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TRANSMITTAL

Date: December 4, 2008
Project Number: 94175 / 7.1

To:

Mr. Tim Hemstreet, P.E.
Senior Project Manager
PacifiCorp Energy Hydro Resources
825 N.E. Multnomah, Suite 1500
Portland, Oregon 97232

Subject:

Updated Evaluation of Mercury Bioaccumulation
Underwood In Lieu Fishing Access Site
Northwestern Lake – Condit Hydroelectric Project
FERC Project No. 2342
White Salmon, Washington

We are sending the following:

Three copies of the above-referenced Updated Evaluation of Mercury Bioaccumulation for the Underwood In Lieu Fishing Access Site.

Remarks:

If you have any questions, please contact me at (503) 644-9447.

Thank you.

By:

Peter L. Stroud, LEG
Principal Engineering Geologist

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UPDATED EVALUATION OF MERCURY BIOACCUMULATION UNDERWOOD IN LIEU FISHING ACCESS SITE NORTHWESTERN LAKE CONDIT HYDROELECTRIC PROJECT FERC PROJECT No. 2342 WHITE SALMON, WASHINGTON KLEINFELDER PROJECT NO. 94175 / 7.1

December 4, 2008

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December 4, 2008
Kleinfelder Project Number 94175 / 7.1

Mr. Tim Hemstreet, P.E.
Senior Project Manager
PacifiCorp Energy Hydro Resources
825 N.E. Multnomah, Suite 1500
Portland, Oregon 97232

Subject: Updated Evaluation of Mercury Bioaccumulation
Underwood In Lieu Fishing Access Site
Northwestern Lake – Condit Hydroelectric Project
FERC Project No. 2342
White Salmon, Washington

Dear Mr. Hemstreet:

We are pleased to present our Updated Evaluation of Mercury Bioaccumulation at the Underwood In Lieu Fishing Access Site. We trust the information contained in this report will meet your needs at this time.

We appreciate this opportunity to provide our services to you. Should you require additional information or have any questions regarding this report, please contact us at (503) 644-9447.

Sincerely,

KLEINFELDER WEST, INC.

Peter L. Stroud, LEG
Principal Engineering Geologist

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1.0 INTRODUCTION

This report presents the results of an evaluation of mercury bioaccumulation from sediment collected at the Underwood In Lieu Fishing Access Site (ILFAS). The evaluation of this supplemental sample collected in May 2008 was performed to provide bioaccumulation information from a reference sample more representative of the fine sediment in Northwestern Lake than was obtained from background sampling conducted in June 2007. This information will enhance the understanding of the potential impacts of the open water release of sediments from Northwestern Lake following the proposed removal of the dam.

In December 2006, Kleinfelder, under contract to PacifiCorp Energy, collected sediment characterization samples from Northwestern Lake and reported the results in a *Sediment Sampling and Analysis Report* (March 2007). This investigation concluded that the average concentration of mercury in the fine silts impounded behind Condit dam that comprise the Lower Basin dredged material management unit (DMMU) is approximately 0.72 milligrams per kilogram (mg/kg). During this work, the maximum detected concentration of mercury in the sediments was 2.03 mg/kg in the surface sediment at a location (boring B-1) near the dam. Laboratory bio-assays conducted on the sediment collected during this field work indicated that the sediment had no adverse effect on the life cycles of test species.

The applicable current regulatory screening levels for mercury in fresh water sediments are found in the *Northwest Regional Sediment Evaluation Framework* (NWRSEF) (September, 2006) and are 0.28 mg/kg (lower screening level, SL1) and 0.75 mg/kg (upper screening level, SL2). The NWRSEF states, "The lower screening level (SL1) corresponds to a concentration below which adverse effects to benthic organisms would not be expected, and the upper screening level (SL2) corresponds to a concentration at which minor adverse effects may be observed in the more sensitive groups of benthic organisms."

Because mercury concentrations were found in excess of the upper screening level (SL2), the Regional Sediment Evaluation Team (RSET), composed of representatives of various state and federal regulatory agencies, requested that PacifiCorp Energy collect supplemental information to confirm the elevated mercury concentrations found in sediment near the dam at boring location B-1 in Northwestern Lake, establish the

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bio-availability of mercury found in the sediments through bioaccumulation studies of fish, worms, and clams, and ascertain background sediment mercury concentrations in the local area.

The supplemental sampling and analysis was completed in July of 2007. However, sediments collected as a reference sample from the Little White Salmon River and used as part of the bioaccumulation study were determined to not be representatively similar to the White Salmon River sediments. Specifically, the Little White Salmon River sediments were composed of less than 70 percent fines, whereas the White Salmon River (and Northwestern Lake) sediments were typically 95 percent (or greater) fines. Based on this, RSET requested an additional bioaccumulation study be performed with sediment from the Underwood In Lieu Fishing Access Site, which is on the White Salmon River and was shown to include sediments that are similar to those collected from Northwestern Lake.

The data presented in this report are intended to further test the hypothesis presented in the *March 2007 Sediment Report* and the *November 2007 Supplemental Evaluation of Mercury in Sediments Report*, which suggested that the elevated concentrations of mercury encountered in the fine-grained sediments impounded in Northwestern Lake behind Condit dam are due to naturally occurring background concentrations of the native element. This hypothesis was developed based on the understanding that hydrothermal alteration associated with recent volcanic activity, such as that which has occurred with Mount St. Helens, is a known source of mercury. Additionally, there are no known anthropogenic sources of mercury within the White Salmon River basin and high background concentrations of mercury have been documented in water quality and sediment samples on the Washington side of the Columbia River from previous studies.

The information presented in this document is intended to satisfy the RSET and *NWRSEF* criteria. Included in this report for comparison are the data provided in the *November 2007 Evaluation of Mercury in Sediments Report*.

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2.0 BACKGROUND INFORMATION

The following sections describe the project and sampling history, the site ranking criteria, and proposed dredging and sampling parameters.

2.1 PROPOSED ACTION

Northwestern Lake sediments are proposed to be released in an "open-water" fashion during the decommissioning of Condit dam. Since the construction of the dam and formation of the lake, the natural transport of sediments by the White Salmon River has been disrupted, and the sediments previously transported to the Columbia River are now deposited in the slack water of Northwestern Lake.

The removal of Condit dam would initiate the discharge of a portion of the impounded sediment into the lower White Salmon River, a tributary of the Columbia River. As the U.S. Army Corps of Engineers (USACOE) Portland District stated in a letter dated December 15, 2004, "Because the sediment will settle out within the river systems, the project would result in unconfined aquatic disposal of sediments into the Lower Columbia River system." Unconfined aquatic disposal of sediments is regulated by the USACOE. The Regional Sediment Evaluation Team; composed of: the USACOE's Seattle District, Portland District, Walla Walla District, and Northwestern Division; in collaboration with the U.S. Environmental Protection Agency (EPA) Region 10; Washington Department of Ecology (WDOE), Washington Department of Natural Resources (WDNR); Oregon Department of Environmental Quality (ODEQ); Idaho Department of Environmental Quality (IDEQ); National Marine Fisheries Service (NMFS); and the U.S. Fish and Wildlife Service (US F&WS); has developed a framework for evaluating sediments and the suitability of disposing those sediments in the Pacific Northwest. This framework is presented in the *Northwest Regional Sediment Evaluation Framework, Interim Final, September 2006*.

The sediments were physically and chemically characterized in 1994 and again in 2006/2007. In addition, information on the bioaccumulation of mercury was evaluated for fish, clams, and aquatic oligochaete worms. To assist with the continued evaluation of the bioaccumulation of mercury, Kleinfelder prepared a Sampling and Analysis Plan (SAP). The objective of this SAP was to detail the collection location, procedures, and analytical methods to be used to obtain the bioaccumulation data to supplement the

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existing data presented in previous sediment characterization reports for the Condit Hydroelectric Project.

2.2 PROJECT DESCRIPTION

The Condit Hydroelectric Project is located along the White Salmon River above Washington State Highway 14 on the border between Klickitat and Skamania Counties, approximately 3.3-miles upstream from the confluence of the White Salmon and Columbia Rivers (Figure 1). The U.S. Geological Survey (USGS) topographic coordinates for the reservoir are Sections 2 and 3, Township 3 North, Range 10 East, Willamette Meridian (Sec. 2 and 3/T3N/R10E W.M.). The Condit Project includes a 125-foot high concrete dam across the White Salmon River that diverts water into a 5,100-foot long wood stave flowline. The wood stave flowline conveys water to a surge tank, where the water is diverted into two pipes (penstocks) for delivery to two turbine generators in the powerhouse downstream of the dam.

The Condit Project is owned and operated by PacifiCorp Energy and is regulated by the Federal Energy Regulatory Commission (FERC) as Project No. 2342. It has been in operation since construction was completed in 1913. The name of the reservoir behind the dam is Northwestern Lake. Northwestern Lake is approximately 1.8-miles long with a surface area of approximately 92 acres. The pool elevation listed on the USGS Northwestern Lake topographic map (1983 Edition) is 294 feet above mean sea level (msl). At the time of its construction, the depth of water in the reservoir ranged from approximately 15 to 110 feet. Since the construction of the dam, the reservoir has been collecting sediments brought in by the White Salmon River. As of 1990, the depth of water in the reservoir reportedly ranged from approximately 3 to 85 feet.

2.3 PREVIOUS INVESTIGATIONS

Bathymetric surveys of the reservoir were conducted by PacifiCorp Energy in 1990, 1997, and 2006. The sediments in Northwestern Lake, located behind Condit dam, were investigated by advancing ten borings for the collection of sediment and bedrock samples in 1994. The results of the 1994 investigation were presented in a report prepared by Squier Associates, entitled *"Condit Hydroelectric Project (FERC Project No. 2342), Northwestern Lake Sediment Characterization Study, White Salmon, Washington,"* dated April 29, 1994. The 1994 investigation was developed in general

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accordance with the protocols of the Puget Sound Dredge Disposal Analysis (PSDDA) program.

The 1994 sediment characterization testing program consisted of both geotechnical and environmental testing. The geotechnical testing parameters included the following:

- soil classification
- moisture content
- grain-size analysis
- unit weight determination

The geotechnical testing indicated that the reservoir sediments consist mainly of fine-grained materials in the downstream deep pool area and granular materials in the upstream area. Located in the middle of the reservoir is a transition area where the upstream granular sediments have overridden the deep pool, fine-grained sediments.

The interpretation of the 1994 environmental testing results indicated that the metal concentrations were within expected background levels. However, remnant pesticides and herbicides were detected in the intermediate-aged sediments in the reservoir.

A second investigation of the sediments was conducted by Squier Associates in 1997. The results of that second investigation were presented in a report entitled, *"Additional Geotechnical Exploration and Laboratory Testing at the Condit Hydroelectric Project (Contract No. P018780)"* dated November 20, 1997.

In 1998, the cooperative interagency/intergovernmental team consisting of the USACOE, EPA Region 10, WDOE, WDNR, and ODEQ produced the Dredged Material Evaluation Framework, Lower Columbia River Management Area (DMEF). The DMEF established a tiered system for ranking the suitability of unconfined aquatic disposal of sediments at proposed dredging sites. The *DMEF* Tier I used existing information to conclude whether or not there is "enough information to determine if project meets exclusion ranking." Exclusionary ranking was a management area ranking that provided the least stringent characterization requirements. Projects from specific areas listed in the *DMEF* were awarded the exclusionary ranking. Northwestern Lake currently was not located in one of the listed zones for exclusionary ranking. The exclusionary criteria also included sediments that were to be used for beach enhancement and sediments whose

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final placement would be the same substrate as their origin. The Northwestern Lake sediments did not meet either criterion.

Exclusionary ranking was also awarded to locations whose sediments had at least 80% sand retained on a number (No.) 230 sieve (i.e., less than 20% fines) and a total volatile solids (TVS) content of less than 5.0%. Mechanical sieve analysis of the sediments collected from the upstream portion of Northwestern Lake demonstrated that those sediments met the criterion of having less than 20% fines.

