND mg/Kg	REPLICATE mg/Kg	RPD	QUALIFIER	ELEMENT SPIKED	SPIKE ADDED mg/L	SPIKED BLANK mg/L	SPIKED SAMPLE mg/Kg	PERCENT RECOVERY	QUALIFIER	DETECTION LIMIT mg/Kg	METHOD CODE
					SPIKE SAMPLE #: WG42491-5							
Hg	0.042	0.027			Hg	0.005	0.0051	0.505	94		0.02	16-01-005

Marine Sediments ICP Q. C. Results
For Samples: L15421-1/2/3/4
Collect Date: 23-Apr-99
Prep Date: 30-Apr-99
Date of Analysis: 02-Jun-99
Analyst: Sean McRae

ELEMENT	MEASURED VALUE mg/Kg	SRM PACS-1 CERTIFIED VALUE mg/Kg	SRM PACS-1 PERCENT RECOVERY	DETECTION LIMIT mg/Kg	QUALIFIER	ELEMENT	BLANK mg/L	BLANK DETECTION LIMIT mg/L	QUALIFIER	METHOD CODE
*Ag	1.7	NC		0.86		Ag	<MDL	0.004		16-02-C04
*Al	17400	NC		21		Al	<MDL	0.1		16-02-C04
As	168	211 ± 11	79	11		As	<MDL	0.05		16-02-C04
Ba						Ba	<MDL			16-02-C04
*Be	0.3	NC		0.21		Be	<MDL	0.001		16-02-C04
Ca						Ca	<MDL			16-02-C04
Cd	3.52	2.38 ± .2	148	0.64	L	Cd	<MDL	0.003		16-02-C04
Cr	55.4	113 ± 8	49	1.1		Cr	<MDL	0.005		16-02-C04
Cu	424	452 ± 16	94	0.86		Cu	<MDL	0.004		16-02-C04
*Fe	34200	NC		11		Fe	0.11	0.05	B	16-02-C04
K						K	<MDL			16-02-C04
Mg						Mg	<MDL			16-02-C04
Mn	270	470 ± 12	57	0.43		Mn	<MDL	0.002		16-02-C04
Mo		12.3 ± .9				Mo	<MDL			16-02-C04
Na						Na	<MDL			16-02-C04
Ni	35	44.1 ± 2	79	4.3		Ni	<MDL	0.02		16-02-C04
Pb	380	404 ± 20	94	6.4		Pb	<MDL	0.03		16-02-C04
Sb		171 ±14				Sb	<MDL			16-02-C04
Se	<MDL	1.09	0	11		Se	<MDL	0.05		16-02-C04
*Tl	<MDL	NC		43		Tl	<MDL	0.2		16-02-C04
Zn	717	824 ± 22	87	1.1		Zn	<MDL	0.005		16-02-C04

* indicates elements not certified

Marine Sediments CVAA-Hg
For Samples: L15421-1/2/3/4
Collect Date: 23-Apr-99
Prep Date: 30-Apr-99
Date of Analysis: 03-May-99
Analyst: Kevin Cummings

ELEMENT	MEASURED VALUE mg/Kg	SRM PACS-1 CERTIFIED VALUE mg/Kg	SRM PACS-1 PERCENT RECOVERY	DETECTION LIMIT mg/Kg	QUALIFIER	ELEMENT	BLANK mg/L	BLANK DETECTION LIMIT mg/L	QUALIFIER	METHOD CODE
Hg	4.5	4.57	99	0.092		Hg	<MDL	0.0002		16-01-C05

Preparation Method: EPA 245.5
Project Number: 423056-160
Project Description: NORFOLK CSO Outfall
Preparation Date: 4/30/99

Work Group Number: WG42491
Analyst: KC
Matrix: SALTWATER SED
Analysis: (1st) 2nd 3rd

ANALYTICAL SAMPLES

	SAMPLE NUMBER	WEIGHT (g)	FINAL VOLUME (ml)	
1	L15421-1	1.007	100ml	
2	-2	1.005	"	
3	-3	1.001	"	
4	-4	1.016	"	
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Comments:

QUALITY CONTROL SAMPLES

	QC SAMPLE NUMBER	QC SAMPLE DESCRIPTION	WEIGHT (g)	FINAL VOLUME (ml)	
1	WG42491-1	Method BLK		100ml	
2	-2	SPK BLK		"	
3	-3	PACS-1	0.218	"	
4	-4	L15421-1 LABDUP	0.999	"	
5	-5	L15421-1 MATSPK	1.010	"	
6					
7					
8					
9					
10					
11					
12					
13					

SOLUTION	SPIKE ELEMENTS (ug/L)	AMOUNT SPIKED (ul)	FINAL VOLUME (ml)
1A	B - 500; Mo -300; Si - 230; Ti - 1,000		
1B	Sb - 600		
2	As, Pb, Tl - 1,000; Be - 100; Ba, Cd, Cr, Co, Cu, Ni, Ag, V, Zn - 300; K - 20,300; Mn - 200; Se - 500		
3	Al - 1200; Ca - 5,000; Mg - 3,000; Na - 1,000		
MERCURY	Hg - 2000	250	100
OTHER			

Preparation Method:	Sediment digestion
Project Number:	423056
Project Description:	Norfolk Sediment
Preparation Date:	6/2/99

Work Group Number:	WG 42979
Analyst:	SM
Matrix:	Salt Sed
Analysis	(1st) 2nd 3rd

ANALYTICAL SAMPLES

	SAMPLE NUMBER	WEIGHT (g)	FINAL VOLUME (ml)
1	L15421-1	0.9985	50
2	2	1.0334	
3	3	1.0209	
4	4	1.0411	
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

Comments: * Dilution of 15421-1

QUALITY CONTROL SAMPLES

	QC SAMPLE NUMBER	QC SAMPLE DESCRIPTION	WEIGHT (g)	FINAL VOLUME (ml)
1	WG42979 1	Method Blank		50
2	2	Spike Blank		
3	3	PACS-1	0.2323	
4	info only	ERA Soil	0.2027	
5	4	15421-1 Dup	1.0055	
6	info only	1 Trip	1.0001	
7	5	1 Spk	1.0000	
8	info only	1 Spk dup	0.9965	
9	6	1 SOIL	*	
10				
11				
12				
13				

SOLUTION	SPIKE ELEMENTS (mg/L)	AMOUNT SPIKED (ml)	FINAL VOLUME (ml)
1A	B 500, Mo 300, Sr 230, Ti 1,000	200	50
1B	Sb 1000	200	
2	As, Cd, Tl 1,000, Be 100, Ba, Cd, Cr, Co, Cu, Ni, Ag, V, Zn 300; K 20,000; Mn 200, Se 500	200	
3	Al 1200, Ca 5,000; Mg 3,000; Na 1,000	500	
MERCURY	Hg		
OTHER			

ORGANIC CHEMISTRY QC DATA

METRO Environmental Laboratory

WORK GROUP REPORT (wk02)

May 26 1999, 07:54 am

Work Group: WG42504 (BS#89-bna) for Department: 7 - Organics, Trace

Created: 03-MAY-1999 Due: Operator: lm/mm

ple	Project Number	Project Description	PKey	C	Product	Matrix	Stat	UA	Workdate	Duedate
6421-1	423056-160	Norfolk Cleanup Study	SED	S	BNA	SALTWTRSED	DONE	U	07-MAY-99	07-JUN-99
6421-2	423056-160	Norfolk Cleanup Study	SED	S	BNA	SALTWTRSED	DONE	U	07-MAY-99	07-JUN-99
6421 3	423056 160	Norfolk Cleanup Study	SED	S	BNA	SALTWTRSED	DONE	U	07-MAY-99	07-JUN-99
6421-4	423056-160	Norfolk Cleanup Study	SED	S	BNA	SALTWTRSED	DONE	U	07-MAY-99	07-JUN-99
2504-1	MB			S	BNA	OTHR SOLID	DONE	U	03-MAY-99	
2504-2	SB			S	BNA	OTHR SOLID	DONE	U	03-MAY-99	
2504-3	MS			S	BNA	SALTWTRSED	DONE	U	03-MAY-99	
2504-4	MSD			S	BNA	SALTWTRSED	DONE	U	03-MAY-99	
2504-5	LD			S	BNA	SALTWTRSED	DONE	U	03-MAY-99	
2504-6	SRM			S	BNA	OTHR SOLID	DONE	U	03-MAY-99	
2504-7	MB			S	BNA	OTHR SOLID	DONE	U	10-MAY-99	
2504-8	SB			S	BNA	OTHR SOLID	DONE	U	10-MAY-99	

ments:

6421-1	3-Grab Composite, 0 - 10 cm
6421-2	3-Grab Composite, 0 - 10 cm
6421-3	3-Grab Composite, 0 - 10 cm
6421-4	3-Grab Composite, 0 - 10 cm
2504-1	MB050399
2504-2	WG42504-1
2504-3	L15421-1
2504-4	WG42504-3 L15421-1
2504-5	L15421-4
2504-6	1941A
2504-7	MB05--99
2504-8	WG42504-7

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 06/07/1999 08:51
Run ID: R29242 Workgroup: WG42504 (BS#89-bna)

