DRAFT MEMORANDUM

To: Port of Seattle project files

5 April 20, 2000

556-2912-001 (61)

From: Doug Henderson / Linda Logan

Range-Finding Water-effect ratio results Round 2.

This memorandum summarizes results of range-finding toxicity tests conducted as part of the water-effect ratio (WER) study for copper in streams receiving STLA stormwater. The purpose of these range-finding WERs is to determine if the final WERs would be robust enough to warrant the expense of conducting definitive studies. Although rangefinding WERs were conducted in February 1999, these tests were conducted on simulated receiving water samples that were mixtures of outfall SDS3 stormwater and instream receiving water. Mixture ratios of these two samples were prepared in the laboratory by combining measured volumes of stormwater and upstream receiving water in proportions estimated to occur in the receiving water (based on hydrographs generated using HSPF). In the event that mixing zones cannot be granted for the creeks, it was agreed that two additional types of range-finding WERs be conducted, one without any mixing with stormwater (i.e., receiving water only) and the other one after complete mix, below outfall discharges.

Sampling

Subject:

Samples were collected at five pre-determined locations during a qualifying storm event on the morning of 15 April 2000. This storm event started at Xh on 15 April and ended at Xh on 15 April 2000. The dry antecedent period preceding this storm was at least 24 hours. Approximately X inches of rain fell at STIA during this x-hour storm.

Taylor Associates collected flow-weighted composite samples for X hours during the storm event from each of the five sampling sites (Miller Creek Upstream, Miller Creek Detention Facility, Northwest Ponds Outlet, Northwest Ponds Inlet, and Des Moines Creek Weir). ISCO samplers automatically composite samples based on flow.

POS Range-finding memorandum



Quality assurance and quality control elements were followed according to the Port's Procedure Manual for Stormwater Monitoring (POS, 1999).

The samples were delivered to Parametrix's toxicology laboratory with completed chainof-custody forms in sufficient time to meet the applicable holding times. The synthetic laboratory water was prepared according to U.S. EPA (1993).

Analysis

The procedure for determining a WER involves using an indicator species to evaluate and quantify the toxicity and bioavailability of a compound in a particular site water compared to that in "clean" laboratory water. To accomplish this, the chemical of concern (in this case, copper) is spiked into both the clean laboratory water and site water at known concentrations. A median lethal concentration (LC50) is then determined for each water, and the two are compared to generate a WER:

 $\frac{\text{LC50 Site Water}}{\text{LC50 Laboratory Water}} = \text{WER}$

The WER is then applied to the generic water quality standard to derive a site-specific standard:

WER * Generic WQS = Site-specific WQS

For example, if the water quality standard for a chemical is 3 μ g/L, and a WER of 3 is derived for a particular site, the resulting site-specific water quality standard would be 9 μ g/L.

Nominal copper test concentrations were prepared using a 500 mg/L copper stock solution made from copper sulfate pentahydrate ($CuSO_4 \cdot 5H_20$) (CAS#7758-99-8). Since these were preliminary tests, concentrations were not measured; thus the WERs were calculated using nominal test concentrations. However, the stock solution was analyzed by Battelle and verified to be 500.0 mg/L copper.

The toxicity tests were conducted according to Short-term Methods for Estimating the Acute Toxicity of Effluents and Receiving Waters to Freshwater Organisms and Marine Organisms. EPA/600/4-90/027F, August 1993. A summary of test conditions for the D. magna toxicity tests is presented in Table 1.

POS Range-finding memorandum

Draft 04/25/00

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lob Name: Port of Seattle	Job Number: 556-2912-001 (61) Date: 15-17 April 2000
Test Protocol:	Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms (Fourth Edition), EPA/600/4-90/027F, August 1993.
Test Material:	Copper-spiked site waters Copper-spiked synthetic laboratory water
Test Organisms/age:	Daphnia magna; ≤24 hrs old
Source:	In-house culture
Number/Test Chamber:	5
Volume/Test Chamber:	20 mL
Nominal Test Concentrations:	Site water: 0, 12.5, 25, 50, 100, 150, and 200 μ g/L copper Synthetic laboratory water: 0, 5, 10, 20, 40, and 80 μ g/L copper
Replicates:	Four
Test Duration:	48 hours
Control:	Unspiked synthetic laboratory water Unspiked site water
Test Chambers:	30 mL polystyrene cups
Lighting:	Fluorescent bulbs (50-100 foot candles)
Photoperiod:	16 hours light; 8 hours dark
Aeration:	None
Feeding:	None
Temperature:	25 ± 1°C
Chemical Data:	Dissolved oxygen, temperature, and pH at test initiation and every 24 hours; specific conductivity at test initiation and termination; hardness, alkalinity, ammonia, and residual chlorine at test initiation for 100% site water sample; hardness and alkalinity for laboratory and site water
Effect Measured:	Mortality
Test Acceptability:	Control mortality ≤10%

 Table 1.
 Summary of test conditions for the acute Daphnia magna toxicity tests.

POS Range-finding memorandum

Draft 04/25/00

Results

Results of the range-finding water-effect ratio tests are presented in Table 2. Reference toxicant results were within acceptable ranges. All raw data sheets and statistical analyses are located in the project files at Parametrix.

	Table 2. Summary of Daphnia magnetic	PNY				H-I
-	Test Water	Hardness (mg/L)	TRUGL	LC50 (µg/l	L) (II Normalized ¹ AIS LC50 (µg/L)	Haw Ner wer
UMQ NI	Cu-Spiked Northwest Ponds Inlet	60	10	143.6	\$ 120.93	64 28.43387
HE DHO	Cu-Spiked Northwest Ponds Outlet Site Water (west branch	90	4.3	132	3.3 75.87	
te mode	Cu-Spiked Miller Creek Detention Facility Site Water	92	4.4	168.8	417 95.03	95 22.34325
MCUP	Cu-Spiked Miller Creek Upstream Site Water	46	5.6	111.6	4.0 120.72	64 28.38372
KE DHWB	RCu-Spiked Des Moines Creek Weir Site Water (Infludel ufluen of Fust wav	(h) 65	5.8	136.6	5.6 106.68	7325.08299
*)	Cu-Spiked Laboratory Water	90	ς.0	7.4	4.25	n/a
	Reference Toxicant (LC50) =				Acceptable	

once finding water-effect ratio for POS:

WER = Calculated water effect ratio

n/a = not applicable

¹ LC50 adjusted to a hardness of 50 mg/L

In summary, given the results of WERs estimated based on nominal concentrations (17.8 - 28.4), we recommend pursuing a definitive WER and application of a site-specific water quality standard for copper.

