June 5, 2009

Russ McMillan
Washington State Department of Ecology
300 Desmond Drive
Lacey, WA 98503

Subject: Re-Analysis of PCB Aroclors in Archived Tissue Sample – Sediment Investigation in Port Gardner, Everett, WA

Dear Mr. McMillan:

In 2008, the Washington State Department of Ecology (Ecology) conducted a study in the Port Gardner/Snohomish River estuary to identify potential areas of sediment contamination and confirm the priority areas for cleanup in the Bay and surrounding area. Ecology designed this study to provide information on the overall quality of sediments, determine the general nature and extent of sediment contamination, and help develop protective cleanup levels. The findings of this investigation were released in a report in April 2009 (SAIC 2009).

As part of the study, English sole specimens in Port Gardner were collected for tissue residue analysis of bioaccumulative chemicals of concern (metals, polychlorinated biphenyls [PCB] Aroclors, and dioxin/furan congeners). A single replicate sample of English sole from trawling location A2-T1 (mouth of the Snohomish River) was found to contain Aroclor 1221 at a concentration of 330 μg/kg wet weight (ww). Aroclor 1221 was not measured in any surface sediment collected and analyzed in Port Gardner. Therefore, Ecology requested that this English sole tissue sample be reanalyzed for PCB Aroclors to confirm these results. This Technical Memorandum summarizes the results of this reanalysis.

Tissue Sample Description

Archived samples from the Port Gardner Sediment Investigation are maintained at Analytical Resources, Inc., Tukwila, WA. The archived English sole tissue sample PG-A2-T1-ES-A was removed from archive on May 11, 2009, and reanalyzed for PCB Aroclors. The English sole sample was originally collected on October 8, 2008, and comprised of five fish. The whole bodies of each fish were homogenized separately. Equal volumes from each fish homogenate were combined to make a final composite sample for analysis. Extraction of the sample occurred on May 14, 2009, and analysis was conducted on May 20, 2009. A duplicate analysis was also conducted.
QA/QC Summary

A Quality Assurance Level 1 (QA1) review was conducted to evaluate the precision and accuracy of the sample analysis (Enclosure 1). The tissue sample was extracted and analyzed within the recommended holding time for frozen samples. The method blank was clean at the reporting limits. The Laboratory Control Sample (LCS) percent recoveries were within control limits, the surrogate percent recoveries were within control limits, and the matrix spike percent recoveries were also within advisory control limits. The data are considered acceptable, as qualified.

Results

The original and reanalysis results for PCB Aroclors for tissue sample PG-A2-T1-ES-A are presented in Table 1. PCB Aroclors were not detected in the reanalysis and duplicate reanalysis. The laboratory data report is provided in Enclosure 2. Aroclor 1221 was not detected in Port Gardner sediments and under the original analysis, the reported concentration of Aroclor 1221 was qualified as “tentatively identified.” The reanalysis results suggest that Aroclor 1221 is not present in English sole tissues in Port Gardner.

References


SAIC appreciates the opportunity to support Ecology’s efforts in Port Gardner. Please contact me if you have questions regarding this Technical Memorandum.

Sincerely,

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

John S. Nakayama
Senior Oceanographer
Environmental Sciences Division

cc: Doug Pearman, SAIC
    Denise Kilpatrick, SAIC
    Will Hafner, SAIC

Enclosures 1 & 2
Table 1: PCB Aroclor results for English sole sample PG-A2-T1-ES-A.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Original Analysis</th>
<th>Reanalysis</th>
<th>Reanalysis Duplicate</th>
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</thead>
<tbody>
<tr>
<td>Lipid (%)</td>
<td>3.27</td>
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</tr>
<tr>
<td>PCBs in ug/kg WW</td>
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<td></td>
<td></td>
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<tr>
<td>Aroclor-1221</td>
<td>330 P NJ</td>
<td>20 U</td>
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</tr>
<tr>
<td>Aroclor-1232</td>
<td>6.5 U U</td>
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<tr>
<td>Total PCBs</td>
<td>330 P NJ</td>
<td>20 U</td>
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</tbody>
</table>