MB:WG42504-1 Matrix: OTHR SOLID Listtype: ORBNA Method: EPA 3550B/8270C (7-3-01-004) Project: PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Qual
N-Nitrosodimethylamine	110	160	ug/Kg	<MDL	
Phenol	110	160	ug/Kg	<MDL	
Bis(2-Chloroethyl)Ether	16	26.7	ug/Kg	<MDL	
2-Chlorophenol	53	107	ug/Kg	<MDL	
Bis(2-Chloroisopropyl)Ether	53	107	ug/Kg	<MDL	
N-Nitrosodi-N-Propylamine	27	53.3	ug/Kg	<MDL	
Hexachloroethane	27	53.3	ug/Kg	<MDL	
Nitrobenzene	27	53.3	ug/Kg	<MDL	
Isophorone	27	53.3	ug/Kg	<MDL	
2-Nitrophenol	27	53.3	ug/Kg	<MDL	
2,4-Dimethylphenol	27	53.3	ug/Kg	<MDL	
Bis(2-Chloroethoxy)Methane	27	53.3	ug/Kg	<MDL	
2,4-Dichlorophenol	27	53.3	ug/Kg	<MDL	
Naphthalene	43	80	ug/Kg	<MDL	
Hexachlorobutadiene	27	53.3	ug/Kg	<MDL	
4-Chloro-3-Methylphenol	53	107	ug/Kg	<MDL	
Hexachlorocyclopentadiene	27	53.3	ug/Kg	<MDL	
2,4,6-Trichlorophenol	110	213	ug/Kg	<MDL	
2-Chloronaphthalene	16	26.7	ug/Kg	<MDL	
Acenaphthylene	16	26.7	ug/Kg	<MDL	
Dimethyl Phthalate	11	16	ug/Kg	<MDL	
2,6-Dinitrotoluene	11	21.3	ug/Kg	<MDL	
Acenaphthene	11	21.3	ug/Kg	<MDL	
2,4-Dinitrophenol	53	107	ug/Kg	<MDL	
4-Nitrophenol	53	107	ug/Kg	<MDL	
2,4-Dinitrotoluene	11	21.3	ug/Kg	<MDL	
Fluorene	16	26.7	ug/Kg	<MDL	
Diethyl Phthalate	27	53.3	ug/Kg	<MDL	
4-Chlorophenyl Phenyl Ether	16	26.7	ug/Kg	<MDL	
4,6-Dinitro-O-Cresol	53	107	ug/Kg	<MDL	
N-Nitrosodiphenylamine	27	53.3	ug/Kg	<MDL	
1,2-Diphenylhydrazine	53	107	ug/Kg	<MDL	
4-Bromophenyl Phenyl Ether	11	16	ug/Kg	<MDL	
Pentachlorophenol	27	53.3	ug/Kg	<MDL	
Phenanthrene	16	26.7	ug/Kg	<MDL	
Anthracene	16	26.7	ug/Kg	<MDL	
Di-N-Butyl Phthalate	27	53.3	ug/Kg	<MDL	
Fluoranthene	16	32	ug/Kg	<MDL	
Benzidine	640	1280	ug/Kg	<MDL	
Pyrene	16	26.7	ug/Kg	<MDL	
Benzyl Butyl Phthalate	16	26.7	ug/Kg	<MDL	
Benzo(a)anthracene	16	26.7	ug/Kg	<MDL	
Chrysene	16	26.7	ug/Kg	<MDL	
3,3'-Dichlorobenzidine	27	53.3	ug/Kg	<MDL	
Bis(2-Ethylhexyl)Phthalate	16	26.7	ug/Kg	<MDL	
Di-N-Octyl Phthalate	16	26.7	ug/Kg	<MDL	
Benzo(b)fluoranthene	43	80	ug/Kg	<MDL	
Benzo(k)fluoranthene	43	80	ug/Kg	<MDL	
Benzo(a)pyrene	27	53.3	ug/Kg	<MDL	
Indeno(1,2,3-Cd)Pyrene	27	53.3	ug/Kg	<MDL	
Dibenzo(a,h)anthracene	43	80	ug/Kg	<MDL	

MB:WG42504-1 Matrix: OTHR SOLID Listtype: ORBNA Method: EPA 3550B/8270C (7-3-01-004) Project: PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Qual
Benzo(g,h,i)perylene	27	53.3	ug/Kg	<MDL	
Aniline	53	107	ug/Kg	<MDL	
Benzyl Alcohol	27	53.3	ug/Kg	<MDL	
2-Methylphenol	27	53.3	ug/Kg	<MDL	
4-Methylphenol	27	53.3	ug/Kg	<MDL	
Benzoic Acid	110	160	ug/Kg	<MDL	
4-Chloroaniline	53	107	ug/Kg	<MDL	
2-Methylnaphthalene	43	80	ug/Kg	<MDL	
2,4,5-Trichlorophenol	110	213	ug/Kg	<MDL	
2-Nitroaniline	110	160	ug/Kg	<MDL	
3-Nitroaniline	110	160	ug/Kg	<MDL	
Dibenzofuran	27	53.3	ug/Kg	<MDL	
4-Nitroaniline	110	160	ug/Kg	<MDL	
Carbazole	27	53.3	ug/Kg	<MDL	
Coprostanol	270	533	ug/Kg	<MDL	
Caffeine	5.3	26.7	ug/Kg	<MDL	

SB:WG42504-2 MB:WG42504-1 Matrix: OTHR SOLID Listtype: ORBNA Method: EPA 3550B/8270C (7-3-01-004) Project: PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Truevalue	SB Value	% Rec.	Qual	Limits	Truevalue	Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
N-Nitrosodimethylamine	110	160	ug/Kg	<MDL	1333.3333	862	65		50-150								100
Phenol	110	160	ug/Kg	<MDL	1333.3333	378	28	*	50-150								100
Bis(2-Chloroethyl)Ether	16	26.7	ug/Kg	<MDL	1333.3333	445	33	*	50-150								100
2-Chlorophenol	53	107	ug/Kg	<MDL	1333.3333	496	37	*	50-150								100
Bis(2-Chloroisopropyl)Ether	53	107	ug/Kg	<MDL	1333.3333	457	34	*	50-150								100
N-Nitrosodi-N-Propylamine	27	53.3	ug/Kg	<MDL	1333.3333	576	43	*	50-150								100
Hexachloroethane	27	53.3	ug/Kg	<MDL	1333.3333	689	52		50-150								100
Nitrobenzene	27	53.3	ug/Kg	<MDL	1333.3333	652	49	*	50-150								100
Isophorone	27	53.3	ug/Kg	<MDL	1333.3333	481	36	*	50-150								100
2-Nitrophenol	27	53.3	ug/Kg	<MDL	1333.3333	616	46	*	50-150								100
2,4-Dimethylphenol	27	53.3	ug/Kg	<MDL	1333.3333	102	8	*	50-150								100
Bis(2-Chloroethoxy)Methane	27	53.3	ug/Kg	<MDL	1333.3333	652	49	*	50-150								100
2,4-Dichlorophenol	27	53.3	ug/Kg	<MDL	1333.3333	642	48	*	50-150								100
Naphthalene	43	80	ug/Kg	<MDL	1333.3333	704	53		50-150								100
Hexachlorobutadiene	27	53.3	ug/Kg	<MDL	1333.3333	681	51		50-150								100
4-Chloro-3-Methylphenol	53	107	ug/Kg	<MDL	1333.3333	1040	78		50-150								100
Hexachlorocyclopentadiene	27	53.3	ug/Kg	<MDL	1333.3333	346	26	*	50-150								100
2,4,6-Trichlorophenol	110	213	ug/Kg	<MDL	1333.3333	827	62		50-150								100
2-Chloronaphthalene	16	26.7	ug/Kg	<MDL	1333.3333	726	54		50-150								100
Acenaphthylene	16	26.7	ug/Kg	<MDL	1333.3333	860	65		50-150								100
Dimethyl Phthalate	11	16	ug/Kg	<MDL	1333.3333	1130	85		50-150								100
2,6-Dinitrotoluene	11	21.3	ug/Kg	<MDL	1333.3333	1030	77		50-150								100
Acenaphthene	11	21.3	ug/Kg	<MDL	1333.3333	851	64		50-150								100
2,4-Dinitrophenol	53	107	ug/Kg	<MDL	1333.3333	873	65		50-150								100
4-Nitrophenol	53	107	ug/Kg	<MDL	1333.3333	1170	87		50-150								100
2,4-Dinitrotoluene	11	21.3	ug/Kg	<MDL	1333.3333	1140	85		50-150								100
Fluorene	16	26.7	ug/Kg	<MDL	1333.3333	1070	81		50-150								100
Diethyl Phthalate	27	53.3	ug/Kg	<MDL	1333.3333	1230	92		50-150								100
4-Chlorophenyl Phenyl Ether	16	26.7	ug/Kg	<MDL	1333.3333	1010	76		50-150								100