However, in order to determine if the 1994 data were suitable, the data were first compared to the framework of Tiers II and IIB. Consequently, it was concluded that the sediments from Northwestern Lake (as one discrete unit) did not meet the criteria for exclusionary ranking. It was further concluded that the low management area ranking was appropriate. The Northwestern Lake sediment source location met the following criteria for low management area ranking:

- Low concentrations of chemicals of concern (COC)
- Some locations of higher percentages of fines
- Few sources of potential contamination

The *DMEF* allowed for the creation of dredged material management units (DMMUs), which are subdivisions of a sediment-generating project site that represent sediments similar in nature. Based on this understanding, the Northwestern Lake sediments were segregated into two DMMUs: the lower basin sediments and the upstream gravels of the upper reservoir. The segregation into two DMMUs provided for one Low management area ranking of homogenous sediments (Lower Basin) and one area of exclusionary ranking (Upper Reservoir). The homogeneity of the sediments was supported by the 1994 mechanical sieve data. Based on the information presented in the *1994 Condit Study*, the lower basin included about 51% of the sediments (approximately 1,122,000 cubic yards).

The DMEF requirement for a homogeneous Low Management Area Ranking DMMU was one sample per 100,000 cubic yards. Accordingly, 12 samples were proposed to characterize the 1,122,000 cubic yards of sediment.

In December 2006, Kleinfelder (formerly Squier Associates and Squier | Kleinfelder) conducted additional sediment sampling in the lower basin of Northwestern Lake in

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order to obtain current data on the chemical characterization of the fine-grained sediments. A total of 15 probes were advanced into the fine-grained sediments for the collection of 12 project and three quality control samples. The analytical results were compared to the screening levels provided in the USACOE's *Dredged Material Evaluation Framework, Lower Columbia River Management Area,* November 1998. The sampling and analysis plan developed for the 2006 phase of sediment sampling was approved by the USACOE in August 2006.

The data that were collected during implementation of the 2006 SAP were intended to satisfy the requirements of the USACOE in accordance with the applicable Tier IIB and Tier III testing guidelines as presented in the DMEF. However, the RSET introduced the Interim Final of the NWRSEF in September 2006. The NWRSEF provides more stringent fresh water screening criteria (compared to marine screening criteria) and divides the screening criterion into two discrete levels (SL1 and SL2). The mercury concentrations reported for four of the 12 project sediment samples and the three duplicate samples collected in December 2006 exceeded the SL2 criterion (0.75 mg/kg) for mercury.

Supplemental sediment sampling and analysis were performed in July of 2007 to confirm sediment mercury concentrations, establish mercury background levels, and assess bioaccumulation as requested by members of the RSET. Ten samples were collected from the Northwestern Lake and White Salmon River region. Sample results again indicated the presence of mercury in fine-grained surface sediments located near the dam, but at lower concentrations than previously found. Additional sediment was collected from Northwestern Lake and from a reference site on the Little White Salmon River (near the fish hatchery) to be used as part of the mercury bioaccumulation study. Clam and aquatic oligochaete worm tissue tested after laboratory exposure to Northwestern Lake sediments indicated that mercury was accumulating in aquatic worm tissue but not in clam tissues. Fish tissues collected from specimens captured in Northwestern Lake were also found to have accumulated mercury.

The reference sediment sample collected from the Little White Salmon River did not contain a similar percentage of fine-grained sediments as the sample from Northwestern Lake. Because the reference sample was not representative of fine sediments such as those contained in Northwestern Lake, the RSET requested that another bioaccumulation study be performed with sediment collected at the Underwood

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In Lieu Fishing Access Site (Figure 2). Physical testing of sediment from the Underwood In Lieu Fishing Access Site demonstrated that sediment at that location was more characteristically similar to the sediment collected from Northwestern Lake.

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3.0 SITE EXPLORATION METHODOLOGY AND LOCATION

The following sections discuss the methodologies and protocols used to complete the field portion of this project.

3.1 SUPPLEMENTAL SAMPLING AND ANALYSIS PLAN

Kleinfelder submitted a *Sampling and Analysis Plan for the Evaluation of Mercury Bioaccumulation at the In-Lieu Fishing Access Site* (*SSAP*) to PacifiCorp Energy on April 15, 2008 (April 2008 SSAP). A copy of the SSAP is included in Appendix A. After PacifiCorp Energy's review and approval, the *April 2008 SSAP* was submitted to RSET for review and approval. The objective of the *April 2008 SSAP* was to provide a systematic approach to collecting additional sediment characterization data that would supplement the existing data presented in the *November 2007 Supplemental Evaluation of Mercury in Sediments Report* (2007 SEMSR). The data collected during implementation of the *April 2008 SSAP* are intended to satisfy the requirements of the RSET in accordance with the *NWRSEF*.

The Project Review Group (PRG) (consisting of a representative from Army Corps of Engineers, National Marine Fisheries Service, and Washington Department of Ecology) approved the *April 2008 SSAP* on May 9, 2008, in a transmittal to PacifiCorp Energy (Appendix B). The Washington Department of Fish and Wildlife provided a *Hydraulic Project Approval* on May 5, 2008, that authorized the sampling program to proceed at the Underwood In Lieu Fishing Access Site. A copy of the *Hydraulic Project Approval* is also included in Appendix B.

3.2 SAMPLING DATE, LOCATION, AND FIELD DOCUMENTATION

A team consisting of two Kleinfelder representatives conducted the field work to collect the sediment sample. The sediment sample was collected from the Underwood In Lieu Fishing Access Site on May 21, 2008. The sample collected at the Underwood In Lieu Fishing Access Site was labeled ILFAS-052108. The location of the sample point was determined with a Global Positioning System (GPS) unit with a minimum of three satellite points for reference. The coordinates of this sampling location and the other sampling locations from the Northwestern Lake sediment sampling characterization effort are included in Table 1. The sample collection location is shown in Figure 2.

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The sediment sampling location was documented by a member of the Kleinfelder field team in the field notes, which were maintained during sampling operations. Included in the field notes was the following information:

- Names of the individuals onsite during sample collection
- Weather conditions
- Depth to top of sediments (mudline) at sampling station
- Date and time of collection of sample
- The sample identification number
- Physical sediment description, including general soil classification and observations for the presence of vegetation, debris, evidence of biological activity, and other distinguishing characteristics or features
- Any deviation from the approved sampling plan

The sediment sample for chemical analysis testing was immediately placed in properly labeled, laboratory-supplied glass jars with Teflon®-lined lids that were then placed on ice. Containers were filled as tightly as possible, eliminating obvious air pockets. With the cap liner's Teflon® side down, the cap was carefully placed on the opening of the container, displacing any excess material. A bulk sample for use in the exposure process of the bioaccumulation testing was placed into three clean, 5-gallon plastic buckets with clean lids.

The sampling containers were labeled with: the project name, sample identification, date, and time and referenced by entry into the field logs. New, disposable nitrile gloves were worn before the sample was collected and changed, as needed, during the collection of the sample as several containers were filled.

3.3 SAMPLE TRANSPORT AND CHAIN-OF-CUSTODY PROCEDURES

Following sample collection, the samples were packed on ice in coolers. A signed and dated chain-of-custody seal was placed on all coolers prior to removal from the site. The chain-of-custody records were maintained throughout all sampling activities and accompanied samples during shipment to the laboratory. Information tracked by the chain-of-custody records included: sample identification number, date and time of sample receipt, and analytical parameters requested.

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4.0 CHEMICAL AND PHYSICAL ANALYSES RESULTS

Chemical and physical analyses of the sediment sample was conducted to determine the similarity of the reference sample collected at the Underwood In Lieu Fishing Access Site to the sediment samples collected from Northwestern Lake. The results of these analyses are presented and discussed below.

4.1 CHEMICAL ANALYSES RESULTS

A split of the sediment sample was delivered under chain-of-custody protocols to Apex Labs (Apex) in Tigard, Oregon, for chemical analysis. The project sample collected on May 21, 2008, was tested for the following:

- mercury concentrations by EPA Method 7471A
- total organic carbon (TOC) by American Society for Testing and Materials (ASTM) Method D 4129-98M.

The results of the chemical analyses are presented in Tables 2 and 3 along with the results from previously collected samples. Copies of the analytical reports provided by Apex are included in Appendix C. The results are summarized as follows:

- The mercury concentration from the sediment sample (ILFAS-052108) obtained from the In Lieu Fishing Access Site in May 2008 was 1.20 mg/kg.
- The mercury concentration in the sediment sample (SP5-071707) collected at this location in July 2007 was 0.72 mg/kg. Thus, the average of the mercury concentrations from sediment samples obtained from the In Lieu Site is 0.96 mg/kg.
- The sediment sample collected from Northwestern Lake in December 2006 (sample B1-72) contained 2.03 mg/kg mercury. The mercury concentrations reported for the seven supplemental samples collected from this same area in 2007 were all less than the concentration detected in sample B1-72. The average mercury concentration in the seven sediment samples collected in Northwestern Lake in July 2007 was 0.60 mg/kg (range 0.094 mg/kg to 0.881 mg/kg). When the sample from 2006 is included, the average concentration of mercury in surface sediment samples in the vicinity of the B1 sample location is 0.78 mg/kg. The mercury concentrations in the supplemental sediment samples appear to be more consistent with the average mercury concentrations derived from the data presented in the *March 2007 Sediment Report*.

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- With an average concentration of 0.78 mg/kg at the B1 sample location, the average concentration of mercury in the 12 sample locations used to characterize sediments contained in the Lower Basin DMMU is 0.617 mg/kg.
- The mercury concentration in the sample collected from the In Lieu Site in May 2008 was almost twice the average concentration of mercury in the Lower Basin DMMU samples.
- At the Underwood In Lieu Fishing Access Site, the percentage of total solids was 67.6. Total solids in Northwestern Lake sediment samples collected in July 2007 ranged from 43.7 percent to 55.1 percent with an average of 50.4 percent (50.1 percent if the 2006 sample is included). Percent solids was not reported for the background sediment samples.

Total organic carbon (TOC) in the sample collected at the Underwood In Lieu Fishing Access Site in May 2008 was 1.20 percent. TOC in the samples collected in Northwestern Lake in July 2007 ranged from 0.86 percent (8,600 mg/kg) to 1.64 percent (16,400 mg/kg) with an average of 1.37 percent (13,700 mg/kg) or 1.33 percent if the 2006 sample is included. TOC in the sample collected from the In Lieu Site was similar to (slightly less than) the average TOC of the Northwestern Lake samples. TOC was not reported for the sediment samples collected for evaluation of background concentrations of mercury.

4.2 PHYSICAL PARAMETER ANALYSES RESULTS

A representative spilt of the sample from the In Lieu Site was delivered to Kleinfelder's soils testing lab in Beaverton, Oregon. The sample was analyzed for grain size determination using ASTM D422 and ASTM D2487 methods. The ASTM D422 analysis used the following sieve sizes: 5-inch; 2.5-inch; 1.25-inch; 0.63-inch; 0.31-inch; and numbers 5, 10, 18, 35, 60, 100, and 200. The fine-grained fraction (finer than No. 200 sieve) was classified using hydrometer analysis. Hydrogen peroxide was not used in the preparation for grain size analysis.

The results of the grain size analysis are provided in Appendix D and are summarized in Table 4. On the basis of the grain size analysis, Kleinfelder has classified the sediment in accordance with the Unified Soil Classification System, ASTM D 2487. The sediment classification is presented in Table 4. Note that the grain size composition of sediments from the locations sampled for background mercury levels are variable and

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not uniformly consistent with the grain size composition of sediments from Northwestern Lake.