REFERENCES

- Parametrix, Inc. 1999. Water-effect ratio screening study at Seattle-Tacoma International Airport: Toxicity evaluation of site water. Prepared for the Port of Seattle, February 1999.
- U.S. EPA. 1993. Methods for measuring the acute toxicity of effluents and receiving waters to freshwater and marine organisms. EPA/600/4-90/027F, August 1993. U.S. Environmental Protection Agency, Cincinnati, Ohio.

POS. 1999. Procedure Manual for Stormwater Monitoring. Port of Seattle, April 1999.

POS Range-finding memorandum

Draft 04/25/00

DRAFT MEMORANDUM

To: Scott Tobiason

April 24, 2000

From: Doug Henderson / Linda Logan

Subject: Sampling and Analysis for Range-Finding WERs in the Absence of a Mixing Zone Round 2

This memorandum provides a summary of our 7 March 2000 meeting regarding the sampling locations and testing requirements for conducting a second round of range-finding water-effect ratios (WERs). The purpose of these range-finding WERs is to determine if the final WERs would be robust enough to warrant the expense of conducting definitive studies. Although range-finding WERs were conducted in February 1999, these tests were conducted on simulated receiving water samples that were mixtures of outfall SDS3 stormwater and instream receiving water. Mixture ratios of these two samples were prepared in the laboratory by combining measured volumes of stormwater and upstream receiving water in proportions estimated to occur in the receiving water (based on hydrographs generated using HSPF). In the event that mixing zones cannot be granted for the creeks, it was agreed that two additional types of range-finding WERs be conducted, one without any mixing with stormwater (i.e., receiving water only) and the other one after complete mix, below outfall discharges. The rationale for choosing these two types of WERs is described below.

Background

The U.S. EPA has developed guidelines for determining and using WERs. However, the *Interim Guidance on Determination and Use of Water-Effect Ratios for Metals* (the Guidelines, U.S. EPA. 1994) were developed for continuous discharges. Therefore, applying the Guidelines to stormwater discharges will require some interpretation. The Guidelines describe three approaches that may be used relative to sampling and discharge locations in the streams. These three approaches are summarized below:

 <u>Upstream water</u>: U.S. EPA describes this as the least useful method as it does not take into account the presence of the effluent (or in this case, stormwater).
 Furthermore, the Guidelines emphasize that a WER should be determined using the water to which the site-specific criterion is to apply. However, given the complexity of the STIA discharges—and that third runway discharges do not yet occur—this option should be evaluated. If it can be demonstrated that upstream water is

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appropriately conservative and representative of receiving waters (i.e., the magnitude of the WER with upstream water would not be significantly higher than it would be downstream after receiving stormwater discharges) and still provides a robust WER, then this may be the method of choice for the definitive WER study.

2. Actual downstream water: U.S. EPA states that the most useful samples of actual downstream receiving waters are probably those taken just downstream of the point at which complete mixing occurs or at the most distant point that is within the site to which the site-specific criterion is to apply. However, the use of actual downstream receiving water samples to quantitatively define the WER for a given discharge is problematic, as the concentration of discharge in the water can only be approximate rather than measured, as is done with the simulated downstream receiving water. Therefore, U.S. EPA only recommends this approach for the "sample-specific WER approach". The sample-specific approach requires a WER to be developed concurrent with every metal sample collected for compliance. In this approach, a quotient would be calculated by dividing the concentration of metal in the sample by the product of the national criterion times the WER obtained for that sample:

 $\frac{Measured Metal Concentration in Stormwater}{(WQC \times WER)}$

A quotient less than one indicates compliance; greater than one indicates a violation.

This approach has several advantages, including:

Pros & Cons.

- Spatial and temporal variation among WERs within a body of water is not a problem,
- it eliminates problems concerning the unknown relationship between toxicity and complex receiving water analytical chemistry, and
- it automatically accounts for synergism, antagonism, and additivity between toxicants (U.S. EPA. 1994).

The main drawback of this approach is that it may lead to additional, rigorous and costly instream and outfall sampling in future NPDES permit strategies. The benefit of this approach is that actual instream biological effects would be quantified frequently and conclusively, in contrast to the application of single numeric water quality criteria. Based upon previous work, it is likely that results would be favorable.

Without a mixing zone or an upstream location that is representative of the water body to which the site-specific water quality criterion is to apply, this may be the only option for the Port. Mixing zones, which must be established by an administrative order or other regulatory means, do not yet exist for POS stormwater discharges. Because STIA is located relatively high in the Des Moines Creek watershed, a source of representative upstream receiving water is not readily available. However, it does appear that suitable upstream waters exist in Miller Creek. 3. <u>Simulated downstream receiving water</u>: U.S. EPA recommends this method because the stormwater discharge and the upstream water samples are mixed at a measured ratio. In other words, the simulated downstream receiving water is prepared in the laboratory by combining measured volumes of stormwater and receiving water in proportions estimated to occur in the receiving water. This is important, as the magnitude of the WER will often depend on the concentration of the discharge. This is the approach that was used in the February 1999 range-finding tests. However, this approach requires a physical mixing zone or modeling to determine the ratio of discharge and upstream water. Given that a mixing zone may not be granted for the creeks in question, this method may not be feasible.

WER Study Using Upstream and Downstream Water

Sampling Locations

Given that the February 1999 WERs were conducted using the third option described above, it was agreed to compare the results of testing using options 1 and 2. Therefore, for Miller Creek, the upstream sample will be collected above the outlet of Lake Reba, but downstream of State Route 518 ("Miller Creek Upstream"). The actual downstream water will be collected at the Miller Creek Detention Facility (MCDF) which is downstream of the Lake Reba outlet, and just upstream of Lora Lake ("Miller Creek Complete Mix"). Samples were collected from these same locations for the 1999 preliminary WER studies.