SB:WG42504-2 MB:WG42504-1 Matrix: OTHR SOLID Listtype: ORBNA Method: EPA 3550B/8270C (7-3-01-004) Project: PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Truevalue	SB Value	% Rec.	Qual	Limits	Truevalue	Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
4,6-Dinitro-O-Cresol	53	107	ug/Kg	<MDL	1333.3333	931	70		50-150								100
N-Nitrosodiphenylamine	27	53.3	ug/Kg	<MDL	1333.3333	1110	83		50-150								100
1,2-Diphenylhydrazine	53	107	ug/Kg	<MDL	1333.3333	1070	80		50-150								100
4-Bromophenyl Phenyl Ether	11	16	ug/Kg	<MDL	1333.3333	995	75		50-150								100
Pentachlorophenol	27	53.3	ug/Kg	<MDL	1333.3333	908	68		50-150								100
Phenanthrene	16	26.7	ug/Kg	<MDL	1333.3333	1110	84		50-150								100
Anthracene	16	26.7	ug/Kg	<MDL	1333.3333	1060	80		50-150								100
Di-N-Butyl Phthalate	27	53.3	ug/Kg	<MDL	1333.3333	1250	94		50-150								100
Fluoranthene	16	32	ug/Kg	<MDL	1333.3333	1140	86		50-150								100
Benzidine	640	1280	ug/Kg	<MDL	1333.3333	<MDL	0	*	50-150								100
Pyrene	16	26.7	ug/Kg	<MDL	1333.3333	1080	81		50-150								100
Benzyl Butyl Phthalate	16	26.7	ug/Kg	<MDL	1333.3333	1110	84		50-150								100
Benzo(a)anthracene	16	26.7	ug/Kg	<MDL	1333.3333	1080	81		50-150								100
Chrysene	16	26.7	ug/Kg	<MDL	1333.3333	1160	87		50-150								100
3,3'-Dichlorobenzidine	27	53.3	ug/Kg	<MDL	1333.3333	140	11	*	50-150								100
Bis(2-Ethylhexyl)Phthalate	16	26.7	ug/Kg	<MDL	1333.3333	1160	87		50-150								100
Di-N-Octyl Phthalate	16	26.7	ug/Kg	<MDL	1333.3333	1380	104		50-150								100
Benzo(b)fluoranthene	43	80	ug/Kg	<MDL	1333.3333	1160	87		50-150								100
Benzo(k)fluoranthene	43	80	ug/Kg	<MDL	1333.3333	1260	95		50-150								100
Benzo(a)pyrene	27	53.3	ug/Kg	<MDL	1333.3333	1070	80		50-150								100
Indeno(1,2,3-Cd)Pyrene	27	53.3	ug/Kg	<MDL	1333.3333	1060	79		50-150								100
Dibenzo(a,h)anthracene	43	80	ug/Kg	<MDL	1333.3333	1150	86		50-150								100
Benzo(g,h,i)perylene	27	53.3	ug/Kg	<MDL	1333.3333	1010	76		50-150								100
Aniline	53	107	ug/Kg	<MDL	1333.3333	<MDL	0	*	50-150								100
Benzyl Alcohol	27	53.3	ug/Kg	<MDL	1333.3333	354	27	*	50-150								100
2-Methylphenol	27	53.3	ug/Kg	<MDL	1333.3333	386	29	*	50-150								100
4-Methylphenol	27	53.3	ug/Kg	<MDL	1333.3333	416	31	*	50-150								100
Benzoic Acid	110	160	ug/Kg	<MDL	1333.3333	110	8	*	50-150								100
4-Chloroaniline	53	107	ug/Kg	<MDL	1333.3333	138	10	*	50-150								100
2-Methylnaphthalene	43	80	ug/Kg	<MDL	1333.3333	729	55		50-150								100
2,4,5-Trichlorophenol	110	213	ug/Kg	<MDL	1333.3333	1000	75		50-150								100
2-Nitroaniline	110	160	ug/Kg	<MDL	1333.3333	983	74		50-150								100
3-Nitroaniline	110	160	ug/Kg	<MDL	1333.3333	914	69		50-150								100
Dibenzofuran	27	53.3	ug/Kg	<MDL	1333.3333	981	74		50-150								100
4-Nitroaniline	110	160	ug/Kg	<MDL	1333.3333	1280	96		50-150								100
Carbazole	27	53.3	ug/Kg	<MDL	1333.3333	2140	161	*	50-150								100
Coprostanol	270	533	ug/Kg	<MDL	13333.3333	4490	34	*	50-150								100

MS:WG42504-3 MSD:WG42504-4 L15421-1 Matrix: SALTWTRSED Listtype: ORBNA Method: EPA 3550B/8270C (7-3-01-004) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	MS Value	% Rec.	Qual	Limits	Truevalue	MSD Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
N-Nitrosodimethylamine	110	160	ug/Kg	<MDL	1333.3333	699	52		50-150	1333.3333	672	50		50-150	4		100
Phenol	110	160	ug/Kg	<MDL	1333.3333	441	33	C	50-150	1333.3333	408	31	*	50-150	6		100
Bis(2-Chloroethyl)Ether	16	26.7	ug/Kg	<MDL	1333.3333	458	34	C	50-150	1333.3333	416	31	*	50-150	9		100
2-Chlorophenol	53	107	ug/Kg	<MDL	1333.3333	509	38	C	50-150	1333.3333	463	35	*	50-150	8		100
Bis(2-Chloroisopropyl)Ether	53	107	ug/Kg	<MDL	1333.3333	459	34	C	50-150	1333.3333	419	31	*	50-150	9		100
N-Nitrosodi-N-Propylamine	27	53.3	ug/Kg	<MDL	1333.3333	595	45	C	50-150	1333.3333	569	43	*	50-150	5		100
Hexachloroethane	27	53.3	ug/Kg	<MDL	1333.3333	591	44	C	50-150	1333.3333	583	44	*	50-150	0		100
Nitrobenzene	27	53.3	ug/Kg	<MDL	1333.3333	617	46	C	50-150	1333.3333	581	44	*	50-150	4		100