4.3 COMPARISON OF FINDINGS TO NWRSEF SCREENING LEVELS

The applicable, current regulatory screening levels for mercury in freshwater sediments are found in the NWRSEF. These screening levels include a lower screening level (SL1) of 0.28 mg/kg and an upper screening level (SL2) of 0.75 mg/kg. The sediment sample (B1-72) collected from Northwestern Lake in 2006 contained mercury at a concentration that exceeded the SL2 of 0.75 mg/kg, above which minor effects may be observed in more sensitive benthic organisms. Five of the seven samples collected to evaluate the distribution of mercury in Northwestern Lake sediments in the vicinity of the sample B1-72 exceeded the SL1 screening level of 0.28 mg/kg, which is a level below which adverse effects to benthic organisms would not be expected. Four of those five samples also exceeded the SL2 screening level. The average mercury concentration for the seven samples (NW1-071807 through NW7-071807) also exceeded the SL1 screening level, and the average including the sample collected in 2006 exceeded the SL2. The sample collected from the In Lieu Site in May 2008 also exceeded the SL1 and SL2 screening levels. The concentration of mercury in the previous sample collected from In Lieu Site in July 2007 exceeded the SL1 and was just below the SL2. Of the sediment samples collected to evaluate background mercury concentrations, only Mill Creek and In Lieu Site sediments contained mercury at levels that exceeded screening levels. The concentration of mercury in sediment taken from Mill Creek exceeded the SL1 but not the SL2.

4.4 QUALITY ASSURANCE AND QUALITY CONTROL

Samples submitted to Apex Labs were initially analyzed for TOC and mercury using EPA Methods SW9060A and 6020, respectively, although the submitted chain of custody specified using Method ASTMD 4129-98M for TOC and EPA Method 7471A for mercury. Once this discrepancy was discovered Apex Labs resubmitted the samples to Columbia Analytical Services (CAS) in Kelso, Washington for analysis by the appropriate methods. The additional time required for re-analysis resulted in an exceedance of the method hold times. The methods specify a hold time of 28 days, and the second set of tests were conducted 55 days after the hold time ended. The two mercury methods should produce comparable results, and the two test results are very similar. The mercury results were 1.14 mg/kg (Method 6020) and 1.20 mg/kg

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(Method 7471). The TOC methods produce results in different unit measurements. The TOC results were 37.6 mg/kg (Method 9060) and 1.20 percent (Method 4129). CAS-Kelso has provided a Case Narrative for their package of laboratory results submitted for this set of analyses (Appendix C). No other anomalies or problems were noted.

Our QA review of the data indicates that the data are valid and, therefore, are acceptable for use in accomplishing the project objectives. Kleinfelder's QA/QC review included an evaluation of both the laboratory and field QA/QC procedures and results.

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5.0 MERCURY BIOACCUMULATION EVALUATION

The State of Washington recognizes certain toxic substances in the environment as being bioaccumulative. Bioaccumulation is the process wherein a member of the biosphere takes in a substance quicker than it will excrete the same substance. This is a problem when the substance is toxic. The bioaccumulated toxic substance can also be passed along from one species (prey) to another species (predator). The larger the organism and the more active a carnivore an organism is, the greater the potential bioaccumulation. Mercury is a recognized bioaccumulative toxic substance.

To evaluate the bioavailability of mercury found in the sediments through invertebrate tissue analysis, bioaccumulation testing was conducted. Previous testing indicated the bioaccumulation of mercury in sediments collected from Northwestern Lake. The purpose of the bioaccumulation study for sediment collected from the In Lieu Site was to evaluate the bioavailability of background mercury in sediment similar to that of Northwestern Lake.

5.1 FIRST PHASE OF LABORATORY ACTIVITY FOR BIOACCUMULATION EVALUATION

Kleinfelder provided NW Aquatic Sciences of Newport, Oregon with 15 gallons of sediment obtained from the In Lieu Site. The sample was collected on May 21, 2008, and placed into clean, 5-gallon buckets dedicated to the bioaccumulation tests.

The reference sample location (ILFAS-052108) was selected because, based on field observations and laboratory testing, sediment at this location most closely resembled the sediment collected from the sample locations in Northwestern Lake that had mercury concentrations in excess of screening levels. A negative control sediment sample was collected by NW Aquatic personnel on May 21, 2008, from Beaver Creek, located about 8-miles south of Newport, Oregon. The negative control sample was press sieved through a 1.0 millimeter screen.

NW Aquatic conducted the exposure portion of the test using In Lieu Site test sediment and control sediments for a period of 28 days. During this 28 day period, oligochaete worm of the species *Lumbriculus* were exposed to the sediments. The exposures were conducted according to protocols based on EPA Method 100.3, EPA document 600/R-99-024, EPA document EPA-B-98-004 (the Inland Testing Manual), and ASTM E-1688-97a. Five sets of animals were used to provide the appropriate controls and replicates.

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Specific details of the test procedures are presented in NW Aquatic's reports which are included in Appendix E.

5.2 SECOND PHASE OF LABORATORY ACTIVITY FOR BIOACCUMULATION EVALUATION

When the exposure period was completed, NW Aquatic provided the following sets of tissue samples to the Brooks Rand laboratory in Seattle, Washington:

- Five sets of tissue comprised of *Lumbriculus* that were exposed to the In Lieu Site sediments.
- Five sets of tissue comprised of *Lumbriculus* that were exposed to the control sediments.
- Five sets of tissue comprised of *Lumbriculus* that were not exposed to any sediments.

Brooks Rand laboratory composited each of the three groups of worms into three individual samples for analysis. One sample represented the tissue exposed to the In Lieu sediment that was collected at a single location; one sample represented the tissue exposed to the control sediment that was from a single location from Newport, Oregon; and one sample represented the tissue that was not exposed to any sediment. Brooks Rand personnel homogenized separately each of the three individual composited oligochaete worm samples. Homogenization blanks were also prepared at that time.

The samples were tested for mercury using an appendix to EPA Method 1631. Further information on the sample preparation is included in Brooks Rand's report, which is included in Appendix F. The results of Brooks Rand's mercury analysis is included in Appendix F and are summarized in Table 5.

5.3 BIOACCUMULATION EVALUATION TEST RESULTS

Mercury was detected in all oligochaete worm tissue samples including the homogenization blank. The level of mercury detected in the tissue of worms exposed to the Underwood In Lieu Fishing Access Site sediments was 0.186 mg/kg. The tissue of worms exposed to the Northwestern Lake sediments collected in June 2007 had an average concentration of 0.347 mg/kg of mercury. During bioaccumulation tests conducted on Underwood In Lieu Fishing Access Site sediments, mercury was detected in the pre-exposure worm tissue at 0.00133 mg/kg and in control worm tissue at 0.0106 mg/kg. During the previous bioaccumulation study of Northwestern Lake sediments

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(collected in June 2007), mercury was detected in the pre-exposure worm tissue sample at an average of 0.00422 mg/kg and in control worm tissue at an average of 0.01312 mg/kg. The background level of mercury in the oligochaetes used in the bioaccumulation test appears to be approximately 0.003 mg/kg lower in the In Lieu Site study samples than in the Northwestern Lake samples, and the difference seems to be carried over into the controls. Controls from the In Lieu Site sediment bioaccumulation study also contained mercury at a level approximately 0.003 mg/kg less than the levels observed in controls in the study of the Northwestern Lake sediments.

The average concentration of mercury in oligochaetes exposed to sediments from Northwestern Lake was almost twice the concentration of mercury found in oligochaetes exposed to sediments from the Underwood In Lieu Fishing Access Site. The difference in the concentrations of mercury between pre-exposed worms and control worms in the two studies is not great enough to explain this difference. These findings suggest that although the concentration of mercury measured in sediment from the Underwood In Lieu Fishing Access Site appears to be slightly greater than the average concentration measured in the samples from Northwestern Lake, the mercury in Northwestern Lake sediments is more bioavailable to *Lumbriculus*. However, it should be noted that this comparison of mercury concentrations in sediment and mercury bioaccumulation in the oligochaetes is made on the basis of a single composite sample from the Underwood In Lieu Fishing Access Site. The use of a composite sample rather than a single individual sample allows greater confidence that the general concentration of mercury in the sediment at this location has been captured. However, the composite sample consists of a blend of individual subsamples and does not allow for an assessment of the variability in mercury concentrations in sediments at this location. Consequently, a single subsample containing a high concentration of mercury could raise the measured level of the entire composite sample.

The Oregon Department of Environmental Quality (DEQ), a co-member of the RSET with WDOE and others, has published its *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment* (April 3, 2007). DEQ's guidance provides the following numerical criteria for mercury.

Acceptable Tissue Levels (ATLs):

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• Humans	General / recreational:	0.40 mg/kg
	Subsistence / Tribal:	0.049 mg/kg
• Mammals	Individual:	0.12 mg/kg
	Population:	0.20 mg/kg
• Birds	Individual:	0.074 mg/kg
	Eagle eggs:	0.18 mg/kg
	Population:	0.15 mg/kg
	Osprey eggs:	0.89 mg/kg
Freshwater Critical Tissue Level (CTL):		0.088 mg/kg

In bioaccumulation tests on sediments from both the Underwood In Lieu Fishing Access Site and Northwestern Lake (all samples), oligochaete worms (*Lumbriculus*) accumulated tissue levels of mercury that exceeded the Freshwater CTL. Assuming that indigenous oligochates will accumulate mercury to the same extent as the test organisms, this finding is a potential concern. Assuming that fish and other organisms in the aquatic food web will have greater concentrations of mercury than the indigenous oligochaetes, and assuming that indigenous oligochaetes will accumulate mercury to similar levels as the *Lumbriculus* worm used in the laboratory tests, one can make tentative comparisons to ATLs and CTLs for other organisms. For example, the concentration of mercury in the oligochaete worms exposed to the sediments from Underwood In Lieu Fishing Access Site exceed the Tribal and Subsistence Fishers Oregon ATL, the Oregon Avian Population and Individual ATLs, the Oregon Avian (Eagle) Egg ATL, and the Oregon Mammal Individual ATL. Individual and average concentrations of mercury in Northwestern Lake sediments collected in 2007 exceeded these same ATLs, plus the Oregon Mammal Population ATL. The oligochaete worm tissues from the pre-exposure sample, the control sample, and pre-exposed tissues did not exceed an Oregon ATL.

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6.0 SUMMARY AND CONCLUSIONS

Previous sediment sampling and analysis for environmental and physical characteristics of sediments were conducted to provide information on the distribution and bioavailability of mercury in Northwestern Lake. Current sediment sampling and analysis were conducted to provide a comparison of the bioavailability of mercury in sediment from the Underwood In Lieu Fishing Access Site, which is similar, to the sediment found in Northwestern Lake. The following conclusions are based on the information presented in this report:

- Chemical analysis of sediments at the Underwood In Lieu Fishing Access Site (White Salmon River) indicate that mercury is present. The mercury concentration detected during the 2007 supplemental investigation was 0.72 mg/kg. The mercury concentration detected during the May 2008 sampling was 1.20 mg/kg.

- Chemical analysis of sediments in Northwestern Lake indicates that mercury is present. The mercury has consistently been detected in the sediments since the sediment evaluation began in 1994. Mercury concentrations detected in Northwestern Lake sediments during the 2007 supplemental investigation ranged from 0.094 mg/kg to 0.881 mg/kg. Including the supplemental samples collected in 2007, the average sediment mercury concentration concentration in the B1 sample location is 0.78 mg/kg, resulting in an average concentration of mercury in the 12 sample locations used to characterize sediments contained in the Lower Basin DMMU of 0.617 mg/kg. This average concentration exceeds the SL1 screening level of 0.28 mg/kg but is below the SL2 screening level of 0.75 mg/kg.

- Physical analysis of sediments at the Underwood In Lieu Fishing Access Site (White Salmon River) indicate they are similar to the sediments collected from Northwestern Lake. Sediments from Northwestern Lake are predominantly silt with variable concentrations of clay and trace sand. Sediments from the In Lieu Site had silt with clay and trace organics (May 2008 sample) and silt with trace sand (July 2007 sample).

- Mercury in background sediment collected from the In Lieu Site can bioaccumulate in worm tissue exposed to the sediment. Although the average concentration of mercury was slightly greater in sediment samples from the In Lieu Site than in samples from Northwestern Lake, the bioavailability of mercury in Northwestern

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Lake sediments appears to be greater based on results of laboratory bioaccumulation tests with the aquatic oligochaete worm *Lumbriculus*. However, these comparisons were made on the basis of a limited number of samples, including only a single bioaccumulation test conducted on In Lieu Site sediments.