Data Validation Qualifiers

U     The compound was analyzed for, but was not detected at or above the method detection limit
P     The analyte was detected on both columns, but values differed by >40% with no chromatographic interference
NJ    The analysis indicated the presence of a "tentatively identified" analyte. Reported value is approximate.
Enclosure 1

QA1 Review Checklist
CHECKLIST FOR PESTICIDES AND PCB COMPOUNDS IN SEDIMENT

Project Name  Sediment Characterization Study in Port Gardner
SAIC Project No.  01-0236-00-6928-500
Lab  Analytical Resources, Inc.
Lab #  OY53
Responsible Technician  Pradeep Divvela, Project Chemist
Reviewed by  John Nakayama  Date checklist prepared  6/3/09
Date: Sampled  8/8/08  Date checklist prepared  6/3/09
Received by lab  8/21/08  Date checklist prepared  6/3/09
Analysis began  PCB Extraction: 05/14/09  PCB Analysis: 05/20/09

Problems noted (e.g., deviations from prescribed methods, analytical problems)

**PCBs:** On May 11, 2009, SAIC requested that one tissue sample (PG-A2-T1-ES-A) be removed from archive and reanalyzed for PCB Aroclors. Aroclor 1221 was measured in this tissue sample previously, but was not corroborated by concentrations in sediments. The sample was extracted and analyzed within recommended holding times for frozen samples.

All required documents submitted? (Y/N)  Yes
Analytical method  SW 8082

COMPLETENESS AND HOLDING CONDITIONS

<table>
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<th># Samples Submitted</th>
<th># Samples Analyzed</th>
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<tbody>
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</tbody>
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Holding conditions acceptable? (Y/N) (1 year for frozen sediment or 14 days at 4°C until extraction: extracts must be processed within 40 days)  Yes

If no, identify samples

Extract conditions acceptable? (Y/N) (1 year for frozen sediment or 14 days at 4°C)  Yes

If no, identify samples
FORMAT

Standard data report sheet

Concentrations in proper units and significant figures  Reported to two significant figures

Qualifiers defined (e.g., U = undetected)

U = the compound was not detected at the reported concentration

QA/QC SAMPLES

Method Blank

Total # 1 for PCBs

Frequency 1 for 1 sample
(minimum 1 per extraction batch)c

Chemicals detected above 5 μg total (for phthalates) and 25 μg totald
(for other organic compounds; lower levels may be appropriate for pesticides and PCBs)

None for PCBs

Certified Reference Materials

Total # 1 LCS for PCBs analysis

Frequency 1 for 1 sample
(<50 samples - 1 per set of samples submitted to lab; >50 samples - 1 per 50 samples analyzed)c

CRM used: PCBs: LCS-051409

Chemicals outside 95% confidence interval (for certified values)d,e

PCBs: All LCS within recovery limits

Analytical Replicates

Total # 1 duplicate for PCBs

Frequency 1 for 1 sample
(<20 samples - 1 per set of samples submitted to lab; =20 samples - 1 triplicate and additional
duplicate for minimum of 5% total replication)c

Samples/chemicals with >35% RPD or CVe

PCBs: None. All Aroclors undetected

Matrix Spikes (not required for A/B/N if isotope dilution used)

Total # 1

Frequency 1 for 1 samples
(<20 samples - 1 per set of samples submitted to lab; =20 samples - 5% of total samples)f

Chemicals outside 50-150% recoveryg None

- Checklists adopted from PSDDA guidance manual: PTI, 1989. -
Detection Limits

Did any DL exceed SL? (Y/N)  N/A

If yes, detection limits exceeding SL (identify samples)

PCBs

Pesticides

Surrogate Recovery (Pesticides/PCBs)