MS:WG42504-3 MSD:WG42504-4 L15421-1 Matrix: SALTWTRSED Listtype: ORBNA Method: EPA 3550B/8270C (7-3-01-004) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	MS Value	% Rec.	Qual	Limits	Truevalue	MSD Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Isophorone	27	53.3	ug/Kg	<MDL	1333.3333	418	31	G	50-150	1333.3333	441	33	*	50-150	6		100
2-Nitrophenol	27	53.3	ug/Kg	<MDL	1333.3333	579	43	G	50-150	1333.3333	561	42	*	50-150	2		100
2,4-Dimethylphenol	27	53.3	ug/Kg	<MDL	1333.3333	43	3	X	50-150	1333.3333	65	5	*	50-150			100
Bis(2-Chloroethoxy)Methane	27	53.3	ug/Kg	<MDL	1333.3333	612	46	G	50-150	1333.3333	600	45	*	50-150	2		100
2,4-Dichlorophenol	27	53.3	ug/Kg	<MDL	1333.3333	650	49	G	50-150	1333.3333	648	49	*	50-150	0		100
Naphthalene	43	80	ug/Kg	<MDL	1333.3333	622	47	G	50-150	1333.3333	629	47	*	50-150	0		100
Hexachlorobutadiene	27	53.3	ug/Kg	<MDL	1333.3333	597	45	G	50-150	1333.3333	571	43	*	50-150	5		100
4-Chloro-3-Methylphenol	53	107	ug/Kg	<MDL	1333.3333	853	64		50-150	1333.3333	997	75		50-150	16		100
Hexachlorocyclopentadiene	27	53.3	ug/Kg	<MDL	1333.3333	345	26	G	50-150	1333.3333	349	26	*	50-150	0		100
2,4,6-Trichlorophenol	110	213	ug/Kg	<MDL	1333.3333	786	59		50-150	1333.3333	854	64		50-150	8		100
2-Chloronaphthalene	16	26.7	ug/Kg	<MDL	1333.3333	716	54		50-150	1333.3333	737	55		50-150	2		100
Acenaphthylene	16	26.7	ug/Kg	<MDL	1333.3333	790	59		50-150	1333.3333	849	64		50-150	8		100
Dimethyl Phthalate	11	16	ug/Kg	<MDL	1333.3333	976	73		50-150	1333.3333	1110	83		50-150	13		100
2,6-Dinitrotoluene	11	21.3	ug/Kg	<MDL	1333.3333	930	70		50-150	1333.3333	1060	80		50-150	13		100
Acenaphthene	11	21.3	ug/Kg	<MDL	1333.3333	792	59		50-150	1333.3333	853	64		50-150	8		100
2,4-Dinitrophenol	53	107	ug/Kg	<MDL	1333.3333	825	62		50-150	1333.3333	918	69		50-150	11		100
4-Nitrophenol	53	107	ug/Kg	<MDL	1333.3333	1060	79		50-150	1333.3333	1070	80		50-150	1		100
2,4-Dinitrotoluene	11	21.3	ug/Kg	<MDL	1333.3333	976	73		50-150	1333.3333	1120	84		50-150	14		100
Fluorene	16	26.7	ug/Kg	<MDL	1333.3333	958	72		50-150	1333.3333	1060	80		50-150	11		100
Diethyl Phthalate	27	53.3	ug/Kg	<MDL	1333.3333	1100	82		50-150	1333.3333	1260	94		50-150	14		100
4-Chlorophenyl Phenyl Ether	16	26.7	ug/Kg	<MDL	1333.3333	942	71		50-150	1333.3333	1040	78		50-150	9		100
4,6-Dinitro-O-Cresol	53	107	ug/Kg	<MDL	1333.3333	851	64		50-150	1333.3333	960	72		50-150	12		100
N-Nitrosodiphenylamine	27	53.3	ug/Kg	<MDL	1333.3333	896	67		50-150	1333.3333	1030	77		50-150	14		100
1,2-Diphenylhydrazine	53	107	ug/Kg	<MDL	1333.3333	973	73		50-150	1333.3333	1070	80		50-150	9		100
4-Bromophenyl Phenyl Ether	11	16	ug/Kg	<MDL	1333.3333	937	70		50-150	1333.3333	1060	80		50-150	13		100
Pentachlorophenol	27	53.3	ug/Kg	<MDL	1333.3333	835	63		50-150	1333.3333	995	75		50-150	17		100
Phenanthrene	16	26.7	ug/Kg	16	1333.3333	1050	77		50-150	1333.3333	1180	88		50-150	13		100
Anthracene	16	26.7	ug/Kg	<MDL	1333.3333	953	71		50-150	1333.3333	1090	81		50-150	13		100
Di-N-Butyl Phthalate	27	53.3	ug/Kg	<MDL	1333.3333	1090	82		50-150	1333.3333	1250	94		50-150	14		100
Fluoranthene	16	32	ug/Kg	<MDL	1333.3333	1060	80		50-150	1333.3333	1170	88		50-150	10		100
Benzidine	640	1280	ug/Kg	<MDL	1333.3333	<MDL	0	X	50-150	1333.3333	<MDL	0	*	50-150			100
Pyrene	16	26.7	ug/Kg	<MDL	1333.3333	1040	78		50-150	1333.3333	1160	87		50-150	11		100
Benzyl Butyl Phthalate	16	26.7	ug/Kg	<MDL	1333.3333	1070	80		50-150	1333.3333	1180	88		50-150	10		100
Benzo(a)anthracene	16	26.7	ug/Kg	<MDL	1333.3333	1010	76		50-150	1333.3333	1120	84		50-150	10		100
Chrysene	16	26.7	ug/Kg	<MDL	1333.3333	1070	81		50-150	1333.3333	1200	90		50-150	11		100
3,3'-Dichlorobenzidine	27	53.3	ug/Kg	<MDL	1333.3333	<MDL	0	X	50-150	1333.3333	<MDL	0	*	50-150			100
Bis(2-Ethylhexyl)Phthalate	16	26.7	ug/Kg	<MDL	1333.3333	1090	81		50-150	1333.3333	1250	94		50-150	15		100
Di-N-Octyl Phthalate	16	26.7	ug/Kg	<MDL	1333.3333	1260	95		50-150	1333.3333	1380	104		50-150	9		100
Benzo(b)fluoranthene	43	80	ug/Kg	<MDL	1333.3333	1060	80		50-150	1333.3333	1220	92		50-150	14		100
Benzo(k)fluoranthene	43	80	ug/Kg	<MDL	1333.3333	1170	88		50-150	1333.3333	1310	98		50-150	11		100
Benzo(a)pyrene	27	53.3	ug/Kg	<MDL	1333.3333	970	73		50-150	1333.3333	1080	81		50-150	10		100
Indeno(1,2,3-Cd)Pyrene	27	53.3	ug/Kg	<MDL	1333.3333	990	74		50-150	1333.3333	1100	83		50-150	11		100
Dibenzo(a,h)anthracene	43	80	ug/Kg	<MDL	1333.3333	998	75		50-150	1333.3333	1180	89		50-150	17		100
Benzo(g,h,i)perylene	27	53.3	ug/Kg	<MDL	1333.3333	884	66		50-150	1333.3333	917	69		50-150	4		100
Aniline	53	107	ug/Kg	<MDL	1333.3333	<MDL	0	X	50-150	1333.3333	<MDL	0	*	50-150			100
Benzyl Alcohol	27	53.3	ug/Kg	<MDL	1333.3333	288	22	G	50-150	1333.3333	157	12	*	50-150	59		100
2-Methylphenol	27	53.3	ug/Kg	<MDL	1333.3333	397	30	G	50-150	1333.3333	433	32	*	50-150	6		100
4-Methylphenol	27	53.3	ug/Kg	<MDL	1333.3333	414	31	G	50-150	1333.3333	394	30	*	50-150	3		100
Benzoic Acid	110	160	ug/Kg	<MDL	1333.3333	776	58		50-150	1333.3333	877	66		50-150	13		100
4-Chloroaniline	53	107	ug/Kg	<MDL	1333.3333	272	20	G	50-150	1333.3333	284	21	*	50-150	5		100
2-Methylnaphthalene	43	80	ug/Kg	<MDL	1333.3333	651	49	G	50-150	1333.3333	700	53		50-150	8		100

MS:WG42504-3 MSD:WG42504-4 L15421-1 Matrix: SALTWTRSED Listtype: ORBNA Method: EPA 3550B/8270C (7-3-01-004) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	MS Value	% Rec.	Qual	Limits	Truevalue	MSD Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
2,4,5-Trichlorophenol	110	213	ug/Kg	<MDL	1333.3333	1010	76		50-150	1333.3333	1160	87		50-150	13		100
2-Nitroaniline	110	160	ug/Kg	<MDL	1333.3333	868	65		50-150	1333.3333	953	71		50-150	9		100
3-Nitroaniline	110	160	ug/Kg	<MDL	1333.3333	455	34	G	50-150	1333.3333	445	33	*	50-150	3		100
Dibenzofuran	27	53.3	ug/Kg	<MDL	1333.3333	892	67		50-150	1333.3333	975	73		50-150	9		100
4-Nitroaniline	110	160	ug/Kg	<MDL	1333.3333	516	39	G	50-150	1333.3333	507	38	*	50-150	3		100
Carbazole	27	53.3	ug/Kg	<MDL	1333.3333	1960	147		50-150	1333.3333	2200	165	*	50-150	12		100
Coprostanol	270	533	ug/Kg	<MDL	13333.3333	5920	44	G	50-150	13333.3333	4920	37	*	50-150	17		100

LD:WG42504-5 L15421-4 Matrix: SALTWTRSED Listtype: ORBNA Method: EPA 3550B/8270C (7-3-01-004) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	LD Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
N-Nitrosodimethylamine	110	160	ug/Kg	<MDL		<MDL						100
Phenol	110	160	ug/Kg	<MDL		<MDL						100
Bis(2-Chloroethyl)Ether	16	26.7	ug/Kg	<MDL		<MDL						100
2-Chlorophenol	53	107	ug/Kg	<MDL		<MDL						100
Bis(2-Chloroisopropyl)Ether	53	107	ug/Kg	<MDL		<MDL						100
N-Nitrosodi-N-Propylamine	27	53.3	ug/Kg	<MDL		<MDL						100
Hexachloroethane	27	53.3	ug/Kg	<MDL		<MDL						100
Nitrobenzene	27	53.3	ug/Kg	<MDL		<MDL						100
Isophorone	27	53.3	ug/Kg	<MDL		<MDL						100
2-Nitrophenol	27	53.3	ug/Kg	<MDL		<MDL						100
2,4-Dimethylphenol	27	53.3	ug/Kg	<MDL		<MDL						100
Bis(2-Chloroethoxy)Methane	27	53.3	ug/Kg	<MDL		<MDL						100
2,4-Dichlorophenol	27	53.3	ug/Kg	<MDL		<MDL						100
Naphthalene	43	80	ug/Kg	<MDL		<MDL						100
Hexachlorobutadiene	27	53.3	ug/Kg	<MDL		<MDL						100
4-Chloro-3-Methylphenol	53	107	ug/Kg	<MDL		<MDL						100
Hexachlorocyclopentadiene	27	53.3	ug/Kg	<MDL		<MDL						100
2,4,6-Trichlorophenol	110	213	ug/Kg	<MDL		<MDL						100
2-Chloronaphthalene	16	26.7	ug/Kg	<MDL		<MDL						100
Acenaphthylene	16	26.7	ug/Kg	<MDL		<MDL						100
Dimethyl Phthalate	11	16	ug/Kg	<MDL		<MDL						100
2,6-Dinitrotoluene	11	21.3	ug/Kg	<MDL		<MDL						100
Acenaphthene	11	21.3	ug/Kg	<MDL		<MDL						100
2,4-Dinitrophenol	53	107	ug/Kg	<MDL		<MDL						100
4-Nitrophenol	53	107	ug/Kg	<MDL		<MDL						100
2,4-Dinitrotoluene	11	21.3	ug/Kg	<MDL		<MDL						100
Fluorene	16	26.7	ug/Kg	<MDL		<MDL						100
Diethyl Phthalate	27	53.3	ug/Kg	<MDL		<MDL						100
4-Chlorophenyl Phenyl Ether	16	26.7	ug/Kg	<MDL		<MDL						100
4,6-Dinitro-O-Cresol	53	107	ug/Kg	<MDL		<MDL						100
N-Nitrosodiphenylamine	27	53.3	ug/Kg	<MDL		<MDL						100
1,2-Diphenylhydrazine	53	107	ug/Kg	<MDL		<MDL						100
4-Bromophenyl Phenyl Ether	11	16	ug/Kg	<MDL		<MDL						100
Pentachlorophenol	27	53.3	ug/Kg	<MDL		<MDL						100
Phenanthrene	16	26.7	ug/Kg	<MDL		<MDL						100
Anthracene	16	26.7	ug/Kg	<MDL		<MDL						100
Di-N-Butyl Phthalate	27	53.3	ug/Kg	<MDL		<MDL						100
Fluoranthene	16	32	ug/Kg	<MDL		34.7						