For Des Moines Creek, the upstream sample will be collected at the inlet to the Northwest Ponds ("Des Moines Creek Upstream"), which is actually just below where this drainage exits from a culvert. This location is the only available known source of streamflow in the West Branch of the creek above STIA outfalls. Open channel flow in this reach is limited to just a few hundred feet before entering the NWP. Due to this limited development of actual "stream" character in this reach, samples may not well represent aquatic conditions. Actual downstream water will be collected at two locations to evaluate the influence of the east branch of the Des Moines Creek which contains stormwater runoff from STIA (primarily SDE4, SDS1). One actual downstream sample will be collected below the outlet of the Northwest Ponds (NWP), but above the outlet from SDS4 ("Des Moines Creek Complete Mix West"). This location engenders mixing of runoff from outfall SDS3 within NWP. Outfall SDS3 drains the majority (74%) of the existing STIA airfield and 48% of the entire STIA SDS. The other actual downstream sample will be collected below the confluence of the east branch of the Des Moines Creek at the upper most Des Moines Creek Weir ("Des Moines Creek Complete Mix").

It should be noted that except for the NWP inlet sampling station, the three other instream sampling locations are existing King County flow gaging stations. Importantly, other non-STLA sources of stormwater exist in both upstream catchments, including several miles of state highways 509, 518 and local city streets and other urban areas.

Sampling Methods

To maximize information, samples will be collected concurrently with the quarterly NPDES monitoring requirements during a qualifying rain event as described in the Port's Procedure Manual for Stormwater Monitoring (POS, 1999a). A qualifying rain event requires at least 24 hours of antecedent conditions with less than 0.1 inches of rain. All samples will be flow-weighted composites, consistent with the Port's NPDES sampling protocols. These samples will represent the discharge that occurs approximately between the first 0.2 and 0.6 inches of rainfall. A minimum of two liters of sample will be collected for each site: approximately one liter for the analytical chemistry, and one liter (minimum) for the range-finding WERs. Field personnel will split samples for delivery to each of the two laboratories involved. Fieldwork and sample handling will be in accordance with EPA 1664 "clean techniques" adapted for stormwater monitoring as described in POS, 1999b.

Analysis

Stormwater and receiving water samples will be analyzed for total and dissolved copper, lead and zinc-to-calculate WERs with a storm to an analyzed for total and dissolved copper,

also be analyzed for hardness, total suspended solids, total organic carbon and dissolved organic carbon. These parameters will be measured by Aquatic Research Incorporated. The above parameters will be measured within the parameter-specific holding time requirements.

Receiving water samples will be used in determining the range-finding WERs. The WERs will be calculated based upon acute bioassays conducted at Parametrix's Environmental Toxicology Laboratory in Kirkland. Samples will be delivered to the Parametrix's Laboratory in the one-gallon glass jars used in the field. Parametrix will transfer the samples into collapsible LDPE cubitainers, sign the chain-of-custody forms, and return the glass jars to the Port. The range-finding WER bioassays will be initiated within 36 hours to meet sample holding time requirements for toxicity tests.

The range-finding tests will consist of concurrent acute toxicity tests using *Ceriodaphnia dubia* or *Daphnia magna* with copper-spiked receiving water sample and copper-spiked laboratory water. Copper will be spiked into the test solutions from a 500 mg/L copper (as cupric sulfate, CAS #7758-99-8) stock solution. Unlike a definitive WER study, exposure concentrations will not be analytically verified. The resulting LC50s will be based on concentrations calculated from the known copper additions only. Although this approach falls short of the requirements associated with proposing a site-specific criterion to the state and federal agencies, it does provide an inexpensive estimate of the magnitude of the WER that could be obtained from a definitive study.

References

POS 1999a. Procedure Manual for Stormwater Monitoring. Port of Seattle, April 1999

POS 1999b. Adapting Clean Sampling Techniques for POS NPDES Stormwater and other Stormwater Monitoring Project Needs. Scott Tobiason, Port of Seattle, June 1999.

Round 2 Range finding...

AQUATIC RESEARCH INCORPORATED LABORATORY & CONSULTING SERVICES

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CASE FILE NUMBER:	POS005-29A	P.	AGE 1	
REPORT DATE:	05/11700	DATE RECEIVED:	04/15/00	
DATE SAMPLED: FINAL REPORT. LABORATORY ANALYS	04/14/00			
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SAMPLES FROM PORT OF SEATTLE				

CASE NARRATIVE

Six water samples were received by the laboratory in good condition. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

	TSS	TURBIDITY	TOC	DOC
SAMPLE ID	(mg/1)	(NTU)	(mg/l)	(mg/l)
NPIN041400	17	8.0	12.6	12.1
NPOLIT041400	12	2.5	7.63	7.84
the second s	36	8.5	7.55	7.22
DMWEIR041400	63	14	12.5	10.9
MCUP041400			14.1	12.1
MCDF041400	21	6.4		10.2
MCUP041400 D	102	15	10.6	1 10.2



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3927 AURORA AVENUE NORTH, SEATTLE, WA 96103 FAX: (206) 632-2417 PHONE: (206) 632-2715

PAGE 1 POS005-29B CASE FILE NUMBER: 05/11/00 REPORT DATE: 04/15/00 DATE RECEIVED: 04/14/00 DATE SAMPLED: FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PORT OF SEATTLE

CASE NARRATIVE

Six water samples were received by the laboratory in good condition. Samples for total recoverable metals analysis were digested according to EPA procedures. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on the subsequent page.