- As previously stated, mercury is a native element commonly found in rocks associated with Cascade Range volcanic activity. Numerous geologic publications discuss the presence of mercury in hydrothermally altered rocks, specifically argillic or fine grained rocks. Hydrothermally altered rocks are related to volcanic activity. The White Salmon River receives direct runoff from nearby Mount Adams, a Cascades Range volcano and from the Big Lava Bed Geologic Area located west of the White Salmon River. This might be the source of mercury found in the sediments.

- According to USGS Professional Paper 1270, background mercury concentrations are considered to be between 0.32 mg/kg and 2.0 mg/kg in the White Salmon River area. The mercury concentrations encountered in the 2007 sediment samples ranged from 0.014 mg/kg to 1.2 mg/kg. In 2006, the mercury concentrations ranged from 0.020 mg/kg to 2.030 mg/kg, and in 1994, the mercury concentrations ranged from less than 0.025 mg/kg to 1.1 mg/kg. The average mercury concentration in the fine grained sediments of Northwestern Lake sampled in 2007 is 0.6 mg/kg. This average increases to 0.7 mg/kg when the 2006 sample results are included in the average.

In summary, mercury is present in the fine-grained sediments impounded by Condit dam at levels that are within the range of background concentrations reported in the literature. Mercury is also present in locations that represent background locations that should be unaffected by sediments contained within Northwestern Lake, including the Underwood In Lieu Fishing Access Site. It is our opinion that the mercury at both locations arises from natural sources in the uplands drained by the White Salmon River. The mercury can be accumulated by the tested aquatic organisms and may bioaccumulate and possibly biomagnify in the food web. The current mercury concentrations in sediments at both the Underwood In Lieu Fishing Access Site and Northwestern Lake might pose a potential health risk for individuals or populations of humans and animals that ingest a diet consisting primarily of tissue obtained from these locations.

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It is important to note that the form of mercury present and mercury cycling are affected by a number of factors such as flow that might differ between Northwestern Lake and the other sampling locations, which appear to be more representative of lotic (free-flowing water) rather than lentic (still water) conditions. Thus, bioavailability of mercury in sediments at Northwestern Lake might change after sediments are released from the impoundment into more lotic conditions.

Mercury in the environment is also constantly cycled and recycled (mercury cycling) through a biogeochemical cycle. The cycle has six major steps: degassing of mercury from rock, sediments, soils, or surface waters; movement in gaseous form through the atmosphere; deposition of mercury on land and surface waters; conversion of the element into insoluble mercury sulfide; precipitation or bioconversion into more volatile or soluble forms such as methylmercury; and reentry into the atmosphere or bioaccumulation in food chains. Therefore, mercury concentrations can also vary due to the dynamic nature of mercury cycling in the environment.

Biological and physical factors that can effect mercury concentrations and particularly methylation and demethylation of mercury are discussed in a technical memorandum in Appendix G. The literature review conducted to assess the rate of mercury demethylation after the sediments are released from Northwestern Lake indicate that there are a number of factors that control mercury methylation and demethylation. Unfortunately, there is not sufficient site-specific information regarding the reservoir sediments and downstream environments in the White Salmon and Columbia Rivers to determine whether, or at what rate, mercury in the sediments in Northwestern Lake will undergo demethylation or methylation following the removal of Condit dam.

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8.0 LIMITATIONS

This work was performed in a manner consistent with that level of care and skill ordinarily exercised by other members of Kleinfelder's profession practicing in the same locality, under similar conditions and at the date the services are provided. Our conclusions, opinions and recommendations are based on a limited number of observations and data. It is possible that conditions could vary between or beyond the data evaluated. Kleinfelder makes no other representation, guarantee or warranty, express or implied, regarding the services, communication (oral or written), report, opinion, or instrument of service provided.

This report may be used only by PacifiCorp Energy and the registered design professional in responsible charge and only for the purposes stated for this specific engagement within a reasonable time from its issuance, but in no event later than two (2) years from the date of the report.

Kleinfelder offers various levels of investigative and engineering services to suit the varying needs of different clients. It should be recognized that definition and evaluation of geologic and environmental conditions are a difficult and inexact science. Judgments leading to conclusions and recommendations are generally made with incomplete knowledge of the subsurface conditions present due to the limitations of data from field studies. Although risk can never be eliminated, more-detailed and extensive studies yield more information, which may help understand and manage the level of risk. Since detailed study and analysis involves greater expense, our clients participate in determining levels of service that provide adequate information for their purposes at acceptable levels of risk. More extensive studies, including subsurface studies or field tests, should be performed to reduce uncertainties. Acceptance of this report will indicate that PacifiCorp Energy has reviewed the document and determined that it does not need or want a greater level of service than provided.

During the course of the performance of Kleinfelder's services, hazardous materials may have been discovered. Kleinfelder assumes no responsibility or liability whatsoever for any claim, loss of property value, damage, or injury that results from pre-existing hazardous materials being encountered or present on the project site, or from the discovery of such hazardous materials. Nothing contained in this report should be construed or interpreted as requiring Kleinfelder to assume the status of an owner, operator, or generator, or person who arranges for disposal, transport, storage or

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Important Information About Your Geoenvironmental Report

Geoenvironmental studies are commissioned to gain information about environmental conditions on and beneath the surface of a site. The more comprehensive the study, the more reliable the assessment is likely to be. But remember: Any such assessment is to a greater or lesser extent based on professional opinions about conditions that cannot be seen or tested. Accordingly, no matter how many data are developed, risks created by unanticipated conditions will always remain. *Have realistic expectations.* Work with your geoenvironmental consultant to manage known and unknown risks. Part of that process should already have been accomplished, through the risk allocation provisions you and your geoenvironmental professional discussed and included in your contract's general terms and conditions. This document is intended to explain some of the concepts that may be included in your agreement, and to pass along information and suggestions to help you manage your risk.

Beware of Change; Keep Your Geoenvironmental Professional Advised

The design of a geoenvironmental study considers a variety of factors that are subject to change. Changes can undermine the applicability of a report's findings, conclusions, and recommendations. *Advise your geoenvironmental professional about any changes you become aware of.* Geoenvironmental professionals cannot accept responsibility or liability for problems that occur because a report fails to consider conditions that did not exist when the study was designed. Ask your geoenvironmental professional about the types of changes you should be particularly alert to. Some of the most common include:

- modification of the proposed development or ownership group,
- sale or other property transfer,
- replacement of or additions to the financing entity,
- amendment of existing regulations or introduction of new ones, or
- changes in the use or condition of adjacent property.

Should you become aware of any change, *do not rely on a geoenvironmental report.* Advise your geoenvironmental professional immediately; follow the professional's advice.

Recognize the Impact of Time

A geoenvironmental professional's findings, recommendations, and conclusions cannot remain valid indefinitely. The more time that passes, the more likely it is that important latent changes will occur. *Do not rely on a geoenvironmental report if too much time has elapsed since it was completed.* Ask your environmental professional to define "too much time." In the case of Phase I Environmental Site Assessments (ESAs), for example, more than 180 days after submission is generally considered "too much."

Prepare To Deal with Unanticipated Conditions

The findings, recommendations, and conclusions of a Phase I ESA report typically are based on a review of historical information, interviews, a site "walkover," and other forms of noninvasive research. When site subsurface conditions are not sampled in any way, the risk of unanticipated conditions is higher than it would otherwise be.

While borings, installation of monitoring wells, and similar invasive test methods can help reduce the risk of unanticipated conditions, *do not overvalue the effectiveness of testing.* Testing provides information about actual conditions only at the precise locations where samples are taken, and only when they are taken. Your geoenvironmental professional has applied that specific information to develop a general opinion about environmental conditions. *Actual conditions in areas not sampled may differ (sometimes sharply) from those predicted in a report.* For example, a site may contain an unregistered underground storage tank that shows no surface trace of its existence. *Even conditions in areas that were tested can change,* sometimes suddenly, due to any number of events, not the least of which include occurrences at

adjacent sites. Recognize, too, that *even some conditions in tested areas may go undiscovered,* because the tests or analytical methods used were designed to detect only those conditions assumed to exist.

Manage your risks by retaining your geoenvironmental professional to work with you as the project proceeds. Establish a contingency fund or other means to enable your geoenvironmental professional to respond rapidly, in order to limit the impact of unforeseen conditions. And to help prevent any misunderstanding, identify those empowered to authorize changes and the administrative procedures that should be followed.

Do Not Permit Any Other Party To Rely on the Report

Geoenvironmental professionals design their studies and prepare their reports to meet the specific needs of the clients who retain them, in light of the risk management methods that the client and geoenvironmental professional agree to, and the statutory, regulatory, or other requirements that apply. The study designed for a developer may differ sharply from one designed for a lender, insurer, public agency...or even another developer. *Unless the report specifically states otherwise, it was developed for you and only you.* Do not unilaterally permit any other party to rely on it. The report and the study underlying it may not be adequate for another party's needs, and you could be held liable for shortcomings your geoenvironmental professional was powerless to prevent or anticipate. Inform your geoenvironmental professional when you know or expect that someone else—a third-party—will want to use or rely on the report. *Do not permit third-party use or reliance until you first confer with the geoenvironmental professional who prepared the report.* Additional testing, analysis, or study may be required and, in any event, appropriate terms and conditions should be agreed to so both you and your geoenvironmental professional are protected from third-party risks. *Any party who relies on a geoenvironmental report without the express written permission of the professional who prepared it and the client for whom it was prepared may be solely liable for any problems that arise.*

Avoid Misinterpretation of the Report

Design professionals and other parties may want to rely on the report in developing plans and specifications. They need to be advised, in writing, that their needs may not have been considered when the study's scope was developed, and, even if their needs were considered, they might misinterpret geoenvironmental findings, conclusions, and recommendations. *Commission your geoenvironmental professional to explain pertinent elements of the report to others who are permitted to rely on it, and to review any plans, specifications or other instruments of professional service that incorporate any of the report's findings, conclusions, or recommendations.* Your geoenvironmental professional has the best understanding of the issues involved, including the fundamental assumptions that underpinned the study's scope.

Give Contractors Access to the Report

Reduce the risk of delays, claims, and disputes by giving contractors access to the full report, *providing that it is accompanied by a letter of transmittal that can protect you* by making it unquestionably clear that: 1) the study was not conducted and the report was not prepared for purposes of bid development, and 2) the findings, conclusions, and recommendations included in the report are based on a variety of opinions, inferences, and assumptions and are subject to interpretation. Use the letter to also advise contractors to consult with your geoenvironmental professional to obtain clarifications, interpretations, and guidance (a fee may be required for this service), and that—in any event—they should conduct additional studies to obtain the specific type and extent of information each prefers for preparing a bid or cost estimate. Providing access to the full report, with the appropriate caveats, helps prevent formation of adversarial attitudes and claims of concealed or differing conditions. If a contractor elects to ignore the warnings and advice in the letter of transmittal, it would do so at its own risk. Your geoenvironmental professional should be able to help you prepare an effective letter.

Do Not Separate Documentation from the Report

Geoenvironmental reports often include supplemental documentation, such as maps and copies of regulatory files, permits, registrations, citations, and correspondence with regulatory agencies. If subsurface explorations were performed, the report may contain final boring logs and copies of laboratory data. If remediation activities occurred on site, the report may include: copies of daily field reports; waste manifests; and information about the disturbance of subsurface materials, the type and thickness of any fill placed on site, and fill placement practices, among other types of documentation. *Do not separate supplemental documentation from the report. Do not, and do not permit any other party to redraw or modify any of the supplemental documentation for incorporation into other professionals' instruments of service.*

Understand the Role of Standards

Unless they are incorporated into statutes or regulations, standard practices and standard guides developed by the American Society for Testing and Materials (ASTM) and other recognized standards-developing organizations (SDOs) are little more than aspirational methods agreed to by a consensus of a committee. The committees that develop standards may not comprise those best-qualified to establish methods and, no matter what, no standard method can possibly consider the infinite client- and project-specific variables that fly in the face of the theoretical "standard conditions" to which standard practices and standard guides apply. In fact, these variables can be so pronounced that geoenvironmental professionals who comply with every directive of an ASTM or other standard procedure could run afoul of local custom and practice, thus violating the standard of care.