LD:WG42504-5 L15421-4 Matrix: SALTWTRSED Listtype: ORBNA Method: EPA 3550B/8270C (7-3-01-004) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	LD Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Benzidine	640	1280	ug/kg	<MDL		<MDL						100
Pyrene	16	26.7	ug/kg	<MDL		26						100
Benzyl Butyl Phthalate	16	26.7	ug/kg	<MDL		<MDL						100
Benzo(a)anthracene	16	26.7	ug/kg	<MDL		<MDL						100
Chrysene	16	26.7	ug/kg	<MDL		<MDL						100
3,3'-Dichlorobenzidine	27	53.3	ug/kg	<MDL		<MDL						100
Bis(2-Ethylhexyl)Phthalate	16	26.7	ug/kg	<MDL		<MDL						100
Di-N-Octyl Phthalate	16	26.7	ug/kg	<MDL		<MDL						100
Benzo(b)fluoranthene	43	80	ug/kg	<MDL		<MDL						100
Benzo(k)fluoranthene	43	80	ug/kg	<MDL		<MDL						100
Benzo(a)pyrene	27	53.3	ug/kg	<MDL		<MDL						100
Indeno(1,2,3-Cd)Pyrene	27	53.3	ug/kg	<MDL		<MDL						100
Dibenzo(a,h)anthracene	43	80	ug/kg	<MDL		<MDL						100
Benzo(g,h,i)perylene	27	53.3	ug/kg	54.7		82				40		100
Aniline	53	107	ug/kg	<MDL		<MDL						100
Benzyl Alcohol	27	53.3	ug/kg	<MDL		<MDL						100
2-Methylphenol	27	53.3	ug/kg	<MDL		<MDL						100
4-Methylphenol	27	53.3	ug/kg	<MDL		<MDL						100
Benzoic Acid	110	160	ug/kg	<MDL		<MDL						100
4-Chloroaniline	53	107	ug/kg	<MDL		<MDL						100
2-Methylnaphthalene	43	80	ug/kg	<MDL		<MDL						100
2,4,5-Trichlorophenol	110	213	ug/kg	<MDL		<MDL						100
2-Nitroaniline	110	160	ug/kg	<MDL		<MDL						100
3-Nitroaniline	110	160	ug/kg	<MDL		<MDL						100
Dibenzofuran	27	53.3	ug/kg	<MDL		<MDL						100
4-Nitroaniline	110	160	ug/kg	<MDL		<MDL						100
Carbazole	27	53.3	ug/kg	<MDL		<MDL						100
Coprostanol	270	533	ug/kg	<MDL		<MDL						100
Caffeine	5.3	26.7	ug/kg	<MDL		<MDL						100

SRM:WG42504-6 Matrix: OTHR SOLID Listtype: ORBNA Method: EPA 3550B/8270C (7-3-01-004) Project: PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	SRM Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Naphthalene	43	80	ug/kg		987.7867	189	19	G	80-120			100
Fluorene	16	26.7	ug/kg		95.1467	20	21	G	80-120			100
Phenanthrene	16	26.7	ug/kg		478.24	332	69	G	80-120			100
Anthracene	16	26.7	ug/kg		179.9467	117	65	G	80-120			100
Fluoranthene	16	32	ug/kg		959.4133	631	66	G	80-120			100
Pyrene	16	26.7	ug/kg		793.1733	573	72	G	80-120			100
Benzo(a)anthracene	16	26.7	ug/kg		417.6	287	69	G	80-120			100
Chrysene	16	26.7	ug/kg		371.6267	447	120		80-120			100
Benzo(b)fluoranthene	43	80	ug/kg		723.7333	799	110		80-120			100
Benzo(k)fluoranthene	43	80	ug/kg		353.0667	374	106		80-120			100
Benzo(a)pyrene	27	53.3	ug/kg		614.1867	362	59	G	80-120			100
Indeno(1,2,3-Cd)Pyrene	27	53.3	ug/kg		489.9733	200	41	G	80-120			100
Dibenzo(a,h)anthracene	43	80	ug/kg		72.2667	43	60	G	80-120			100
Benzo(g,h,i)perylene	27	53.3	ug/kg		513.44	128	25	G	80-120			100

MB:WG42504-7 Matrix: OTHR SOLID Listtype: ORBNA Method: EPA 3550B/8270C (7-3-01-004) Project: PKey: SED

Parameter	Mcl	Rcl	Units	MB Value	Qual
N-Nitrosodimethylamine	110	160	ug/Kg	<MDL	
Phenol	110	160	ug/Kg	<MDL	
Bis(2-Chloroethyl)Ether	16	26.7	ug/Kg	<MDL	
2-Chlorophenol	53	107	ug/Kg	<MDL	
Bis(2-Chloroisopropyl)Ether	53	107	ug/Kg	<MDL	
N-Nitrosodi-N-Propylamine	27	53.3	ug/Kg	<MDL	
Hexachloroethane	27	53.3	ug/Kg	<MDL	
Nitrobenzene	27	53.3	ug/Kg	<MDL	
Isophorone	27	53.3	ug/Kg	<MDL	
2-Nitrophenol	27	53.3	ug/Kg	<MDL	
2,4-Dimethylphenol	27	53.3	ug/Kg	<MDL	
Bis(2-Chloroethoxy)Methane	27	53.3	ug/Kg	<MDL	
2,4-Dichlorophenol	27	53.3	ug/Kg	<MDL	
Naphthalene	43	80	ug/Kg	<MDL	
Hexachlorobutadiene	27	53.3	ug/Kg	<MDL	
4-Chloro-3-Methylphenol	53	107	ug/Kg	<MDL	
Hexachlorocyclopentadiene	27	53.3	ug/Kg	<MDL	
2,4,6-Trichlorophenol	110	213	ug/Kg	<MDL	
2-Chloronaphthalene	16	26.7	ug/Kg	<MDL	
Acenaphthylene	16	26.7	ug/Kg	<MDL	
Dimethyl Phthalate	11	16	ug/Kg	<MDL	
2,6-Dinitrotoluene	11	21.3	ug/Kg	<MDL	
Acenaphthene	11	21.3	ug/Kg	<MDL	
2,4-Dinitrophenol	53	107	ug/Kg	<MDL	
4-Nitrophenol	53	107	ug/Kg	<MDL	
2,4-Dinitrotoluene	11	21.3	ug/Kg	<MDL	
Fluorene	16	26.7	ug/Kg	<MDL	
Diethyl Phthalate	27	53.3	ug/Kg	<MDL	
4-Chlorophenyl Phenyl Ether	16	26.7	ug/Kg	<MDL	
4,6-Dinitro-O-Cresol	53	107	ug/Kg	<MDL	
N-Nitrosodiphenylamine	27	53.3	ug/Kg	<MDL	
1,2-Diphenylhydrazine	53	107	ug/Kg	<MDL	
4-Bromophenyl Phenyl Ether	11	16	ug/Kg	<MDL	
Pentachlorophenol	27	53.3	ug/Kg	<MDL	
Phenanthrene	16	26.7	ug/Kg	<MDL	
Anthracene	16	26.7	ug/Kg	<MDL	
Di-N-Butyl Phthalate	27	53.3	ug/Kg	<MDL	
Fluoranthene	16	32	ug/Kg	<MDL	
Benzidine	640	1280	ug/Kg	<MDL	
Pyrene	16	26.7	ug/Kg	<MDL	
Benzyl Butyl Phthalate	16	26.7	ug/Kg	<MDL	
Benzo(a)anthracene	16	26.7	ug/Kg	<MDL	
Chrysene	16	26.7	ug/Kg	<MDL	
3,3'-Dichlorobenzidine	27	53.3	ug/Kg	<MDL	
Bis(2-Ethylhexyl)Phthalate	16	26.7	ug/Kg	<MDL	
Di-N-Octyl Phthalate	16	26.7	ug/Kg	<MDL	
Benzo(b)fluoranthene	43	80	ug/Kg	<MDL	
Benzo(k)fluoranthene	43	80	ug/Kg	<MDL	
Benzo(a)pyrene	27	53.3	ug/Kg	<MDL	
Indeno(1,2,3-Cd)Pyrene	27	53.3	ug/Kg	<MDL	