SAMPLE DATA

		L RECOVERABLE MI	PTALS	L I	ISSOLVED METALS		
	COPPER	LEAD	ZINC	COPPER	LEAD	ZINC (mg/l)	HARDNESS imgCaCOS/1)
SAMPLE ID	(mg/1)	ting/1)	(mg/1)	(mg/1)	(mg/l) <0.0020	0.026	63.7
NPIN041400	0.0100	<0.0020	0.040	0.0080	<0.0020	<0.005	96.0
NPOUT041400	0.0043	<0.0020	<0.005	0.0033	<0.0020	0.005	72.7
DMWEIR041400	0.0058	<0.0020	0.014	0.0056	<0.0020	0.007	64.1
MCUP041400	0.0056	<0.0020	0.020	0.0040	<0.0020	<0.005	95.2
MCDF041400	0.0044	<0.0020	0.011	0.0047	<0.0020	0.010	64.1
MCUP041400 D	0.0050	<0.0020	0.021	0.0044			



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CASE FILE NUMBER:	POS005-29A		PAGE 2	
REPORT DATE:	05/11/00	DATE RECEIVED:	04/15/00	
DATE SAMPLED: FINAL REPORT, LABORATORY ANALY	04/14/00 SIS OF SELECTED PARAMET			
SAMPLES FROM PORT OF SEATTLE				

9A/9C DATA

- · ·		M TO DIO TOY	TOC	DOC
OC PARAMETER	TSS	TURBIDITY	(mg/l)	(NTU)
	(mg/l)	(NTU)	NA NA	NA
CAS NUMBER	NA	NA	EPA 160.2	EPA 180.1
METHOD	EPA 160.2	EPA 180.1		04/20/00
DATE ANALYZED	04/18/00	04/15/00	04/20/00	0.250
PRACTICAL QUANITIATION LIMIT	0.50	0.10		0.100
DETECTION LIMIT	0.50	0.10	0.100	0.100
DUPLICATE		-		
	DefWE28043400	MC20F043400	BATTCH	BATYCE
SAMPLE ID	36	6.4	<0.250	<0.250
ORIGINAL	35	6.5	<0.250	<0.250
DUPLICATE	2.82%	1.55%	NC	NC
RPD	2.82%	1.00%		
SPIKE SAMPLE				BATFCH
SAMPLE ID			BATTON	<0.250
ORIGINAL		1	<0.250	
0.000	1		3.86	3.81
SPIKE ADDED			3.60	3.60
% RECOVERY	NA	NA	107.22%	105.83%
* 1000-200				
OC CHECK				
mg /1			2.01	2.01
FOUND	10	8.2	2.00	2.00
TRUE	10'	8.0		100.25%
% RECOVERY	102.00%	102.50%	100.25%	
			<0.250	<0.250
BLANK	<0.50	NA	CU.200	

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Steven Lazoff

Laboratory Director



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		P	AGE 2	
CASE FILE NUMBER:	POS005-29B	· · · · · · · · · · · · · · · · · · ·		
REPORT DATE:	05/11/00		04/15/00	
DATE SAMPLED:	04/14/00	DATE RECEIVED:	06/15/00	
FINAL REPORT, LABORATORY A	NALYSIS OF SELECTED PARAD	METERS ON WATER	· .	
SAMPLES FROM PORT OF SEAT	TLE			

9A/9C DATA -TOTAL & DISSOLVED METALS

-				D	ISSOLVED METALS		
Ĺ		TOTAL METALS	ZINC	COPPER	LEAD	ZINC	HARDNESS
OC PARAMETER	COPPER	LEAD		(mg/l)	(mg/l)	(mg/l)	ImgCaCO3/
	(mg/l)	(mg/1)	(mg/l)	7440-50-8	7439-92-1	7440-66-6	NA
CAS NUMBER	7440-50-8	7439-92-1	7440-66-6	EPA 220.2	EPA 239.2	EPA 200.7	EPA 130.
METHOD	EPA 220.2	EPA 239.2	EPA 200.7	05/09/00	05/09/00	05/09/00	04/18/00
DATE ANALYZED	05/09/00	05/09/00	05/09/00	0.0020	0.0020	0.005	2.00
RACTICAL QUANTITATION LINET	0.0020	0.0020	0.005	0.0010	0.0010	0.005	1.00
DETECTION LIMIT	0.0010	0.0010	0.005	0.0010	0.0010		
DUPLICATE							
			BATCE	MCDP061400	MCDF041400	BATCH	39930041400
SAMPLE ID	BATCH	BATCE	0.016	0.0047	<0.0020	0.009	63.7
ORIGINAL	0.0442	<0.0020	0.018	0.0053	<0.0020	0.007	63.7
DUPLICATE	0.0427	<0.0020		12.00%	NC	25.00%	0.00%
RPD	3.45%	NC	6.06%				
SPIKE SAMPLE		·					
		BATCH	BATCH	MCDF041400	MCDF041400	BATCH	1075N043400
SAMPLE ID	BATCH	1	0.016	0.0047	<0.0020	0.009	63.7
ORIGINAL	0.0442	<0.0020	1.01	0.0149	0.0106	1.04	83.6
SPIKED SAMPLE	0.0551	0.0118	1.00	0.0125	0.0125	1.00	20.0
SPIKE ADDED	0.0125	0.0125	99.40%	81.60%	84.80%	103.20%	99.679
% RECOVERY	87.20%	94.40%	98.40%				
1. The second							1
OC CHECK			-				
tmg/1)			1.02	0.0264	0.0259	1.03	40.7
•	0.0264	0.0259	1.02	0.0250	0.0250	1.00	40.0
TRUE	0.0250	0.0250	101.70%	101.20%	96.00%	102.80%	101.63
% RECOVERY	105.60%	103.60%	101.70%				•
		1	<0.005	<0.0010	<0.0010	<0.005	<2.00
PREP BLANK BLANK SPIKE % RECOVERY	<0.0010	<0.0010	103.0%	98.3%	101.0%	NA	NA
	98.3%	101.076	100.0 %				

Submitted By 2 2 Steven Lazoff Laboratory Director

AR 024979

Chain of Custody Record

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Port of Seattle Sea-Tac Airport Stormwater Program: Sample Chain of Custody Record Laboratory: Aquatic Research Inc., 392/ Aurora Ave. N.