Accordingly, when geoenvironmental professionals indicate in their reports that they have performed a service "in general compliance" with one standard or another, it means they have applied professional judgement in creating and implementing a scope of service designed for the specific client and project involved, and which follows some of the general precepts laid out in the referenced standard. To the extent that a report indicates "general compliance" with a standard, you may wish to speak with your geoenvironmental professional to learn more about what was and was not done. *Do not assume a given standard was followed to the letter.* Research indicates that that seldom is the case.

Realize that Recommendations May Not Be Final

The technical recommendations included in a geoenvironmental report are based on assumptions about actual conditions, and so are preliminary or tentative. Final recommendations can be prepared only by observing actual conditions as they are exposed. For that reason, you should retain the geoenvironmental professional of record to observe construction and/or remediation activities on site, to permit rapid response to unanticipated conditions. *The geoenvironmental professional who prepared the report cannot assume responsibility or liability for the report's recommendations if that professional is not retained to observe relevant site operations.*

Understand That Geotechnical Issues Have Not Been Addressed

Unless geotechnical engineering was specifically included in the scope of professional service, a report is not likely to relate any findings, conclusions, or recommendations about the suitability of subsurface materials for construction purposes, especially when site remediation has been accomplished through the removal, replacement, encapsulation, or chemical treatment of on-site soils. The equipment, techniques, and testing used by geotechnical engineers differ markedly from those used by geoenvironmental professionals; their education, training, and experience are also significantly different. If you plan to build on the subject site, but have not yet had a geotechnical engineering study conducted, your geoenvironmental professional should be able to provide guidance about the next steps you should take. The same firm may provide the services you need.

Read Responsibility Provisions Closely

Geoenvironmental studies cannot be exact; they are based on professional judgement and opinion. Nonetheless, some clients, contractors, and others assume geoenvironmental reports are or certainly should be unerringly precise. Such assumptions have created unrealistic expectations that have led to wholly unwarranted claims and disputes. To help prevent such problems, geoenvironmental professionals have developed a number of report provisions and contract terms that explain who is responsible for what, and how risks are to be allocated. Some people mistake these for "exculpatory clauses," that is, provisions whose purpose is to transfer one party's rightful responsibilities and liabilities to someone else. Read the responsibility provisions included in a report and in the contract you and your geoenvironmental professional agreed to. *Responsibility provisions are not "boilerplate."* They are important.

Rely on Your Geoenvironmental Professional for Additional Assistance

Membership in ASFE exposes geoenvironmental professionals to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a geoenvironmental project. Confer with your ASFE-member geoenvironmental professional for more information.

ASFE

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TABLE 1
SAMPLE POINT LOCATIONS WITH COORDINATES
NORTHWESTERN LAKE, WASHINGTON

Sample Point Description	Sample Name	latitude	longitude	northing	Easting	feet below sediment surface	comments
Northwestern Lake	NW1-071707	45.76830	121.53825	160362.593	1375455.849	1	vicinity of B-1 (N45.76825 / W121.53781)
Northwestern Lake	NW2-071707	45.76818	121.53799	160317.964	1375521.621	1	vicinity of B-1 (N45.76825 / W121.53781)
Northwestern Lake	NW3-071707	45.76842	121.53788	160405.106	1375550.843	1	vicinity of B-1 (N45.76825 / W121.53781)
Northwestern Lake	NW4-071807	45.76847	121.53829	160424.714	1375446.457	1	vicinity of B-1 (N45.76825 / W121.53781)
Northwestern Lake	NW5-071807	45.76866	121.53852	160494.766	1375388.677	1	vicinity of B-1 (N45.76825 / W121.53781)
Northwestern Lake	NW6-071807	45.76865	121.53779	160488.668	1375574.913	1	vicinity of B-1 (N45.76825 / W121.53781)
Northwestern Lake	NW7-071807	45.76833	121.53788	160372.289	1375550.411	1	vicinity of B-1 (N45.76825 / W121.53781)
Buck Creek	no sample						cobble to gravel sediment, no fines available
Little Buck Creek	LBC-071807	45.77117	121.53925	161412.436	1375214.453	0.5	at confluence with Northwestern Lake
Mill Creek	MC-071807	45.77547	121.53169	163687.211	1326134.593	0.5	at confluence with Northwestern Lake
Spring Creek	BC-071807	45.77028	121.53951	161088.791	1375143.831	0.5	at confluence with Northwestern Lake
Salt Creek	SP1-071707	46.1256	121.58598	290806.368	1365069.744	0.5	southwest of Mount Adams, lahar material
Trout Lake	SP2-071707	46.00735	121.55015	247566.488	1373579.702	1	in marshy area
Gilmer Creek	SP3-071707	45.85725	121.50428	192684.111	1384537.475	0.5	at confluence with White Salmon River
Rattlesnake Creek	SP4-071707	45.79726	121.48.551	170749.64	1389046.291	0.5	
White Salmon River	SP5-071707	45.72936	121.52377	146115.618	1378966.628	0.5	at boat dock, near confluence with Columbia River
Little White Salmon River	LWS-071907	45.71852	121.64498	142588.662	1347956.739	0.5	below fish hatchery, near Columbia River
Wind River	WR-071907	45.71708	121.79044	142637.214	1310796.723	0.5	near boat ramp, near Columbia River
In-Lieu Fishing Access Site	ILFAS-052108	45.72931	121.52324			1	off boat dock, near confluence with Columbia River, almost exact location of previous sample identified as White Salmon River

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TABLE 2
ANALYTICAL DATA FOR MERCURY DISTRIBUTION ANALYSIS
NORTHWESTERN LAKE, WASHINGTON

Location	B-1	NW-1	NW-2	NW-3	NW-4	NW-5	NW-6	NW-7	In-Lieu Fishing Access Site		
Sample #	B1-72	NW1-071807	NW2-071807	NW3-071807	NW4-071807	NW5-071807	NW6-071807	NW7-071807	ILFAS-052108	average	average
Depth Below Water Surface (feet)	72	72	71	72	25	70	70	69	15	7 Supplemental Samples	7 Supplemental Samples and B-1 Samples
Depth Below Sediment Surface (feet)	1	1	1	1	1	1	1	1	1		
Sample Collection Date	18-Dec-06	18-Jul-07	18-Jul-07	18-Jul-07	18-Jul-07	18-Jul-07	18-Jul-07	18-Jul-07	21-May-08		
Total Solids (percent)	48.0	43.7	49.5	52.6	52	55.1	48.4	51.6	67.6	50.4	50.1
Total Volatile Solids (percent)	4.01	5.74	5.85	5.18	4.33	3.67	5.47	4.71		4.99	4.87
Total Organic Carbons (percent)	1.05	1.55	1.56	1.64	1.10	0.86	1.56	1.35	1.20	1.37	1.33
Ammonia (mg/Kg)	2.88	26.9	21.3	18.7	18.4	11.0	19.7	16.1		18.9	16.9
Sulfide (mg/Kg)	<0.5	<0.5	2.2	50.2	10.1	7.3	44.5	2.4		19.5	19.5
Mercury (mg/Kg)	**2.03**	**0.881**	**0.774**	**0.647**	**0.832**	**0.856**	0.105	0.094	**1.20**	**0.60**	**0.78**
NWRSEF Mercury SL1	***0.28***	***0.28***	***0.28***	***0.28***	***0.28***	***0.28***	*0.28*	*0.28*	***0.28***	***0.28***	***0.28***
NWRSEF Mercury SL2	***0.75***	***0.75***	***0.75***	*0.75*	***0.75***	***0.75***	*0.75*	*0.75*	***0.75***	*0.75*	***0.75***
percent passing 3/4-inch sieve	100	100	100	100	100	100	100	100	100	100.00	100.0
percent passing 1/2-inch sieve	100	100	100	100	100	100	100	100	100	100.00	100.0
percent passing 3/8-inch sieve	100	100	100	100	100	100	100	100	100	100.00	100.0
percent passing 1/4-inch sieve	100	100	100	100	100	100	100	99	100	99.86	99.9
percent passing #4 sieve	100	100	100	100	100	100	100	99	100	99.86	99.9
percent passing #8 sieve	100	100	100	100	100	100	100	99	-	99.86	99.9
percent passing #10 sieve	100	100	99	100	100	100	100	99	100	99.71	99.8
percent passing #16 sieve	100	100	99	100	100	100	100	99	-	99.71	99.8
percent passing #30 sieve	100	99	99	100	100	99	99	99	-	99.29	99.4
percent passing #40 sieve	100	99	99	99	99	99	99	99	100	99.00	99.1
percent passing #50 sieve	100	99	98	99	99	99	99	99	-	98.86	99.0
percent passing #100 sieve	100	98	98	99	98	99	98	98	100	98.29	98.5
percent passing #120 sieve	100										
percent passing #200 sieve	100	95	94	96	92	97	93	93	98.7	94.29	95.0
percent passing #230 sieve	100										
percent passing 2 micron	9	9	11	5	6	6	4	5	9	6.57	6.9

mg/Kg = milligrams per kilogram
NWRSEF Mercury SL1 = Northwest Regional Sediment Evaluation Framework Lower Screening Level
NWRSEF Mercury SL2 = Northwest Regional Sediment Evaluation Framework Upper Screening Level

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TABLE 3
ANALYTICAL DATA FOR MERCURY BACKGROUND EVALUATION
NORTHWESTERN LAKE, WASHINGTON

Location	Little Buck Creek	Mill Creek	Spring Creek	Salt Creek	Trout Lake	Gilmer Creek	Rattlesnake Creek	White Salmon River	Little White Salmon River	Wind River	In-Lieu Fishing Access Site	average
Sample #	LBC-071807	MC-071807	BC-071807	SP1-071707	SP2-071707	SP3-071707	SP4-071707	SP5-071707	LWS-071907	WR-071907	ILFAS-052108	
Depth Below Water Surface (feet)	0.5	1	0.5	0.5	1	1	0	2	0	0	15	2.0
Depth Below Sediment Surface (feet)	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Date	18-Jul-07	18-Jul-07	18-Jul-07	17-Jul-07	17-Jul-07	17-Jul-07	17-Jul-07	17-Jul-07	17-Jul-07	17-Jul-07	21-May-08	14-Aug-07
Mercury (mg/Kg)	0.067	**0.443**	0.051	0.031	0.007	0.021	0.016	**0.72**	0.014	0.054	**1.20**	0.239
Mercury (mg/Kg) in samples< 200 sieve	**0.85**	**1.2**	**0.73**	**0.29**	0.11	0.08	0.10					**0.48**
NWRSEF Mercury SL1	***0.28***	***0.28***	***0.28***	***0.28***	*0.28*	*0.28*	*0.28*	***0.28***	*0.28*	*0.28*	***0.28***	***0.28***
NWRSEF Mercury SL2	***0.75***	***0.75***	*0.75*	*0.75*	*0.75*	*0.75*	*0.75*	*0.75*	*0.75*	*0.75*	***0.75***	*0.75*
Total Solids (percent)	51.4	33	19.1	73.2	27.1	58	75.3	56.3	63.9	49.3	52.4	50.8
percent passing 3/4-inch sieve	100	100	100	100	100	100	100	100	100	100	100	100
percent passing 1/2-inch sieve	100	100	100	100	100	100	71	100	100	100	100	97
percent passing 3/8-inch sieve	100	100	100	100	100	100	61	100	100	100	100	96
percent passing 1/4-inch sieve	100	100	100	100	100	100	55	100	98	100	100	96
percent passing #4 sieve	99	100	99	100	100	100	49	100	94	100	100	95
percent passing #8 sieve	99	99	98	100	98	100	42	99	86	100	100	93
percent passing #10 sieve	99	99	97	100	97	100	40	99	84	100	100	92
percent passing #16 sieve	98	98	94	98	93	98	37	98	81	99	100	90
percent passing #30 sieve	95	97	89	95	88	94	27	98	78	98	100	87
percent passing #40 sieve	91	97	87	94	85	78	18	98	75	98	100	84
percent passing #50 sieve	82	97	82	90	82	61	12	97	71	97	100	79
percent passing #100 sieve	65	94	60	65	74	40	6	97	52	91	100	68
percent passing #120 sieve	61	93	59	56	65	35	5					53
percent passing #200 sieve	53	89.2	45.7	20.4	59.2	23.3	3	95	30	68	98.7	53
percent passing #230 sieve	49.7	89.4	43.9	14.7	52.7	20.7	2.5					39
percent passing 2 micron								5	2	7	9	6

mg/Kg = milligrams per kilogram
NWRSEF Mercury SL1 = Northwest Regional Sediment Evaluation Framework Lower Screening Level
NWRSEF Mercury SL2 = Northwest Regional Sediment Evaluation Framework Upper Screening Level