Were surrogates added to all samples? (Y/N)  Yes

Identify samples with <60 percent surrogate recovery  None

Method Blanks (Relative blank contamination)

Were sample concentrations less than 5 times blank concentrations? (Y/N)  Yes

If yes, identify compounds and samples

Organic Compounds

The following documentation is needed for organic compounds:

• A cover letter referencing or describing the procedure used and discussing any analytical problems
• Reconstructed ion chromatograms for GC/MS analyses for each sample
• Mass spectra of detected target compounds (GC/MS) for each sample and associated library spectra
• GC/ECD and/or GC/flame ionization detection chromatograms for each sample
• Raw data quantification reports for each sample
• A calibration data summary reporting calibration range used [and decafluoro-triphenylphosphine (DFTPP) and bromofluorobenzene (BFB) spectra and quantification report for GC/MS analyses]
• Final dilution volumes, sample size, wet-to-dry ratios, and instrument detection limit
• Analyte concentrations with reporting units identified (to two significant figures unless otherwise justified)
• Quantification of all analytes in method blanks (ng/sample)
• Method blanks associated with each sample
• Recovery assessments and a replicate sample summary (laboratories should report all surrogate spike recovery data for each sample; a statement of the range of recoveries should be included in reports using these data)
• Data qualification codes and their definitions
Prototype sampling and analysis plan provided by David Fox, U.S. Army Corps of Engineers on 7 August 1991.

For batches of 5 samples or less, the minimum QA checks should be a blank and the analysis of a CRM (and matrix spikes for any analytes not certified in the CRM). In general, the priority of QA checks for batches of =5 samples should be as follows: CRM > analytical replicate > matrix spikes.

PSEP control limit.

Enclosure 2

Laboratory Data Report
May 27, 2009

John Nakayama  
SAIC  
18706 North Creek Parkway, Suite 110  
Bothell, WA  98011  

RE: Client Project: 01-0236-00-6929, Port Gardner  
ARI Job No.: OY53  

Dear John:  

Please find enclosed the Chain-of-Custody (COC) record, sample receipt documentation, and the final data package for samples from the project referenced above.  

Problems associated with these analyses are discussed in the Case Narrative.  

An electronic copy of this package will remain on file with ARI. Should you have any questions or problems, please feel free to contact me at your convenience.  

Sincerely,  

ANALYTICAL RESOURCES, INC.  

Susan Dunnihoo  
Director, Client Services  
sue@arilabs.com  
206-695-6207  

Enclosures  

cc: eFile OY53  
SD/co
# CHAIN OF CUSTODY RECORD

**Project No.:** 01-0236-00-6929  
**Project Mgr.:** John Nakayama  
**Project Location:** Everett, WA  
**Sample Collectors:** LO, JE, JN  
**Client Name:** Ecology

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**Number of Shipping Containers:** 5  
**Date Shipped:** 8/21/06  
**Carrier:** SAIC  
**Waybill No.:**

**Comments**

---

**RELINQUISHED BY:***  
**Signature:** [Signature]  
**Date/Time:** 8/21/06 12:00  
**Affiliation:** SAIC

**RECEIVED BY:***  
**Signature:** [Signature]  
**Date/Time:** 8/21/06 14:50  
**Affiliation:** [Affiliation]  

---

*White Lab Returns to Originator Upon Receipt of Samples  
Canary: Lab Retains  
Pick: Lab Returns to Project Manager with Final Report  
Goldcoast: Retained by Sampler
Cooler Receipt Form

ARI Client: SAIC  Project Name: Port Gardner
COC No:  Delivered by: Hard
Assigned ARI Job No: NCSO  Tracking No:

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of cooler? YES NO
Were custody papers included with the cooler? YES NO
Were custody papers properly filled out (ink, signed, etc.) YES NO
Record cooler temperature (recommended 2.0-6.0 °C for chemistry) -2.810.04/0.811.7°C
Cooler Accepted by: [Signature] Date: 8/4/08 Time: 4:50