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Miscellaneous Notes:

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CASE FILE NUMBER:	POS005-30A	P	AGE 1	
REPORT DATE:	05/11/00 04/18/00	DATE RECEIVED:	04/18/00	
DATE SAMPLED: FINAL REPORT, LABORATORY ANALY		ERS ON WATER		
SAMPLES FROM PORT OF SEATTLE				· · ·

CASE NARRATIVE

One water sample was received by the laboratory in good condition. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TSS	TURBIDITY	TOC	DOC
	(mg/l)	INTU)	(mg/l)	(mg/l)
NP1N041807-B	<0.50	0.35	<0.250	<0.250

EQUIPMENT (FIELD) BLANK

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CASE FILE NUMBER:	POS005-30B	- 2		
REPORT DATE:	05/11/00		04/18/00	
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FINAL REPORT, LABORATORY	ANALYSIS OF SELECTED PARAM	ETERS ON WATER		
SAMPLES FROM PORT OF SEAT				

CASE NARRATIVE

Four water samples were received by the laboratory in good condition. Samples for total recoverable metals analysis were digested according to EPA procedures. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on the subsequent page.

SAMPLE DATA

				D	ISSOLVED METALS			
		RECOVERABLE M	ZINC	COPPER	LEAD	ZINC	HARDNESS	
	COPPER	LEAD		img/1)	(mg/l)	(mg/1)	imgCaCOS/I)	ł
SAMPLE ID	(mg/l)	(mg/l)	(mg/1)	<0.0020	<0.0020	<0.005	6.84	
NP1N041800-B	<0.0020	<0.0020	<0.005	0.0020				



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CASE FILE NUMBER:	POS005-30A		PAGE 2
REPORT DATE:	05/11/00		
DATE SAMPLED:	04/18/00	DATE RECEIVED:	04/18/00
FINAL REPORT, LABORATORY ANAL	TSIS OF SELECTED PARAMET	ERS ON WATER	
SAMPLES FROM PORT OF SEATTLE			

ga/gc data				
OC PARAMETER	TSS	TURBIDITY	TOC	DOC
,	(mg/l)	(NTU)	(mg/l)	(NTU)
CAS NUMBER	NA	NA	NA	NA
METHOD	EPA 160.2	EPA 180.1	EPA 160.2	EPA 180.1
DATE ANALYZED	04/18/00	04/18/00	04/20/00	- 04/20/00
ACTICAL QUANTITATION LIMIT	0.50	0.10	0.250	0.250
DETECTION LIMIT	0.50	0.10	0.100	0.100
DUPLICATE				
SAMPLE ID	BATCH	MP1N041800-B	NP1N041800-8	10-10041800-B
ORIGINAL	36	0.35	<0.250	<0.250
DUPLICATE	35	0.35	<0.250	<0.250
RPD	2.82%	0.00%	NC	NC
SPIKE SAMPLE			10110041800-B	3F18041800-8
SAMPLE ID		· .	<0.250	<0.250
ORIGINAL	}	х.	3.86	3.81
	1		3.60	3.60
SPIKE ADDED	1		107.22%	105.89%
% RECOVERY	NA	NA	107.22%	1.00.00 %
OC CHECK				
mg/1			0.01	2.01
FOUND	10	0.80	2.01	2.01
TRUE	10	0.80	2.00	100.259
% RECOVERY	102.00%	100.00%	100.25%	1 100.209
	1			
BLANK	<0.50	NA	<0.250	<0.250

THEO - RELATIVE FERCENT DEFFERENCE. BIA - NOT APPLICABLE OR NOT AVABABLE. BIC - NOT COLICILABLE DUE TO GRE OR NORE VALUES BEENG RELOW THE DETECTION LINUT. OR - RECOVERT NOT CALCILABLE DUE TO REPORT BANFLE OUT OF RANGE OR BERG TOO LOW RELATIVE TO BANFLE CONCERTRATION

Steven Lazoff

Laboratory Director 2 1_ Ĺ

AR 024983



LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103 FAX: (208) 632-2417 PHONE: (206) 682-2715

		P	AGE 2	
CASE FILE NUMBER:	POS005-30B			
REPORT DATE:	05/11/00		04/18/00	•
TATE SAMPLED	04/18/00	DATE RECEIVED:	04/10/00	
FINAL REPORT, LABORATORY ANALYSI	S OF SELECTED PARAME	TERS ON WATER		
SAMPLES FROM PORT OF SEATTLE				

9A/9C DATA -TOTAL & DISSOLVED METALS

				D	ISSOLVED METALS		
		TOTAL METALS	ZINC	COPPER	LEAD	ZINC	HARDNESS
OC PARAMETER	COPPER	LEAD	(mg/l)	(mg/l)	(mg/1)	(mg/l)	(mgCaCOS/l)
	(mg/l)	(mg/l)	7440-66-6	7440-50-8	7439-92-1	7440-66-6	NA <
CAS NUMBER	7440-50-8	7439-92-1	EPA 200.7	EPA 220.2	EPA 239.2	EPA 200.7	EPA 130.2
METHOD	EPA 220.2	EPA 239.2		05/09/00	05/09/00	05/09/00	04/18/00
DATE ANALYZED	05/09/00	05/09/00	05/09/00	0.0020	0.0020	0.005	2.00
RACTICAL QUANTITATION LIMIT	0.0020	0.0020	0.005	0.0010	0.0010	0.005	1.00
DETECTION LIMIT	0.0010	0.0010	0.005	0.0010		-	
DUPLICATE							
		DATCE	BATCE	BATCH	MICH	BATCE	BATCH
SAMPLE ID	BATCH	<0.0020	0.016	0.0047	<0.0020	0.009	17.6
ORIGINAL	0.0442	1	0.017	0.0053	<0.0020	0.007	17.8
DUPLICATE	0.0427	<0.0020	6.06%	12.00%	NC	25.00%	1.10%
RPD	3.45%	NC	0.00%				
SPIKE SAMPLE		•		•			
	BATCH	BATCH	BATCH	BATCH	BATCH	MICE	BATCH
SAMPLE ID		<0.0020	0.016	0.0047	<0.0020	0.009	17.6
ORIGINAL	0.0442	0.0118	1.01	0.0149	0.0106	1.04	37.7
SPIKED SAMPLE	0.0551	0.0118	1.00	0.0125	0.0125	1.00	20.0
SPIKE ADDED	0.0125	94.40%	99.40%	81.60%	84.80%	103.20%	100.659
% RECOVERY	87.20%	94.40%	88.40 %				
OC CHECK					•		
(mg/1)			1.00	0.0264	0.0259	1.03	40.7
	0.0264	0.0259	1.02	0.0250	0.0250	1.00	40.0
TRUE	0.0250	0.0250	1.00	101.20%	96.00%	102.80%	101.63
% RECOVERY	105.60%	103.60%	101.70%	101.20%			
				<0.0010	<0.0010	<0.005	<2.00
PREP BLANK	<0.0010	<0.0010	<0.005	98.3%	101.0%	NA	NA
BLANK SPIKE % RECOVERY	98.3%	101.0%	103.0%	50.076			