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TABLE 4
SOIL CLASSIFICATION OF SEDIMENT SAMPLES
NORTHWESTERN LAKE, WASHINGTON

Sample Location	Percent retained					USCS		ASTM
	gravel	sand	silt	clay				
B1-72	0%	0%	91%	9%		ML		silt with some clay
NW-1	0%	5%	86%	9%		ML		silt with some clay
NW-2	0%	6%	83%	11%		ML		silt with some clay and trace sand
NW-3	0%	4%	91%	5%		ML		silt with trace clay and trace sand
NW-4	0%	8%	86%	6%		ML		silt with trace clay and trace sand
NW-5	0%	3%	91%	6%		ML		silt with trace clay and trace sand
NW-6	0%	7%	89%	4%		ML		silt with trace clay and trace sand
NW-7	0%	7%	88%	5%		ML		silt with trace clay and trace sand
LBC	1%	47%	52%	-		SM		sandy silt with trace gravel
MC	0%	11%	89%	-		MH		silt with some sand
BC	0%	54%	46%	-		SM		silty sand
SP-1	0%	80%	20%	-		SM		silty sand
SP-2	0%	41%	59%	-		SM		sandy silt
SP-3	0%	77%	23%	-		SM		silty sand
SP-4	45%	52%	3%	-		SP		gravelly sand with trace silt
SP-5	0%	5%	95%	-		ML		silt with trace sand
LWS	2%	70%	28%	-		SM		silty sand with trace gravel
WR	0%	32%	68%	-		SM		sandy silt
ILFAS	0%	1%	83%	16%		ML		Silt with clay and trace organics

USCS = Unified Soil Classification System designation
ASTM = classification according to American Society for Testing and Materials D 2488

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TABLE 5
COMPARISON OF BIOACCUMULATION ANALYTICAL RESULTS TO OREGON GUIDELINES
NORTHWESTERN LAKE, WASHINGTON

sample	sample	laboratory	sample location	ng/g	mg/Kg	Human ATL		Avian ATL				Mammals		Freshwater
type	number	identification	and / or identifier			general	tribal	Individual		Population		Individual	Population	CTL
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
worms	1138G-01	07BR1309-01	pre-exposure sample	4.390	0.00439	0.40	0.049	0.074	0.18	0.15	0.89	0.12	0.20	0.088
worms	1138G-02	07BR1309-02	pre-exposure sample	4.160	0.00416	0.40	0.049	0.074	0.18	0.15	0.89	0.12	0.20	0.088
worms	1138G-03	07BR1309-03	pre-exposure sample	4.240	0.00424	0.40	0.049	0.074	0.18	0.15	0.89	0.12	0.20	0.088
worms	1138G-04	07BR1309-04	pre-exposure sample	4.340	0.00434	0.40	0.049	0.074	0.18	0.15	0.89	0.12	0.20	0.088
worms	1138G-05	07BR1309-05	pre-exposure sample	3.970	0.00397	0.40	0.049	0.074	0.18	0.15	0.89	0.12	0.20	0.088
worms	NAS 1729G	0828032-03	pre-exposure sample	1.330	0.00133	0.40	0.049	0.074	0.18	0.15	0.89	0.12	0.20	0.088
worms	1172G-01	07BR1309-11	control sample	13.400	0.01340	0.40	0.049	0.074	0.18	0.15	0.89	0.12	0.20	0.088
worms	1172G-02	07BR1309-12	control sample	13.500	0.01350	0.40	0.049	0.074	0.18	0.15	0.89	0.12	0.20	0.088
worms	1172G-03	07BR1309-13	control sample	13.300	0.01330	0.40	0.049	0.074	0.18	0.15	0.89	0.12	0.20	0.088
worms	1172G-04	07BR1309-14	control sample	13.100	0.01310	0.40	0.049	0.074	0.18	0.15	0.89	0.12	0.20	0.088
worms	1172G-05	07BR1309-15	control sample	12.300	0.01230	0.40	0.049	0.074	0.18	0.15	0.89	0.12	0.20	0.088
worms	NAS 1817G	0828032-01	control sample	10.600	0.01060	0.40	0.049	0.074	0.18	0.15	0.89	0.12	0.20	0.088
worms	1173G-01	07BR1309-16	Northwestern Lake	340.000	**0.34000**	0.40	**0.049**	**0.074**	**0.18**	**0.15**	0.89	**0.12**	**0.20**	**0.088**
worms	1173G-02	07BR1309-17	Northwestern Lake	346.000	**0.34600**	0.40	**0.049**	**0.074**	**0.18**	**0.15**	0.89	**0.12**	**0.20**	**0.088**
worms	1173G-03	07BR1309-18	Northwestern Lake	354.000	**0.35400**	0.40	**0.049**	**0.074**	**0.18**	**0.15**	0.89	**0.12**	**0.20**	**0.088**
worms	1173G-04	07BR1309-19	Northwestern Lake	340.000	**0.34000**	0.40	**0.049**	**0.074**	**0.18**	**0.15**	0.89	**0.12**	**0.20**	**0.088**
worms	1173G-05	07BR1309-20	Northwestern Lake	357.000	**0.35700**	0.40	**0.049**	**0.074**	**0.18**	**0.15**	0.89	**0.12**	**0.20**	**0.088**
worms	1174G-01	07BR1309-21	Little White Salmon River	4.980	0.00498	0.40	0.049	0.074	0.18	0.15	0.89	0.12	0.20	0.088
worms	1174G-02	07BR1309-22	Little White Salmon River	4.740	0.00474	0.40	0.049	0.074	0.18	0.15	0.89	0.12	0.20	0.088
worms	1174G-03	07BR1309-23	Little White Salmon River	4.460	0.00446	0.40	0.049	0.074	0.18	0.15	0.89	0.12	0.20	0.088
worms	1174G-04	07BR1309-24	Little White Salmon River	4.910	0.00491	0.40	0.049	0.074	0.18	0.15	0.89	0.12	0.20	0.088
worms	1174G-05	07BR1309-25	Little White Salmon River	4.980	0.00498	0.40	0.049	0.074	0.18	0.15	0.89	0.12	0.20	0.088
worms	NAS 1818G	0828032-02	In-Lieu Fishing Access Site	186.000	**0.18600**	0.40	**0.049**	**0.074**	**0.18**	**0.15**	0.89	**0.12**	0.20	**0.088**
blank	HB-07-0606-Hg	07BR0799-04	homogenizing blank	0.070	0.00007	0.40	0.049	0.074	0.18	0.15	0.89	0.12	0.20	0.088
blank	HB-Hg-07-1022	07BR1309-41	homogenizing blank	0.650	0.00065	0.40	0.049	0.074	0.18	0.15	0.89	0.12	0.20	0.088
blank	HB-Hg-07-0992	07BR1309-42	homogenizing blank	0.650	0.00065	0.40	0.049	0.074	0.18	0.15	0.89	0.12	0.20	0.088
blank	HB-B081104-Hg	0828032-04	homogenizing blank											

ng/g = nanograms per gram
mg/Kg = milligrams per kilogram
ATL = acceptable tissue level
CTL = critical tissue level

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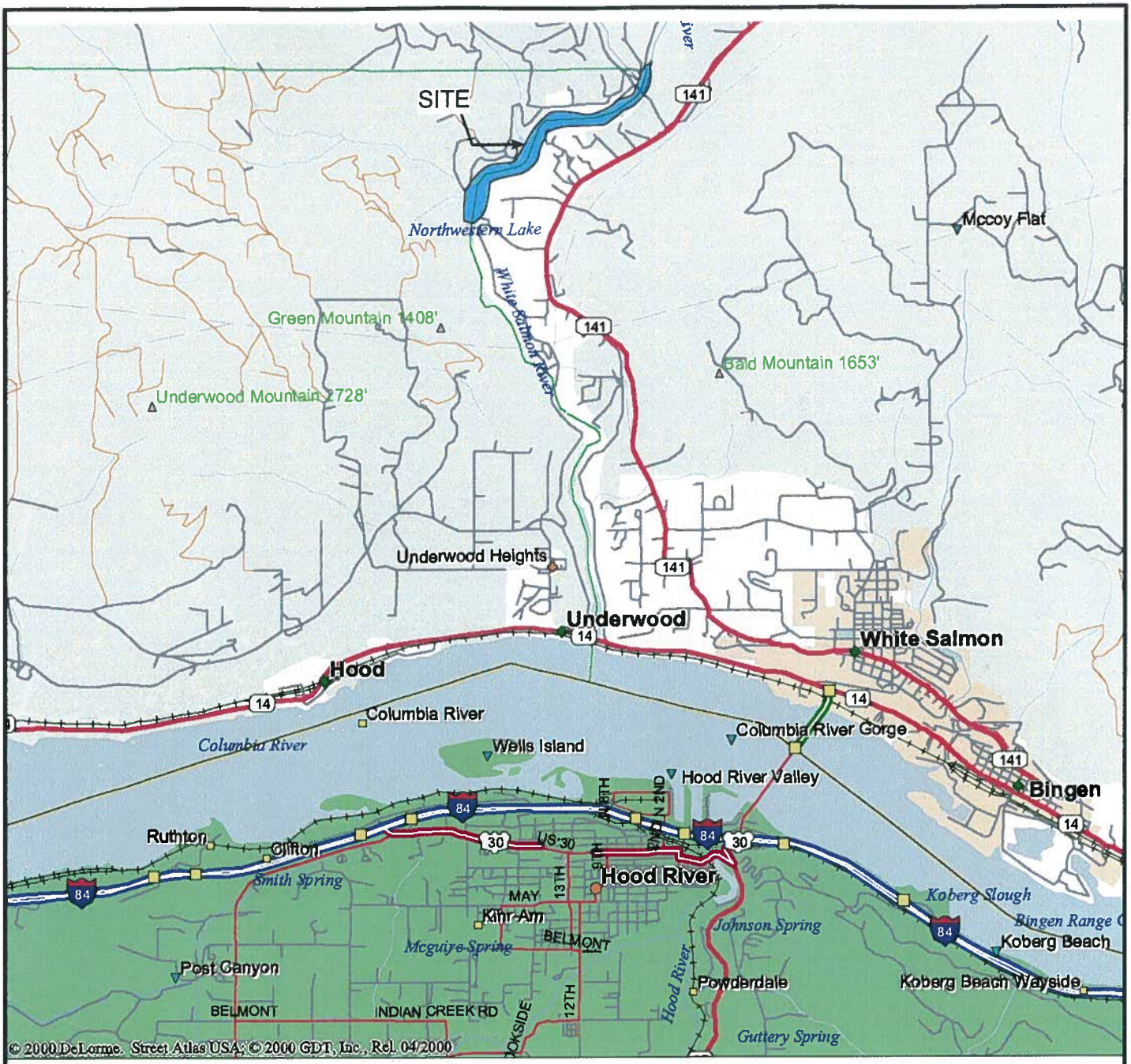

Mag 13.00
Tue Jun 27 08:54 2006
Scale 1:62,500 (at center)