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? YES NO
What kind of packing material was used? [ ]
Was sufficient ice used (if appropriate)? YES NO
Were all bottles sealed in individual plastic bags? YES NO
Did all bottle arrive in good condition (unbroken)? YES NO
Were all bottle labels complete and legible? YES NO
Did all bottle labels and tags agree with custody papers? YES NO
Were all bottles used correct for the requested analyses? YES NO
Do any of the analyses (bottles) require preservation? (attach preservation checklist) YES NO
Were all VOC vials free of air bubbles? YES NO
Was sufficient amount of sample sent in each bottle? YES NO

Samples Logged by: [Signature] Date: 8/4/08 Time: 16:30

** Notify Project Manager of discrepancies or concerns **

Explain discrepancies or negative responses:

By:  Date:
Case Narrative

Client: SAIC
Project: 01-0236-00-6929, Port Gardner
Matrix: Tissue
ARI Job No.: OY53

Sample receipt

As requested by SAIC on May 11, 2009, one tissue sample was removed from archive and logged under ARI job OY53. The sample was analyzed in duplicate for PCBs, as requested.

PCB-Aroclors by SW8082

The sample was extracted and analyzed within recommended holding times for frozen samples.

Initial and continuing calibrations were within the requirements. The internal standard areas were within accepted limits.

The method blank was clean at the reporting limit. The LCS percent recoveries were within control limits.

The surrogate percent recoveries were within control limits.

The matrix spike and matrix spike percent recoveries were within advisory control limits.
Data Reporting Qualifiers
Effective 12/28/04

Inorganic Data

U  Indicates that the target analyte was not detected at the reported concentration

*  Duplicate RPD is not within established control limits

B  Reported value is less than the CRDL but ≥ the Reporting Limit

N  Matrix Spike recovery not within established control limits

NA  Not Applicable, analyte not spiked

H  The natural concentration of the spiked element is so much greater than the concentration spiked that an accurate determination of spike recovery is not possible

L  Analyte concentration is ≤5 times the Reporting Limit and the replicate control limit defaults to ±1 RL instead of the normal 20% RPD

Organic Data

U  Indicates that the target analyte was not detected at the reported concentration

*  Flagged value is not within established control limits

B  Analyte detected in an associated Method Blank at a concentration greater than one-half of ARI’s Reporting Limit or 5% of the regulatory limit or 5% of the analyte concentration in the sample.

J  Estimated concentration when the value is less than ARI’s established reporting limits

D  The spiked compound was not detected due to sample extract dilution

NR  Spiked compound recovery is not reported due to chromatographic interference

.E  Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.

S  Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obtain valid quantification of the analyte

NA  The flagged analyte was not analyzed for
NS The flagged analyte was not spiked into the sample

M Estimated value for an analyte detected and confirmed by an analyst but with low spectral match parameters. This flag is used only for GC-MS analyses

M2 The sample contains PCB congeners that do not match any standard Aroclor pattern. The PCBs are identified and quantified as the Aroclor whose pattern most closely matches that of the sample. The reported value is an estimate.

N The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"

Y The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.

C The analyte was positively identified on only one of two chromatographic columns. Chromatographic interference prevented a positive identification on the second column

P The analyte was detected on both chromatographic columns but the quantified values differ by ≥40% RPD with no obvious chromatographic interference

Geotechnical Data

A The total of all fines fractions. This flag is used to report total fines when only sieve analysis is requested and balances total grain size with sample weight.

F Samples were frozen prior to particle size determination

SM Sample matrix was not appropriate for the requested analysis. This normally refers to samples contaminated with an organic product that interferes with the sieving process and/or moisture content, porosity and saturation calculations

SS Sample did not contain the proportion of "fines" required to perform the pipette portion of the grain size analysis

W Weight of sample in some pipette aliquots was below the level required for accurate weighting
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<th>CONC. UG/MLSOLVENT</th>
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*=REVERIFIED SOLUTION

#=PROJECT SPECIFIC SOLUTION
# Surr Solutions

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<td>J</td>
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</table>

* = Revised Solution

# = Project Specific Solution
Data Summary Package

prepared
for

Science Applications, Intl.