RED - RELATIVE PERCENT DEFTENDENCE. BA - ROT APPLICABLE OR NOT AVALABLE. RC - ROT APPLICABLE DE TO ORE OR NORE VALUES BESIG BELOW THE DETECTION LBGT. CC - RECOVERY NOT GALCULABLE DIE TO SPEC BANGLE OUT OF PARGE OR BREE TOO LOW RELATIVE TO BANGLE CONCENTRATIO

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Submitted By: Steven Lazoff Laboratory Director

Miscellaneous Notes:

generic COC

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(8-0) need2	1 1 1 1 1	ତ		1					_		_	+							-	PRES /W H2SO4 4/18/00	
Color (0-5)		0																		2	
Turbidity (0-5)		0			<u></u>								+-		gree					7	
(8-0) sbilo2 qau2		· O		<u> .</u>											5 = present to considerable degree					5	-
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Total Recov Cu		X		+	++										-Q 60 11					ს <u>კ</u>	j.
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Fecals, MF					+							$\left - \right $		+-			4				revise
Fecals, MPN			·												when wereance and magnitude: 0 = absent,						
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Containers		M -			6		-+-	+	+-	1	+				1			14	700	3	
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	an lime in	B:05			R		·												*		
tiudy Date: <u>V18</u> - Page <u>1</u> of <u>1</u> Case File st irements: weekStandard		co I			E								+	<u> </u>	_			4	N.	•	
study Date: - Page <u>1</u> Case File# ifements: week	6	Q Q			N													Co.	SSAC		
itudy Data - Page <u>I</u> Case File# irements: week	Date Laken				Å												uished by:	M 1. 3	PIS		
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DOS DOS Requ					B			•									Relinqu	Dar	E.	9	
Spill Nother Do Study Date: <u>V(8/00</u>) Jason, 444-8738 W & Page 1 of 1 al: <u>Scale S</u> Case Filef Turnaround Requirements: 148 hour6 day _2 weekStandard	5	5			Je P						_	_			_	lie I	E Re	Ê		150	
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NPDE8 Spill Xother cott Toblason, 444-6798 ersonnel: <u>Crole C S</u> Turnaroum	AND SAMPLE DAME NOT COMPANY	NPINDYIBOU				-										e CO	142 147				
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ect: NPDE8 St tact: Scott Toblason pling Personnel:48 ho		1 2										_				16 88	a las				
Project: NPDES Spill Xother D0 S Contact: Scott Toblason, 44.4738 WER Sampling Personnel: <u>Ccg E S</u> Turmaround Requ	Actual	- 2		4 10	G	- 0	0	9	=	12	13	14	15 1 A	21	18	 Time sample completed If composite 					
LE O N	× 2		1	1	1		1	1	1	1 1	1			-		•					

Chain of Custody Record

Port of Seattle Sea-Tac Airport Stormwater Program: Sample Chain of Custody Record Analva Laboratory: Aquatic Research Inc., 392t Aurora Ave. N, Seattle, WA 98103 206-632-2715

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AQUATIC RESEARCH INCORPORATED LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 95103

PHONE: (206) 632-2715 FAX: (206) 632-2417

		a a faith an		
CASE FILE NUMBER:	POS005-28A	,	PAGE 1	
REPORT DATE:	05/11/00			
DATE SAMPLED:	04/13.14/00	DATE RECEIVED:	04/14/00	
FINAL REPORT, LABORATORY ANA	LYSIS OF SELECTED PARAMETE	rs on water	· ·	
SAMPLES FROM PORT OF SEATTL	E			

CASE NARRATIVE

Eight water samples were received by the laboratory in good condition. Samples analyzed for NWTPH-Dx were subjected to sulfuric acid/silica gel cleanup after extraction but prior to final sample concentration. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

		í	NWTPH-DX			
	pН	FEGAL COLFORM	DIESEL	MOTOR OIL		
SAMPLE ID		t#/100ml)	(mg/l)	(mg/l)		
SDE4041300 GRAB	6.69	130	<0.05	0.29		
SDS3041300 GRAB	7.69	8	<0.05	<0.10		
SDN4041300 GRAB	7.39	33	0.17	0.35		
SDN1041300 GRAB	5.94	< 2	0.10	0.13		

					GLYCOLS	
TSS SAMPLE ID (mg/l)		TURBIDITY (NTU)	BOD5 (mg/l)	ETHYLENE (mg/l)	PROPYLENE img/1)	TOTAL img/l)
SDE4041300 COMP	59	2.2	8.88	<2.00	<2.00	<2.00
SDS3041400 COMP	15	7.2	18.1	<2.00	<2.00	<2.00
SDN4041300 COMP	4.7	4.5	5.62	<2.00	<2.00	<2.00
SDN1041300 COMP	46	15	6.54	<2.00	<2.00	<2.00

	TOC	DOC
SAMPLE ID	(mg/l)	(mg/l)
SDE4041300 COMP	7.11	6.27
SDS3041400 COMP	12.0	8.88
SDN4041300 COMP	5.32	4.90
SDN1041300 COMP	6.35	5.93



LABORATORY & CONSULTING SERVICES

 S927 AURORA AVENUE NORTH, SEATTLE, WA 98103

 PHONE: (206) 652-2715
 FAX: (206) 652-2417

CASE FILE NUMBER:	POS005-28B		PAGE 1	
REPORT DATE:	05/11/00			
DATE SAMPLED:	04/18,14/00	DATE RECEIVED:	04/14/00	
FINAL REPORT, LABORATORY ANAL	YSIS OF SELECTED PARAM	eters on water		
SAMPLES FROM PORT OF SEATTLE				

CASE NARRATIVE

Four water samples were received by the laboratory in good condition. Samples for total recoverable metals analysis were digested according to EPA procedures. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on the subsequent page.