MB:WG42504-7 Matrix: OTHR SOLID Listtype: ORBNA Method: EPA 3550B/8270C (7-3-01-004) Project: PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Qual
Dibenzo(a,h)anthracene	43	80	ug/kg	<MDL	
Benzo(g,h,i)perylene	27	53.3	ug/kg	<MDL	
Aniline	53	107	ug/kg	<MDL	
Benzyl Alcohol	27	53.3	ug/kg	<MDL	
2-Methylphenol	27	53.3	ug/kg	<MDL	
4-Methylphenol	27	53.3	ug/kg	<MDL	
Benzoic Acid	110	160	ug/kg	<MDL	
4-Chloroaniline	53	107	ug/kg	<MDL	
2-Methylnaphthalene	43	80	ug/kg	<MDL	
2,4,5-Trichlorophenol	110	213	ug/kg	<MDL	
2-Nitroaniline	110	160	ug/kg	<MDL	
3-Nitroaniline	110	160	ug/kg	<MDL	
Dibenzofuran	27	53.3	ug/kg	<MDL	
4-Nitroaniline	110	160	ug/kg	<MDL	
Carbazole	27	53.3	ug/kg	<MDL	
Coprostanol	270	533	ug/kg	<MDL	
Caffeine	5.3	26.7	ug/kg	<MDL	

SB:WG42504-8 MB:WG42504-7 Matrix: OTHR SOLID Listtype: ORBNA Method: EPA 3550B/8270C (7-3-01-004) Project: PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Truevalue	SB Value	% Rec.	Qual	Limits	Truevalue	Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
N-Nitrosodimethylamine	110	160	ug/kg	<MDL	1333.3333	612	46	*	50-150								100
Phenol	110	160	ug/kg	<MDL	1333.3333	592	44	*	50-150								100
Bis(2-Chloroethyl)Ether	16	26.7	ug/kg	<MDL	1333.3333	523	39	*	50-150								100
2-Chlorophenol	53	107	ug/kg	<MDL	1333.3333	745	56		50-150								100
Bis(2-Chloroisopropyl)Ether	53	107	ug/kg	<MDL	1333.3333	523	39	*	50-150								100
N-Nitrosodi-N-Propylamine	27	53.3	ug/kg	<MDL	1333.3333	599	45	*	50-150								100
Hexachloroethane	27	53.3	ug/kg	<MDL	1333.3333	800	60		50-150								100
Nitrobenzene	27	53.3	ug/kg	<MDL	1333.3333	641	48	*	50-150								100
Isophorone	27	53.3	ug/kg	<MDL	1333.3333	353	26	*	50-150								100
2-Nitrophenol	27	53.3	ug/kg	<MDL	1333.3333	698	52		50-150								100
2,4-Dimethylphenol	27	53.3	ug/kg	<MDL	1333.3333	300	23	*	50-150								100
Bis(2-Chloroethoxy)Methane	27	53.3	ug/kg	<MDL	1333.3333	545	41	*	50-150								100
2,4-Dichlorophenol	27	53.3	ug/kg	<MDL	1333.3333	751	56		50-150								100
Naphthalene	43	80	ug/kg	<MDL	1333.3333	713	53		50-150								100
Hexachlorobutadiene	27	53.3	ug/kg	<MDL	1333.3333	736	55		50-150								100
4-Chloro-3-Methylphenol	53	107	ug/kg	<MDL	1333.3333	1030	77		50-150								100
Hexachlorocyclopentadiene	27	53.3	ug/kg	<MDL	1333.3333	564	42	*	50-150								100
2,4,6-Trichlorophenol	110	213	ug/kg	<MDL	1333.3333	928	70		50-150								100
2-Chloronaphthalene	16	26.7	ug/kg	<MDL	1333.3333	783	59		50-150								100
Acenaphthylene	16	26.7	ug/kg	<MDL	1333.3333	834	63		50-150								100
Dimethyl Phthalate	11	16	ug/kg	<MDL	1333.3333	1050	79		50-150								100
2,6-Dinitrotoluene	11	21.3	ug/kg	<MDL	1333.3333	1140	85		50-150								100
Acenaphthene	11	21.3	ug/kg	<MDL	1333.3333	912	68		50-150								100
2,4-Dinitrophenol	53	107	ug/kg	<MDL	1333.3333	1100	82		50-150								100
4-Nitrophenol	53	107	ug/kg	<MDL	1333.3333	1290	97		50-150								100
2,4-Dinitrotoluene	11	21.3	ug/kg	<MDL	1333.3333	1290	96		50-150								100
Fluorene	16	26.7	ug/kg	<MDL	1333.3333	1080	81		50-150								100
Diethyl Phthalate	27	53.3	ug/kg	<MDL	1333.3333	1180	88		50-150								100

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 06/07/1999 08:51
Run ID: R29242 Workgroup: WG42504 (BS#89-bna)

SB:WG42504-8 MB:WG42504-7 Matrix: OTHR SOLID Listtype: ORBNA Method: EPA 3550B/8270C (7-3-01-004) Project: PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Truevalue S3 Value	% Rec.	Qual	Limits	Truevalue Value	% Rec.	Qual	Limits	RPD/RSD Qual	Limits
4-Chlorophenyl Phenyl Ether	16	26.7	ug/Kg	<MDL	1333.3333 1100	83		50-150						100
4,6-Dinitro-O-Cresol	53	107	ug/Kg	<MDL	1333.3333 1080	81		50-150						100
N-Nitrosodiphenylamine	27	53.3	ug/Kg	<MDL	1333.3333 879	66		50-150						100
1,2-Diphenylhydrazine	53	107	ug/Kg	<MDL	1333.3333 863	65		50-150						100
4-Bromophenyl Phenyl Ether	11	16	ug/Kg	<MDL	1333.3333 1090	82		50-150						100
Pentachlorophenol	27	53.3	ug/Kg	<MDL	1333.3333 1100	83		50-150						100
Phenanthrene	16	26.7	ug/Kg	<MDL	1333.3333 1150	86		50-150						100
Anthracene	16	26.7	ug/Kg	<MDL	1333.3333 1100	83		50-150						100
Di-N-Butyl Phthalate	27	53.3	ug/Kg	<MDL	1333.3333 1340	101		50-150						100
Fluoranthene	16	32	ug/Kg	<MDL	1333.3333 1290	97		50-150						100
Benzidine	640	1280	ug/Kg	<MDL	1333.3333 <MDL	0	*	50-150						100
Pyrene	16	26.7	ug/Kg	<MDL	1333.3333 1150	87		50-150						100
Benzyl Butyl Phthalate	16	26.7	ug/Kg	<MDL	1333.3333 1150	86		50-150						100
Benzo(a)anthracene	16	26.7	ug/Kg	<MDL	1333.3333 1110	83		50-150						100
Chrysene	16	26.7	ug/Kg	<MDL	1333.3333 1090	81		50-150						100
3,3'-Dichlorobenzidine	27	53.3	ug/Kg	<MDL	1333.3333 160	12	*	50-150						100
Bis(2-Ethylhexyl)Phthalate	16	26.7	ug/Kg	<MDL	1333.3333 1110	83		50-150						100
Di-N-Octyl Phthalate	16	26.7	ug/Kg	<MDL	1333.3333 1270	95		50-150						100
Benzo(b)fluoranthene	43	80	ug/Kg	<MDL	1333.3333 1220	92		50-150						100
Benzo(k)fluoranthene	43	80	ug/Kg	<MDL	1333.3333 1280	96		50-150						100
Benzo(a)pyrene	27	53.3	ug/Kg	<MDL	1333.3333 1090	82		50-150						100
Indeno(1,2,3-Cd)Pyrene	27	53.3	ug/Kg	<MDL	1333.3333 1120	84		50-150						100
Dibenzo(a,h)anthracene	43	80	ug/Kg	<MDL	1333.3333 1080	81		50-150						100
Benzo(g,h,i)perylene	27	53.3	ug/Kg	<MDL	1333.3333 1020	77		50-150						100
Aniline	53	107	ug/Kg	<MDL	1333.3333 119	9	*	50-150						100
Benzyl Alcohol	27	53.3	ug/Kg	<MDL	1333.3333 302	23	*	50-150						100
2-Methylphenol	27	53.3	ug/Kg	<MDL	1333.3333 590	44	*	50-150						100
4-Methylphenol	27	53.3	ug/Kg	<MDL	1333.3333 666	50		50-150						100
Benzoic Acid	110	160	ug/Kg	<MDL	1333.3333 420	32	*	50-150						100
4-Chloroaniline	53	107	ug/Kg	<MDL	1333.3333 285	21	*	50-150						100
2-Methylnaphthalene	43	80	ug/Kg	<MDL	1333.3333 720	54		50-150						100
2,4,5-Trichlorophenol	110	213	ug/Kg	<MDL	1333.3333 1130	84		50-150						100
2-Nitroaniline	110	160	ug/Kg	<MDL	1333.3333 1090	81		50-150						100
3-Nitroaniline	110	160	ug/Kg	<MDL	1333.3333 553	41	*	50-150						100
Dibenzofuran	27	53.3	ug/Kg	<MDL	1333.3333 1000	75		50-150						100
4-Nitroaniline	110	160	ug/Kg	<MDL	1333.3333 836	63		50-150						100
Carbazole	27	53.3	ug/Kg	<MDL	1333.3333 1180	88		50-150						100
Coprostanol	270	533	ug/Kg	<MDL	13333.3333930	29	*	50-150						100

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 06/07/1999 08:51
Run ID: R29242 Workgroup: WG42504 (BS#89-bna)