1 Miles

2 KM

N W E S

- Local Road
- Major Connector
- State Route
- Trail
- Interstate/Limited Access
- Toll Highway
- US Highway
- Exit
- Utility/Pipe
- Railroad
- Point of Interest
- County Seat
- Small Town
- Summit
- Geographic Feature
- Locale
- Private Airport
- Cemetery
- County Boundary
- State Boundary
- Population Center
- Land
- Water
- National Park

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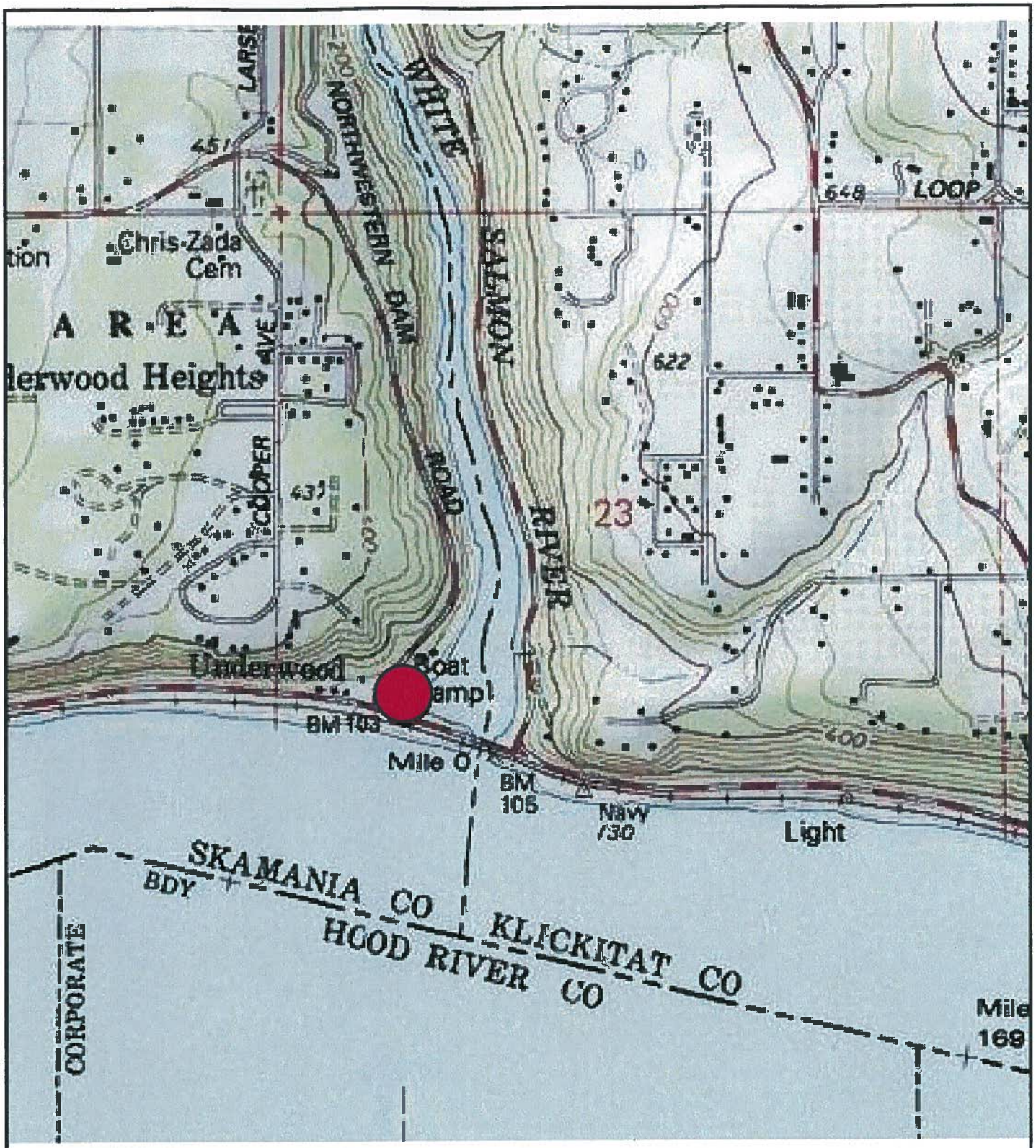
SITE LOCATION MAP

NORTHWESTERN LAKE, WASHINGTON

FIGURE: 1



LEGEND

SAMPLE LOCATION

SCALE IN FEET

0 1000 2000

N W E S

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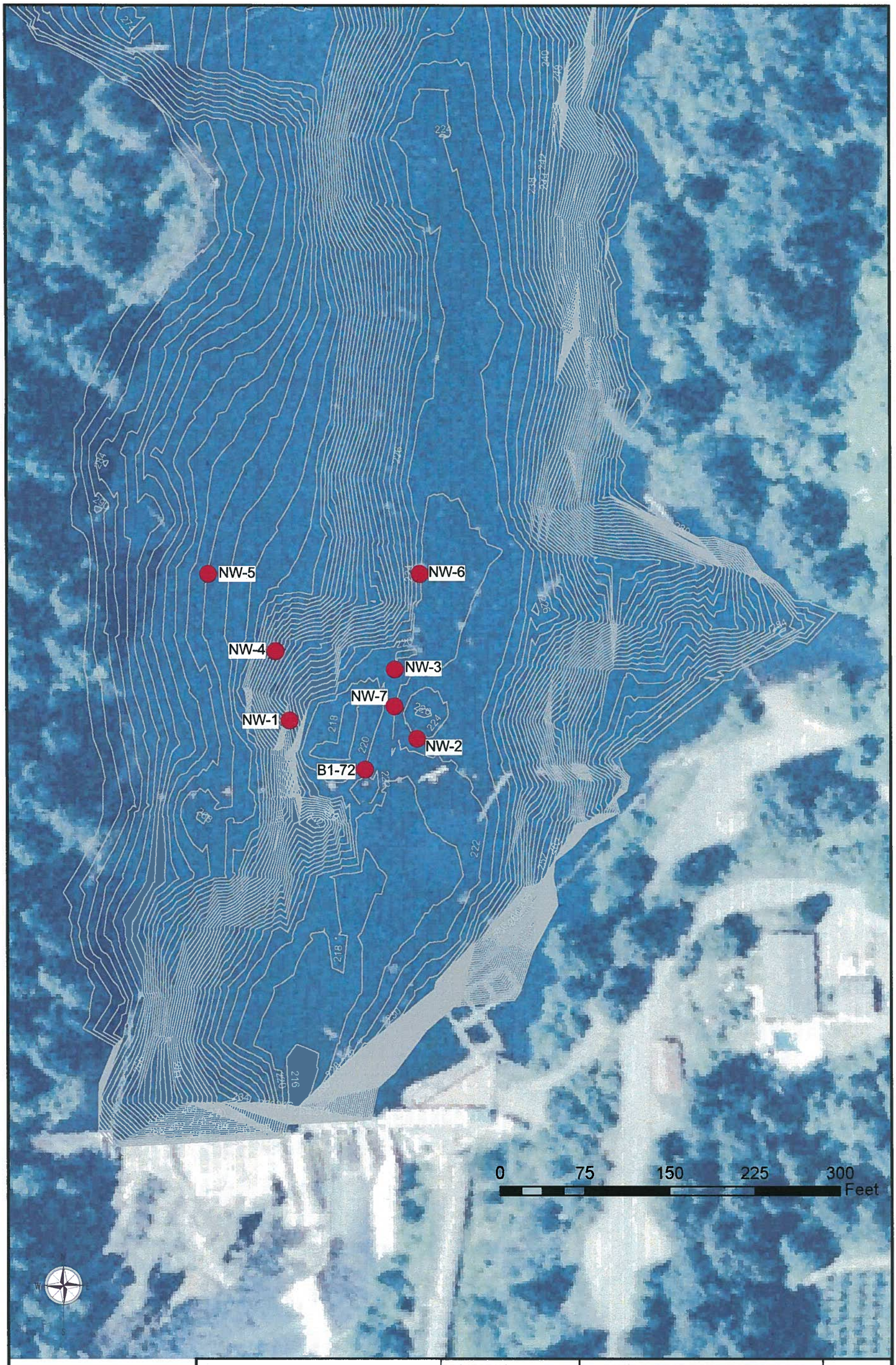
WHITE SALMON RIVER (IN-LIEU FISHING SITE SAMPLE LOCATION

NORTHWESTERN LAKE, WASHINGTON

FIGURE: **2**



LEGEND

● SAMPLE LOCATION

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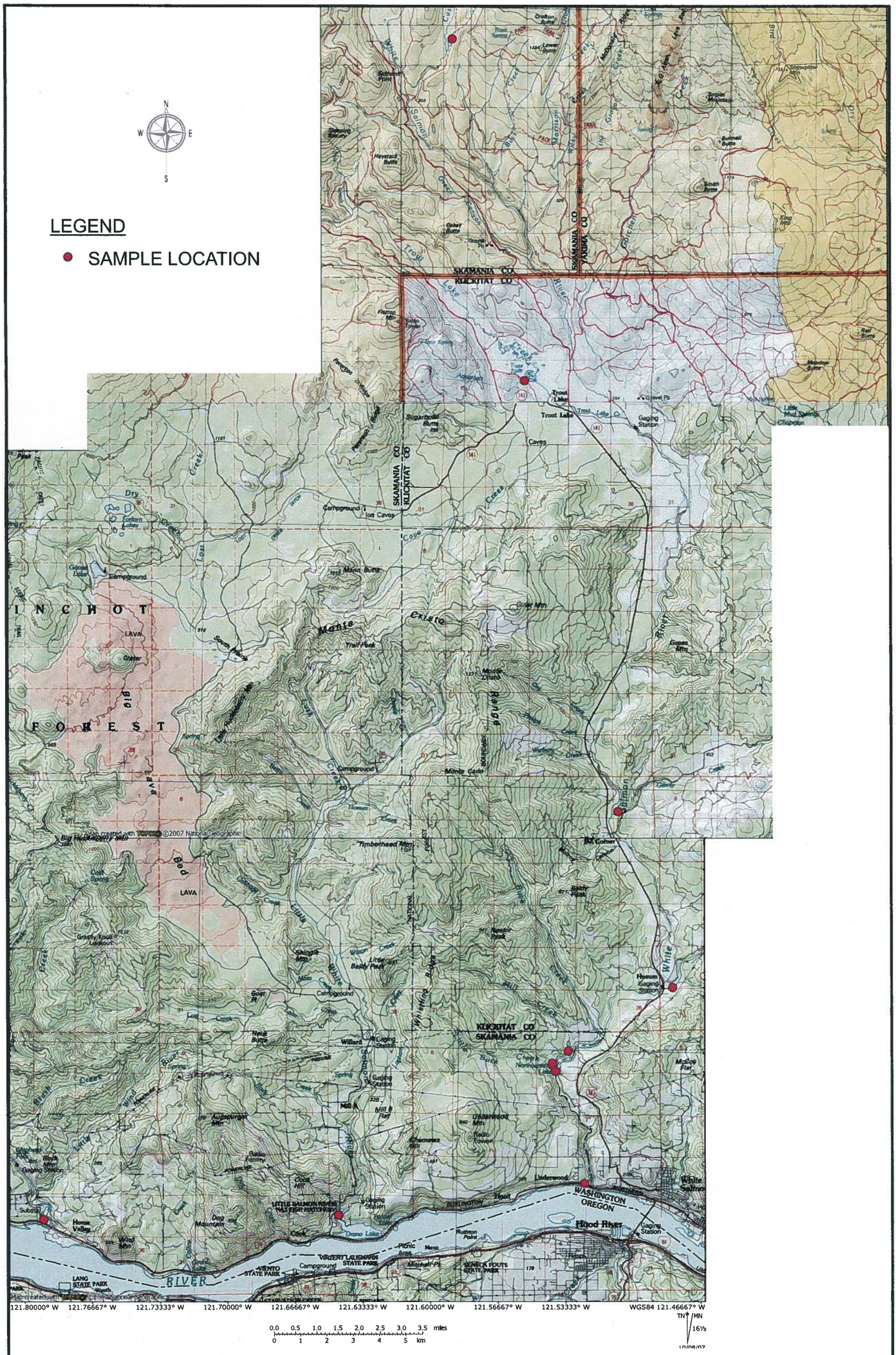
MERCURY DISTRIBUTION IN SEDIMENT SAMPLE LOCATIONS

NORTHWESTERN LAKE, WASHINGTON

FIGURE: **3**



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MERCURY BACKGROUND SAMPLE LOCATIONS

NORTHWESTERN LAKE, WASHINGTON

FIGURE: **4**

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TRANSMITTAL

Date: April 15, 2008
Project Number: 86540 / 7.1

To:

Tim Hemstreet, P.E.
PacifiCorp Energy Hydro Resources
825 N.E. Multnomah, Suite 1500
Portland, Oregon 97232

Subject:

Sampling and Analysis Plan for Evaluating Mercury Bioaccumulation
At In-Lieu Fishing Access Site – Condit Hydroelectric Project
FERC Project No. 2342
White Salmon, Washington

We are sending the following:

One pdf of the above-referenced Sampling and Analysis Plan.