SAMPLE DATA

	TOTA	L RECOVERABLE MI	ETALS	DISSOLVED METALS				
	COPPER	LEAD	ZINC	COPPER	LEAD	ZINC	HARDNESS	
SAMPLE ID	(mg/l)	(mg/1)	(mg/l)	(mg/1)	img/l)	img/1)	(mgCaCOS/I)	
SDE4041300 COMP	0.0176	<0.0020	0.139	0.0153	<0.0020	0.103	16.8]
			0.029	0.0212	<0.0020	0.016	39.7	1
SDS3041400 COMP	0.0244	<0.0020	the second s	0.0417	<0.0020	0.009	45.9	1
SDN4041300 COMP	0.0442	<0.0020	0.016		<0.0020	0.356	(17.6)	۲ kc
SDN1041300 COMP	0.0347	<0.0020	0.410	0.0258	<0.0020	0.000	<u> </u>	-1/2



LABORATORY & CONSULTING SERVICES 3927 AURORA AVENUE NORTH, SEATTLE, WA 98103 FAX: (206) 632-2417 PHONE: (206) 632-2715

AR 024988

CASE FILE NUMBER:	POS005-28A	P	AGE 2
REPORT DATE:	05/11/00	DATE RECEIVED:	04/14/00
DATE SAMPLED: FINAL REPORT, LABORATORY ANAL	04/13.14/00 TSIS OF SELECTED PARAMET		
SAMPLES FROM PORT OF SEATTLE			

pH	FECAL COLIFORM	DIESEL	MOTOR OIL
	(#/)OOml)	tmg/1)	(mg/l)
NA	NA	NA	NA
EPA 150.1	SM 18 9221E	NWTPH-DX	NWTPH-DX
04/14/00	04/14/00	04/18/00	04/18/00
0.10	2	0.05	0.10
0.10	2	0.05	0.10
	SCH1041300 GRAB	BORIO-1300 GRAB	BON1041300 GRAB
	< 2	0.10	0.13
	< 2	0.05	0.16
NA	NC	NC	NC
L			т
ſ		· .	1
1			
	1	NTA	NA
NA	NA	NA	1
	1	0.50	1.02
	1	0.50	1.00
NA	NA	100.00%	102.00%
NA	< 2	<0.05	<0.10
	EPA 150.1 04/14/00 0.10 0.10 NA	(#/100ml) NA NA EPA 150.1 SM 18 9221E 04/14/00 04/14/00 0.10 2 0.10 2 0.10 2 0.10 2 NA NC NA NC NA NA NA NA NA NA	(#/100ml) tmg/l) NA NA NA EPA 150.1 SM 18 9221E NWTPH-DX 04/14/00 04/14/00 04/18/00 0.10 2 0.05 0.10 2 0.05 0.10 2 0.05 NA NC NC NA NC NC NA NA NA NA NA NA

INTO - NELATIVE FERCENT DUTERDICE. No - NOT ANTI-DALLE OR NOT AVALABLE. NEC - NOT ANTI-DALLE TO ORE OR HORE VALUES BEING BELOW THE DETECTION LIMIT. OR - RECOVERY NOT ONLOLEABLE DUE TO BYRE MANYLE OUT OF PAREL OR BYRE TOO LOW RELATIVE TO BANFLE CONCENTRATION



LABORATORY & CONSULTING SERVICES S927 AURORA AVENUE NORTH, SEATTLE, WA 96103 PHONE: (206) 632-2715 FAX: (206) 632-2417

ASE FILE NUMBER:		POS005-28A			PAGE	
EPORT DATE:		05/11/00	-		PT).	04/14/00
ATE SAMPLED: 04/13.14/				DATE RECEIV		04/14/00
NAL REPORT, LABORATORY	ANALYSIS OF	SELECTED PAR	AMETERS ON W	ATER		
MPLES FROM PORT OF SEA						
ga/gc data			-	0.110		
				GLYC	PROPYLENE	4
OC PARAMETER	TSS	TURBIDITY	BOD5		(mg/l)	
	(mg/l)	(NTU)	(mg/l)	(mg/l)	57-55-6	
CAS NUMBER	NA	NA	NA	107-21-1	AR SOP	
METHOD	EPA 160.2	EPA 180.1	EPA 405.1	AR SOP	AR SOP 05/03/00	
DATE ANALYZED	04/18/00	04/15/00	04/14/00	05/03/00	2.00	
RACTICAL QUANTITATION LIMIT	0.50	0.10	4.00	2.00	2.00	1
DETECTION LIMIT	0.50	0.10	2.00	2.00	2.00	-4
DUPLICATE						
			· · · · · · · · · · · · · · · · · · ·		T	-
SAMPLE ID	BDE4041300 COMP	SCH1041300 COMP	SCH1041300 CCMP			
ORIGINAL	59	15	6.54		· · · ·	
DUPLICATE	62	16	6.76	1		1
RPD	4.96%	6.45%	3.31%			
SPIKE SAMPLE						1
		1	1	BATCH	BATCH	
SAMPLE ID				< 2.00	< 2.00	
ORIGINAL				27.4	33.6	. 1
SPIKED SAMPLE				28.2	33.5	
DPLICATE SPIKE		1		2.88%	0.30%	
RPD				25.0	25.0	1
SPIKE ADDED % RECOVERY	NA	NA	NA	111.20%	134.20%	
* RECOVERI	1963		1			
OC CHECK						1
mg/l						
FOUND	10	8.2	4.59	24.7	24.1	
TRUE	10	8.0	4.62	25.0	25.0	
% RECOVERY	102.00%	102.50%	99.35%	98.80%	96.40%	
A 14000 1211						
BLANK	<0.50	NA	<2.00	<2.00	<2.00	
		<u> </u>				• • • ·