Sample #	2-Fluorophenol 50-150		d5-Phenol 50-150		d5-Nitrobenzene 50-150	d4-2-Chlorophenol 50-150	d4-1,2-Dichlorobenzene 50-150	2-Fluorobiphenyl 50-150	2,4,6-Tribromophenol 50-150	d14-Terphenyl 50-150
L15421-1	33 G	avg=40	28 G	avg=71.25	54	36 G	52	58	63 G	121
L15421-2	25 G	avg=32.5	28 G	avg=66.25	51	33 G	49	52	44 G	113
L15421-3	27 G	avg=32	30 G	avg=75	58	34 G	58	62	37 G	122
L15421-4	31 G	avg=39	36 G	avg=61.75	41	40 G	58	48	49 G	100
WG42504-1	39 G	avg=41.5	21 G	avg=69.25	56	40 G	56	55	66 G	110
WG42504-2	35 G	avg=49.5	33 G	avg=66.75	55	41 G	54	60	89 G	98
WG42504-3	36 G	avg=46.25	38 G	avg=61.75	51	42 G	47	57	69 G	92
WG42504-4	33 G	avg=46	33 G	avg=62	48	37 G	44	56	81 G	100
WG42504-5	42 G	avg=46.5	38 G	avg=61.75	43	47 G	54	47	59 G	93
WG42504-6	50	avg=76.5	93	avg=82.25	62	69	46	96	94	125
WG42504-7	55	avg=50.75	44	avg=56	42	56	52	47	48	73
WG42504-8	63	avg=70	48	avg=68.75	50	61	57	61	108	97

SOLID AND TISSUE SAMPLE EXTRACTION RECORD FOR BNA ANALYSIS
TRACE ORGANICS LABORATORY

chlorobenzene: WG 42503

'090

QC BATCH NO.: BS 89

EPA SW-846 EXTRACTION METHOD: 1:1 Acetone : $MeCl_2$

(SONICATION EPA 3550) SOXHLET EPA 3540

WORKGROUP NO.: WG 42504

BNA SURROGATE SPIKE I.D.#: 54

BNA MATRIX SPIKE I.D.#: ~~23,4,5~~ 80, 71, 47

full spike / copmst. / cuff
1 / 121 / 122

Date/ Analyst	Sample Number	Project Number	Sample Description	coc	Init. Amt (g)	Spike Amount (uL)	Vf (mL)	Clean ups (GPC)	Conc Anal.	Turn Over Date	Comments
5-3-99 LM/MM	WG42504-1	QC	MB		15	54 - 5 ml	0.5	GPC	MM	5/5/99	
	-2		SB			54 - 5 ml ~~100 ml~~ 80 - 100 ml					
	-3		MS (L15421-1)			121 ~~#47 = 80~~					
	-4		MSD (L15421-1)			122 ~~#47 = 20~~ 5/7/99					
OK	~~-5~~		~~LD (L15421-2)~~			54 - 50 ul					Rename TO L15421-2
	-6		SRM (1941A)								
	L15421-1	423056-165	Norfolk Cleanup								
	-2		failed SURROGATE Rec								Use LD data
	-3										
	-4		failed SURROGATE Rec								Re-extract
5-10-99 LM/MM	WG42504-7		MB		15	54 - 50 ul	0.5	GPC	LM	5/12/99	all glassware acid rinsed
	WG42504-8		SB			54 - 50 ul 80 - 100 ml 121 ~~#47 = 80~~ 122 54 - 50 ul					
	WG-42504-5		LD (L15421-4)								
	L15421-4		Norfolk Cleanup								

METRO Environmental Laboratory

WORK GROUP REPORT (wk02)

May 18 1999, 01:20 pm

Work Group: WG42503 (BS#89-chlorobenzenes) for Department: 7 - Organics, Trace

Created: 03-MAY-1999 Due: Operator: lm/mm

mple	Project Number	Project Description	PKey	C	Product	Matrix	Stat	UA	Workdate	Duedate
5421-1	423056-160	Norfolk Cleanup Study	SED	S	CHLOROBENZENES	SALTWTRSED	ANAL	U	07-MAY-99	07-JUN-99
5421-2	423056-160	Norfolk Cleanup Study	SED	S	CHLOROBENZENES	SALTWTRSED	ANAL	U	07-MAY-99	07-JUN-99
5421-3	423056-160	Norfolk Cleanup Study	SED	S	CHLOROBENZENES	SALTWTRSED	ANAL	U	07-MAY-99	07-JUN-99
5421-4	423056-160	Norfolk Cleanup Study	SED	S	CHLOROBENZENES	SALTWTRSED	ANAL	U	07-MAY-99	07-JUN-99
42503-1	MB			S	CHLOROBENZENES	OTHR SOLID	ANAL	U	03-MAY-99	
42503-2	SB			S	CHLOROBENZENES	OTHR SOLID	ANAL	U	03-MAY-99	
42503-3	MS			S	CHLOROBENZENES	SALTWTRSED	ANAL	U	03-MAY-99	
42503-4	MSD			S	CHLOROBENZENES	SALTWTRSED	ANAL	U	03-MAY-99	
42503-5	LD			S	CHLOROBENZENES	SALTWTRSED	ANAL	U	03-MAY-99	
42503-7	MB			S	CHLOROBENZENES	OTHR SOLID	ANAL	U	10-MAY-99	
42503-8	SB			S	CHLOROBENZENES	OTHR SOLID	PREP	U	18-MAY-99	

mments:

5421-1	3-Grab Composite, 0 - 10 cm
5421-2	3-Grab Composite, 0 - 10 cm
5421-3	3-Grab Composite, 0 - 10 cm
5421-4	3-Grab Composite, 0 - 10 cm
42503-1	MB050399
42503-2	WG42503-1
42503-3	L15421-1
42503-4	WG42503-3 L15421-1
42503-5	L15421-4
42503-7	MB051099
42503-8	WG42503-7

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 05/25/1999 03:02
Run ID: R28764 Workgroup: WG42503 (BS#89-chlorobenzenes)

MB:WG42503-1 Matrix: OTHR SOLID Listtype: ORCHLOROB Method: EPA3550B/8270C SIM(7-3-01-004) Project: PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Qua.
1,3-Dichlorobenzene	.69	1.33	ug/Kg	<MDL	
1,4-Dichlorobenzene	.69	1.33	ug/Kg	<MDL	
1,2-Dichlorobenzene	.69	1.33	ug/Kg	<MDL	
1,2,4-Trichlorobenzene	.69	1.33	ug/Kg	<MDL	
Hexachlorobenzene	.69	1.33	ug/Kg	<MDL	

SB:WG42503-2 MB:WG42503-1 Matrix: OTHR SOLID Listtype: ORCHLOROB Method: EPA3550B/8270C SIM(7-3-01-004) Project: PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Truevalue	SB Value	% Rec.	Qual	Limits	Truevalue	Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
1,3-Dichlorobenzene	.69	1.33	ug/Kg	<MDL	1333.3333	747	56		50-150								100
1,4-Dichlorobenzene	.69	1.33	ug/Kg	<MDL	1333.3333	759	56		50-150								100
1,2-Dichlorobenzene	.69	1.33	ug/Kg	<MDL	1333.3333	784	59		50-150								100
1,2,4-Trichlorobenzene	.69	1.33	ug/Kg	<MDL	1333.3333	649	49	*	50-150								100
Hexachlorobenzene	.69	1.33	ug/Kg	<MDL	1333.3333	916	69		50-150								100

MS:WG42503-3 MSD:WG42503-4 L15421-1 Matrix: SALTWTRSED Listtype: ORCHLOROB Method: EPA3550B/8270C SIM(7-3-01-004) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	MS Value	% Rec.	Qual	Limits	Truevalue	MSD Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
1,3-Dichlorobenzene	.69	1.33	ug/Kg	<MDL	1333.3333	652	49	G	50-150	1333.3333	631	47	*	50-150	4		100
1,4-Dichlorobenzene	.69	1.33	ug/Kg	<MDL	1333.3333	644	48	G	50-150	1333.3333	621	47	*	50-150	2		100
1,2-Dichlorobenzene	.69	1.33	ug/Kg	<MDL	1333.3333	684	51		50-150	1333.3333	661	50		50-150	2		100
1,2,4-Trichlorobenzene	.69	1.33	ug/Kg	<MDL	1333.3333	578	43	G	50-150	1333.3333	576	43	*	50-150	0		100
Hexachlorobenzene	.69	1.33	ug/Kg	<MDL	1333.3333	898	67		50-150	1333.3333	1040	78		50-150	15		100

LD:WG42503-5 L15421-4 Matrix: SALTWTRSED Listtype: ORCHLOROB Method: EPA3550B/8270C SIM(7-3-01-004) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	LD Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
1,3-Dichlorobenzene	.69	1.33	ug/Kg	<MDL		<MDL						100
1,4-Dichlorobenzene	.69	1.33	ug/Kg	<MDL		<MDL						100
1,2-Dichlorobenzene	.69	1.33	ug/Kg	<MDL		<MDL						100
1,2,4-Trichlorobenzene	.69	1.33	ug/Kg	<MDL		<MDL						100
Hexachlorobenzene	.69	1.33	ug/Kg	<MDL		<MDL						100