Project: PORT GARDNER, 01-0236-00-6929

ARI JOB NO: OY53

prepared
by

Analytical Resources, Inc.
Lab Sample ID: OY53A  
LIMS ID: 09-11059  
Matrix: Tissue  
Data Release Authorized:  
Reported: 05/22/09  

Date Extracted: 05/14/09  
Date Analyzed: 05/20/09 19:30  
Instrument/Analyst: ECD5/PKC  
GPC Cleanup: Yes  
Sulfur Cleanup: No  
Acid Cleanup: Yes  
Florisil Cleanup: No  

Project: PORT GARDNER  
01-0236-00-6929  
Date Sampled: 08/08/08  
Date Received: 05/12/09  

Sample Amount: 25.1 g-as-rec  
Final Extract Volume: 5.0 mL  
Dilution Factor: 1.00  
Silica Gel: No  
Percent Moisture: NA  

<table>
<thead>
<tr>
<th>CAS Number</th>
<th>Analyte</th>
<th>RL</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>12674-11-2</td>
<td>Aroclor 1016</td>
<td>20</td>
<td>&lt; 20 U</td>
</tr>
<tr>
<td>53469-21-9</td>
<td>Aroclor 1242</td>
<td>20</td>
<td>&lt; 20 U</td>
</tr>
<tr>
<td>12672-29-6</td>
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<td>&lt; 20 U</td>
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<tr>
<td>11097-69-1</td>
<td>Aroclor 1254</td>
<td>20</td>
<td>&lt; 20 U</td>
</tr>
<tr>
<td>11096-82-5</td>
<td>Aroclor 1260</td>
<td>20</td>
<td>&lt; 20 U</td>
</tr>
<tr>
<td>11104-28-2</td>
<td>Aroclor 1221</td>
<td>20</td>
<td>&lt; 20 U</td>
</tr>
<tr>
<td>11141-16-5</td>
<td>Aroclor 1232</td>
<td>20</td>
<td>&lt; 20 U</td>
</tr>
<tr>
<td>37324-23-5</td>
<td>Aroclor 1262</td>
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<tr>
<td>11100-14-4</td>
<td>Aroclor 1268</td>
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</table>

Reported in µg/kg (ppb)

**PCB Surrogate Recovery**

<table>
<thead>
<tr>
<th>Surrogate</th>
<th>Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decachlorobiphenyl</td>
<td>90.0%</td>
</tr>
<tr>
<td>Tetrachlorometaxylene</td>
<td>94.8%</td>
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</tbody>
</table>
### ORGANICS ANALYSIS DATA SHEET

**Sample ID:** FG-A2-T1-ES-A  
**Duplicate**

**Lab Sample ID:** OY53A  
**LIMS ID:** 09-11059  
**Matrix:** Tissue  
**Data Release Authorized:**  
**Reported:** 05/22/09  
**QC Report No:** OY53-Science Applications, Intl.  
**Project:** FORT GARDNER  
**01-0236-00-5929**  
**Date Sampled:** 08/08/08  
**Date Received:** 05/12/09  
**Sample Amount:** 25.1 g-as-rec  
**Final Extract Volume:** 5.0 mL  
**Dilution Factor:** 1.00  
**Silica Gel:** No  
**Percent Moisture:** NA

**Date Extracted:** 05/14/09  
**Date Analyzed:** 05/20/09 19:48  
**Instrument/Analyst:** ECD5/PKC  
**GFC Cleanup:** Yes  
**Sulfur Cleanup:** No  
**Acid Cleanup:** Yes  
**Florisil Cleanup:** No