OR - NECOVERY NOT CALCULABLE DUE TO SPECE SAMPLE OUT OF NAMES OR SPEET TOO LOW RELATIVE TO SAMPLE OUNCER

LABORATORY & CONSULTING SERVICES 3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

		P	AGE 4	
CASE FILE NUMBER: REPORT DATE: DATE SAMPLED: FINAL REPORT, LABORATORY ANALYSIS	POS005-28A 05/11/00 04/13,14/00 OF SELECTED PARAMET	DATE RECEIVED: ERS ON WATER	04/14/00	
FINAL REPORT, LABORATORY HELE			<u></u>	

9A/9C DATA

	the second s	
TO DUDANETER	TOC	DOC
OC PARAMETER	(mg/1)	(NTU)
	NA	NA
CAS NUMBER	EPA 160.2	EPA 180.1
METHOD	04/20/00	04/20/00
DATE ANALYZED	0.250	0.250
PRACTICAL QUANTITATION LIMIT		0.100
DETECTION LIMIT	0.100	000
DUPLICATE		
SAMPLE ID	BATTON	BAIFCE
	<0.25	<0.25
ORIGINAL	<0.25	<0.25
DUPLICATE	NC	NC
SPIKE SAMPLE		
SAMPLE ID	MATTON	BALLACE .
ORIGINAL	<0.25	<0.25
SPIKED SAMPLE	3.86	3.81
SPIKE ADDED	3.60	3.60
% RECOVERY	107.22%	105.83%
OC CHECK		,
mg/1	2.01	2.01
FOUND	2.00	2.00
TRUE	100.25%	100.25%
% RECOVERY		
	<0.250	<0.250
BLANK	1 40.000	

RED - RELATIVE FERCENT DEFINISHER. NO - NOT APPLICABLE OR NOT AVAILABLE. NO - NOT GALCULABLE DUE TO GREE OR MORE VALUES BEING BELOW THE DETECTION LIMIT. OR - RECOVERY NOT GALCULABLE DUE TO SPIRE BANFLE OUT OF RANGE OR SPIRE TOO LOW RELATIVE TO BANFLE CONCENTRATION.

Steven Lazoff

Laboratory Director ._!

AQUATIC RESEARCH INCORPORATED LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103 PHONE: (206) 652-2715 FAX: (206) 652-2417

			PAGE 2	
CASE FILE NUMBER:	POS005-28B			•
	05/11/00		04/14/00	
REPORT DATE:	04/13,14/00	DATE RECEIVED:		
DATE SAMPLED: FINAL REPORT, LABORATORY ANALYSIS	OF SELECTED PARAM	eters on water		
FINAL REPORT, LABORATORI AND TO	···			
SAMPLES FROM PORT OF SEATTLE				

9A/9C DATA -TOTAL & DISSOLVED METALS

C DATA -TOTAL & DIES					SSOLVED METALS	-	
r-		TOTAL METALS			LEAD	ZINC	HARDNESS
	COPPER	LEAD	ZINC	COPPER	(mg/l)	(mg/1)	imgCaCOS/I
OC PARAMETER	(mg/l)	(mg/l)	(mg/l)	(mg/l)	7439-92-1	7440-66-6	NA
· •	7440-50-8	7439-92-1	7440-66-6	7440-50-8		EPA 200.7	EPA 130.
CAS NUMBER	1	EPA 239.2	EPA 200.7	EPA 220.2	EPA 239.2	05/09/00	04/18/00
METHOD	EPA 220.2	05/09/00	05/09/00	05/09/00	05/09/00	0.005	2.00
DATE ANALYZED	05/09/00	0.0020	0.005	0.0020	0.0020	0.005	1.00
ACTICAL QUANTITATION LIMIT	0.0020	0.0010	0.005	0.0010	0.0010	0.000	
DETECTION LIMIT	0.0010	0.0010			•		
DUPLICATE							SUR1041300 CO
			8084041300 CCMP	BATCH	BATCH	BON4041300 COMP	17.6
SAMPLE ID	\$2384041300 COMP	3094041300 COMP	0.016	0.0047	<0.0020	0.009	17.8
ORIGINAL	0.0442	<0.0020		0.0053	<0.0020	0.007	
DUPLICATE	0.0427	<0.0020	0.017	12.00%	NC	25.00%	1.10%
RPD	3.45%	NC	6.06%	12.0010	J	-	1
SPIKE SAMPLE							
Srine Gene				BATCH	BATCH	30314041900 COMP	80W1041900 C
SAMPLE ID	SON4041300 COMP	2014041300 COMP	ED84041300 COMP	0.0047	<0.0020	0.009	17.6
ORIGINAL	0.0442	<0.0020	0.016	0.0149	0.0106	1.04	37.7
	0.0551	0.0118	1.01	0.0125	0.0125	1.00	20.0
SPIKED SAMPLE	0.0125	0.0125	1.00	-	84.80%	103.20%	100.65
SPIKE ADDED	87.20%	94.40%	99.40%	81.60%	64.00 %		1
% RECOVERY	01.20 %			-			
OC CHECK						1.03	40.7
tmg/1)	0.0264	0.0259	1.02	0.0264	0.0259	1.00	40.0
		0.0250	1.00	0.0250	0.0250	102.80%	101.6
TRUE	0.0250	103.60%	101.70%	101.20%	96.00%	102.00%	
% RECOVERY	105.60%	103.00%			0.0010	<0.005	<2.0
		<0.0010	<0.005	<0.0010	<0.0010	NA NA	NA
	<0.0010	101.0%	103.0%	98.3%	101.0%		
PREP BLANK BLANK SPIKE % RECOVERY							

Submitted By: Steven Lazoff ~ Laboratory Director

	Ac thylor	PH=C.69	PH=5.94			₽.K.
Note	"" " " " " " " " " " " " " " " " " " "		0 0 0 0 0 0			PRES W/H2504 4/01/680000000000000000000000000000000000
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