MB:WG42503-7 Matrix: OTHR SOLID Listtype: ORCHLOROB Method: EPA3550B/8270C SIM(7-3-01-004) Project: PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Qual
1,3-Dichlorobenzene	.69	1.33	ug/Kg	<MDL	
1,4-Dichlorobenzene	.69	1.33	ug/Kg	<MDL	
1,2-Dichlorobenzene	.69	1.33	ug/Kg	<MDL	
1,2,4-Trichlorobenzene	.69	1.33	ug/Kg	<MDL	
Hexachlorobenzene	.69	1.33	ug/Kg	<MDL	

SB:WG42503-B MB:WG42503-7 Matrix: OTHR SOLID Listtype: ORGHLORO8 Method: EPA3550B/8270C SIM(7-3-01-004) Project: PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Truevalue	SB Value	% Rec.	Qual	Limits	Truevalue	Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
1,3-Dichlorobenzene	.69	1.33	ug/kg	<MDL	1333.3333	873	65		50-150								100
1,4-Dichlorobenzene	.69	1.33	ug/kg	<MDL	1333.3333	871	65		50-150								100
1,2-Dichlorobenzene	.69	1.33	ug/kg	<MDL	1333.3333	910	68		50-150								100
1,2,4-Trichlorobenzene	.69	1.33	ug/kg	<MDL	1333.3333	708	53		50-150								100
Hexachlorobenzene	.69	1.33	ug/kg	<MDL	1333.3333	1040	78		50-150								100

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 05/25/1999 03:02
Run ID: R28764 Workgroup: WG42503 (BS#89-chlorobenzenes)

Sample #		d4-1,2-Dichlorobenzene 50-150
L15421-1	avg=35	35 G
L15421-2	avg=32	32 G
L15421-3	avg=38	38 G
L15421-4	avg=33	33 G
WG42503-1	avg=38	38 G
WG42503-2	avg=45	45 G
WG42503-3	avg=39	39 G
WG42503-4	avg=36	36 G
WG42503-5	avg=35	35 G
WG42503-7	avg=34	34 G
WG42503-8	avg=51	51

METRO Environmental Laboratory

WORK GROUP REPORT (wk02)

May 04 1999, 02:40 pm

Work Group: WG42505 (PPS#175-pcb) for Department: 7 - Organics, Trace

Created: 03-MAY-1999 Due: Operator: lm/mm

le	Project Number	Project Description	PKey	C	Product	Matrix	Stat	UA	Workdate	Duedate
21-1	423056-160	Norfolk Cleanup Study	SED	S	PCB	SALTWTRSED	PREP	U	07-MAY-99	07-JUN-99
21-2	423056-160	Norfolk Cleanup Study	SED	S	PCB	SALTWTRSED	PREP	U	07-MAY-99	07-JUN-99
21-3	423056-160	Norfolk Cleanup Study	SED	S	PCB	SALTWTRSED	PREP	U	07 MAY 99	07 JUN 99
21-4	423056-160	Norfolk Cleanup Study	SED	S	PCB	SALTWTRSED	PREP	U	07-MAY-99	07-JUN-99
505-1	MB			S	PCB	OTHR SOLID	PREP	U	03-MAY-99	
505-2	SB			S	PCB	OTHR SOLID	PREP	U	03-MAY-99	
505-3	MS			S	PCB	SALTWTRSED	PREP	U	03-MAY-99	
505-4	MSD			S	PCB	SALTWTRSED	PREP	U	03-MAY-99	
505-5	LD			S	PCB	SALTWTRSED	PREP	U	03-MAY-99	
505-6	SRM			S	PCB	OTHR SOLID	PREP	U	03-MAY-99	

ents:

21-1	3-Grab Composite, 0 - 10 cm
21-2	3-Grab Composite, 0 - 10 cm
21-3	3-Grab Composite, 0 - 10 cm
21-4	3-Grab Composite, 0 - 10 cm
505-1	MB050399
505-2	WG42505-1
505-3	L15421-1
505-4	WG42505 3 L15421 1
505-5	L15421-2
505-6	HS2

KING COUNTY METRO ENVIRONMENTAL LABORATORY
Lab QC Report - 05/24/1999 10:53
Run ID: R28582 Workgroup: WG42505 (PPS#175-pcb)

MB:WG42505-1 Matrix: OTHR SOLID Listtype: ORPCB Method: EPA 3550B/8082 (7-3-03-002) Project: PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Qual
Aroclor 1016	17	33.3	ug/Kg	<MDL	
Aroclor 1221	17	33.3	ug/Kg	<MDL	
Aroclor 1232	17	33.3	ug/Kg	<MDL	
Aroclor 1242	17	33.3	ug/Kg	<MDL	
Aroclor 1248	17	33.3	ug/Kg	<MDL	
Aroclor 1254	17	33.3	ug/Kg	<MDL	
Aroclor 1260	17	33.3	ug/Kg	<MDL	

SB:WG42505-2 MB:WG42505-1 Matrix: OTHR SOLID Listtype: ORPCB Method: EPA 3550B/8082 (7-3-03-002) Project: PKey: SED

Parameter	Mdl	Rdl	Units	MB Value	Truevalue	SB Value	% Rec.	Qual	Limits	Truevalue	Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Aroclor 1260	17	33.3	ug/Kg	<MDL	100	93	93		50-150								

MS:WG42505-3 MSD:WG42505-4 L15421-1 Matrix: SALTWTRSED Listtype: ORPCB Method: EPA 3550B/8082 (7-3-03-002) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	MS Value	% Rec.	Qual	Limits	Truevalue	MSD Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Aroclor 1016	17	33.3	ug/Kg	<MDL		<MDL			50-150		<MDL			50-150			100
Aroclor 1221	17	33.3	ug/Kg	<MDL		<MDL			50-150		<MDL			50-150			100
Aroclor 1232	17	33.3	ug/Kg	<MDL		<MDL			50-150		<MDL			50-150			100
Aroclor 1242	17	33.3	ug/Kg	<MDL		<MDL			50-150		<MDL			50-150			100
Aroclor 1248	17	33.3	ug/Kg	<MDL		<MDL			50-150		<MDL			50-150			100
Aroclor 1254	17	33.3	ug/Kg	<MDL		<MDL			50-150		<MDL			50-150			100
Aroclor 1260	17	33.3	ug/Kg	<MDL	100	100	100		50-150	100	97.8	98		50-150	2		100

LD:WG42505-5 L15421-2 Matrix: SALTWTRSED Listtype: ORPCB Method: EPA 3550B/8082 (7-3-03-002) Project: 423056-160 PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	LD Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Aroclor 1016	17	33.3	ug/Kg	<MDL		<MDL						100
Aroclor 1221	17	33.3	ug/Kg	<MDL		<MDL						100
Aroclor 1232	17	33.3	ug/Kg	<MDL		<MDL						100
Aroclor 1242	17	33.3	ug/Kg	<MDL		<MDL						100
Aroclor 1248	17	33.3	ug/Kg	<MDL		<MDL						100
Aroclor 1254	17	33.3	ug/Kg	<MDL		<MDL						100
Aroclor 1260	17	33.3	ug/Kg	<MDL		<MDL						100

SRM:WG42505-6 Matrix: OTHR SOLID Listtype: ORPCB Method: EPA 3550B/8082 (7-3-03-002) Project: PKey: SED

Parameter	Mdl	Rdl	Units	SampValue	Truevalue	SRM Value	% Rec.	Qual	Limits	RPD/RSD	Qual	Limits
Aroclor 1254	10	20	ug/Kg		111.8	96.8	87		80-120			

Sample #	2,4,5,6-Tetrachloro-m-xylene 50-150	Decachlorobiphenyl 50-150
L15421-1	100	97
L15421-2	109	109
L15421-3	106	104
L15421-4	101	105
WG42505-1	93	98
WG42505-2	98	97
WG42505-3	99	103
WG42505-4	103	103
WG42505-5	88	96
WG42505-6	98	112

TRACE ORGANICS LABORATORY

QC BATCH NO.: PPS#175 (1:1 Methylene Chloride : Acetone) WORKGROUP NO.: WG42505

EPA SW-846 EXTRACTION METHOD:

SONICATION EPA 3550 SOXHLET EPA 3540 PCB

PESTICIDE SURROGATE SPIKE I.D.#: 100

PESTICIDE MATRIX SPIKE ID.#: 102

000064

Date/ Analyst	Sample Number	Project Number	Sample Description	coc	Init. Amt (g)	Spike Amount (uL)	Vf (mL)	Clean ups (GPC AL TBA H+)	Conc Anal.	Turn Over Date	Comments
5-3-99 L.M/mn	WG42505-1	QC	MB		30	#100 - 100ul	10	H+, TBA	mn	5/4/99	
	-2		SB			#100 - 100ul #102 - 300ul					
	-3		MS (L15421-1)								
	-4		MSD (L15421-1)								
	-5		LD (L15421-2)			#100 - 100ul					
	-6		SRM: LCS ~~Norfolk Cleanup~~		15	#100 - 50ul	3				
	L15421-1	42505-1,6	Norfolk Cleanup		30	#100 - 100ul	10				
	-2										
	-3										
	-4										