<table>
<thead>
<tr>
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<th>RL</th>
<th>Result</th>
</tr>
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</tr>
<tr>
<td>11100-14-4</td>
<td>Aroclor 1268</td>
<td>20</td>
<td>&lt; 20 U</td>
</tr>
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</table>

**Reported in µg/kg (ppb)**

**PCB Surrogate Recovery**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Decachlorobiphenyl</td>
<td>83.2%</td>
</tr>
<tr>
<td>Tetrachlorometaxylene</td>
<td>87.5%</td>
</tr>
</tbody>
</table>
**SW8082/PCH SOIL/SEDIMENT SURROGATE RECOVERY SUMMARY**

Matrix: Tissue  
Project: PORT GARDNER  
01-0236-00-6929

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<tr>
<th>Client ID</th>
<th>DCBP % REC</th>
<th>LCL-UCL</th>
<th>DCBP % REC</th>
<th>LCL-UCL</th>
<th>TCMB % REC</th>
<th>LCL-UCL</th>
<th>TCMB % REC</th>
<th>LCL-UCL</th>
<th>TOT OUT</th>
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<tbody>
<tr>
<td>MB-051409</td>
<td>97.0%</td>
<td>30-160</td>
<td>87.8%</td>
<td>30-160</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LCS-051409</td>
<td>90.5%</td>
<td>30-160</td>
<td>87.5%</td>
<td>30-160</td>
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</tr>
<tr>
<td>PG-A2-T1-ES-A</td>
<td>90.0%</td>
<td>30-160</td>
<td>94.8%</td>
<td>30-160</td>
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<tr>
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<td>83.2%</td>
<td>30-160</td>
<td>87.5%</td>
<td>30-160</td>
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Client Specified Control Limits  
Prep Method: TissM  
Log Number Range: 09-11059 to 09-11059
Lab Sample ID: LCS-051409
LIMS ID: 09-11059
Matrix: Tissue
Data Release Authorized: Yes
Reported: 05/22/09

Date Extracted: 05/14/09
Date Analyzed: 05/20/09 19:13
Instrument/Analyst: ECD5/PKC
GFC Cleanup: Yes
Sulfur Cleanup: No
Acid Cleanup: Yes
Florisil Cleanup: No

Project: FORT GARDNER
01-0236-00-6929
Date Sampled: NA
Date Received: NA

Sample Amount: 25.0 g-as-rec
Final Extract Volume: 5.0 mL
Dilution Factor: 1.00
Silica Gel: No
Percent Moisture: NA

**Analyte** | **Lab Control** | **Spike Added** | **Recovery**
--- | --- | --- | ---
Aroclor 1016 | 111 | 100 | 111%
Aroclor 1260 | 115 | 100 | 115%

**PCB Surrogate Recovery**
- Decachlorobiphenyl: 90.5%
- Tetrachlorometaxylene: 87.5%

Results reported in µg/kg (ppb)
Lab Name: ANALYTICAL RESOURCES, INC  
ARI Job No.: OY53  
Lab Sample ID: OY53MBS1  
Date Extracted: 05/14/09 
Date Analyzed: 05/20/09  
Time Analyzed: 18:56  
Client: SAIC  
Project: PORT GARDNER  
Lab File ID: 0520B030  
Matrix: SOLID  
Instrument ID: ECD5  
GC Columns: ZB5/ZB35

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS and MSD:

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<th>DATE ANALYZED</th>
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<tr>
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ALL RUNS ARE DUAL COLUMN
LAB SAMPLE ID: MB-051409
LIMS ID: 09-11059
Matrix: Tissue
Data Release Authorized: 05/22/09

Date Extracted: 05/14/09
Date Analyzed: 05/20/09 18:56
Instrument/Analyst: ECD5/PKC

Sample Amount: 25.0 g
Final Extract Volume: 5.0 mL
Dilution Factor: 1.00

Percent Moisture: NA

Project: FORT GARDNER
01-0236-00-6929
Date Sampled: NA
Date Received: NA

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FORM I