Remarks:

If you have any questions, please contact me at (503) 644-9447.

Thank you.

By:

Peter L. Stroud, L.E.G.
Principal Engineering Geologist

H:\Geotech\Projects\94175 In Lieu Sampling - PacifiCorp Energy\Task 7.1\In Lieu sampling report\Work Plan.doc
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SAMPLING AND ANALYSIS PLAN FOR EVALUATING MERCURY BIOACCUMULATION AT IN-LIEU FISHING ACCESS SITE CONDIT HYDROELECTRIC PROJECT FERC PROJECT No. 2342 WHITE SALMON, WASHINGTON KLEINFELDER PROJECT NO. 86540 / 7.1

April 15, 2008

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April 15, 2008
Kleinfelder Project Number 86540 / 7.1

Tim Hemstreet, P.E.
PacifiCorp Energy Hydro Resources
825 N.E. Multnomah, Suite 1500
Portland, Oregon 97232

Subject: Sampling and Analysis Plan for Evaluating Mercury Bioaccumulation At In-Lieu Fishing Access Site – Condit Hydroelectric Project FERC Project No. 2342 White Salmon, Washington

Dear Mr. Hemstreet:

We are pleased to present our Sampling and Analysis Plan (Plan) for the above referenced project. We trust the information contained in the Plan will meet your needs at this time.

We appreciate this opportunity to provide our services to you. Should you require additional information or have any questions regarding this report, please contact us at (503) 644-9447.

Sincerely,

KLEINFELDER WEST, INC.

Peter L. Stroud, L.E.G.
Principal Engineering Geologist

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KLEINFELDER 15050 S.W. Koll Parkway, Suite L, Beaverton, OR 97006-6028 (503) 644-9447 (503) 643-1905 fax

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FIGURES

1. Vicinity Map
2. Sample Location Map

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1.0 INTRODUCTION

In December 2006, Kleinfelder, under contract to PacifiCorp Energy, collected sediment characterization samples from Northwestern Lake and reported the results in a *Sediment Sampling and Analysis Report* (March 2007). This investigation concluded that the average concentration of mercury in the fine silts impounded behind Condit dam is approximately 0.7 milligrams per kilogram (mg/Kg). During this work, the maximum detected concentration of mercury in the sediments was 2.03 mg/Kg in the surface sediment at a location (boring B-1) near the dam. Laboratory bio-assays conducted on the sediment collected during this field work indicated that the sediment had no adverse effect on the life cycles of test species.

The applicable current regulatory screening levels for mercury in fresh water sediments are found in the *Northwest Regional Sediment Evaluation Framework* (NWRSEF) (September, 2006) and are 0.28 mg/Kg (lower screening level, SL1) and 0.75 mg/Kg (upper screening level, SL2). The NWRSEF states, "The lower screening level (SL1) corresponds to a concentration below which adverse effects to benthic organisms would not be expected, and the upper screening level (SL2) corresponds to a concentration at which minor adverse effects may be observed in the more sensitive groups of benthic organisms."

Because mercury concentrations were found in excess of the upper screening level (SL2), the Regional Sediment Evaluation Team (RSET), composed of representatives of various state and federal regulatory agencies, requested that PacifiCorp collect supplemental information to confirm sediment concentrations in Northwestern Lake, establish the bio-availability of mercury found in the sediments through fish tissue analysis, and ascertain background mercury sediment concentrations in the local area.

The Supplemental Sampling and Analysis was completed in July of 2007. However, sediments collected as a reference sample from the Little White Salmon River and used as part of the bioaccumulation study were determined to not be representatively similar to the White Salmon River sediments. Specifically, the Little White Salmon River sediments were composed of less than 70 percent fines, whereas the White Salmon River (and Northwestern Lake) sediments were typically 95 percent (or greater) fines. Based on this, RSET has requested an additional bioaccumulation study be performed with sediment from the In-Lieu Fishing Access Site, which is on the White

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Salmon River and has proven to include sediments that are similar to those collected from Northwestern Lake.

This document presents the Sampling and Analysis Plan (SAP) to collect the sediments from the In-Lieu Fishing Access Site.

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2.0 BACKGROUND INFORMATION

The following sections describe the project location and description, the site ranking criteria, and proposed dredging and sampling parameters.

2.1 PROPOSED ACTION

Northwestern Lake sediments are proposed to be released in an "open-water" fashion during the decommissioning of Condit dam. Since the construction of the dam and formation of the lake, the natural transport of sediments by the White Salmon River has been disrupted, and the sediments previously transported to the Columbia River are now deposited in the slack water of Northwestern Lake.

The removal of Condit dam would initiate the discharge of a portion of the impounded sediment into the lower White Salmon River, a tributary of the Columbia River. As the U.S. Army Corps of Engineers (USACOE) Portland District stated in a letter dated December 15, 2004, "Because the sediment will settle out within the river systems, the project would result in unconfined aquatic disposal of sediments into the Lower Columbia River system." Unconfined aquatic disposal of sediments is regulated by the USACOE. The Regional Sediment Evaluation Team; composed of the USACOE's Seattle District, Portland District, Walla Walla District, and Northwestern Division, in collaboration with the U.S. Environmental Protection Agency (EPA) Region 10, Washington Department of Ecology (WDOE), Washington Department of Natural Resources (WDNR), Oregon Department of Environmental Quality (ODEQ), Idaho Department of Environmental Quality (IDEQ), National Marines Fisheries Service (NMFS), and the U.S. Fish and Wildlife Service (US F&WS); has developed a framework for evaluating sediments and the suitability of disposing those sediments in the Pacific Northwest. This framework is presented in the *Northwest Regional Sediment Evaluation Framework, Interim Final, September 2006.*

The sediments were physically and chemically characterized in 1994 and again in 2006/2007. In addition, information on the bioaccumulation of mercury was evaluated for fish, clams, and worms. To assist with the continued evaluation of the bioaccumulation of mercury, Kleinfelder has prepared this Sampling and Analysis Plan. The objective of this SAP is to provide a systematic approach to collecting bioaccumulation data that will supplement the existing data presented in the previous reports for the Condit Hydroelectric Project (FERC Project No. 2342).

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2.2 PROJECT DESCRIPTION

The Condit Hydroelectric Project is located along the White Salmon River above Washington State Highway 14 on the border between Klickitat and Skamania Counties, approximately 3.3-miles upstream from the confluence of the White Salmon and Columbia Rivers (refer, Figure 1). The U.S. Geological Survey (USGS) topographic coordinates for the reservoir are Sections 2 and 3, Township 3 North, Range 10 East, Willamette Meridian (Sec. 2 and 3/T3N/R10E W.M.). The Condit Project includes a 125-foot high concrete dam across the White Salmon River that diverts water into a 1-mile long wood stave flowline. The wood stave flowline conveys water to a surge tank, where the water is diverted into two pipes (penstocks) for delivery through two turbine generators in the powerhouse downstream of the dam.

The Condit Project is owned and operated by PacifiCorp Energy. It has been in operation since its construction in 1913. The name of the reservoir behind the dam is Northwestern Lake. Northwestern Lake is approximately 1.8-miles long with a surface area of approximately 92 acres. The pool elevation listed on the USGS Northwestern Lake topographic map (1983 Edition) is 294 feet above mean sea level (msl). At the time of its construction, the depth of water in the reservoir ranged from approximately 15 to 110 feet. Since the construction of the dam, the reservoir has been collecting sediments brought in by the White Salmon River. As of 1990, the depth of water in the reservoir reportedly ranged from approximately 3 to 85 feet.

2.3 PREVIOUS INVESTIGATIONS

Bathymetric surveys of the reservoir have been conducted by PacifiCorp in 1990, 1997, and 2006. The sediments in Northwestern Lake, located behind Condit dam, were investigated by advancing ten borings for the collection of sediment and bedrock samples in 1994. The results of the 1994 investigation were presented in a report prepared by Squier Associates, entitled *"Condit Hydroelectric Project (FERC Project No. 2342), Northwestern Lake Sediment Characterization Study, White Salmon, Washington,"* dated April 29, 1994. The 1994 investigation was developed in general accordance with the protocols of the Puget Sound Dredge Disposal Analysis (PSDDA) program.

The 1994 sediment characterization testing program consisted of both geotechnical and environmental testing. The geotechnical testing parameters included the following:

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- soil classification
- moisture content
- grain-size analysis
- unit weight determination

The geotechnical testing disclosed that the reservoir sediments consist mainly of fine-grained materials in the downstream deep pool area and granular materials in the upstream area. Located in the middle of the reservoir is a transition area where the upstream granular sediments have overridden the deep pool, fine-grained sediments.

The interpretation of the 1994 environmental testing results indicated that the metal concentrations were within expected background levels. However, remnant pesticides and herbicides were detected in the intermediate-aged sediments in the reservoir.

A second investigation of the sediments was conducted by Squier Associates in 1997. The results of that second investigation were presented in a report entitled, *"Additional Geotechnical Exploration and Laboratory Testing at the Condit Hydroelectric Project (Contract No. P018780)"* dated November 20, 1997.

In 1998, the cooperative interagency/intergovernmental team consisting of the USACOE, EPA Region 10, WDOE, WDNR, and ODEQ produced the Dredged Material Evaluation Framework, Lower Columbia River Management Area (DMEF). The DMEF established a tiered system for ranking of proposed dredging sites. The *DMEF* Tier I used existing information to conclude whether or not there is "enough information to determine if project meets exclusion ranking." Exclusionary Ranking was a Management Area Ranking that provided the least stringent characterization requirements. Projects from specific areas listed in the *DMEF* were awarded the Exclusionary Ranking. Northwestern Lake currently was not one of the listed zones for Exclusionary Ranking. The Exclusionary Criteria also included sediments that were to be used for beach enhancement and sediments whose final placement will be the same substrate as their origin. It is our understanding that the Northwestern Lake sediments did not meet either criterion.

Exclusionary Ranking was also awarded to locations whose sediments had at least 80% sand retained on a number (No.) 230 sieve (i.e., less than 20% fines) and a Total Volatile Solids (TVS) content of less than 5.0%. Mechanical sieve analysis of the sediments collected from the upstream portion of Northwestern Lake demonstrated that those sediments met the criterion of having less than 20% fines.

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However, in order to determine if the 1994 data were suitable, the data were first compared to the framework of Tiers II and IIB. Consequently, it was concluded that the sediments from Northwestern Lake (as one discrete unit) did not meet the criteria for Exclusionary Ranking. It was further concluded that the Low Management Area Ranking was appropriate. The Northwestern Lake sediment source location met the following criteria for Low Management Area Ranking:

- Low concentrations of chemicals of concern (COC)
- Some locations of higher percentages of fines
- Few sources of potential contamination

The *DMEF* allowed for the creation of Dredged Material Management Units (DMMUs), which are subdivisions of a sediment-generating project site that represent sediments similar in nature. Based on this understanding, the Northwestern Lake sediments were segregated into two DMMUs: the lower basin sediments and the upstream gravels. The segregation into two DMMUs provided for one Low Management Area Ranking of homogenous sediments (Lower Basin) and one area of Exclusionary Ranking (Upper Reservoir). The homogeneity of the sediments was supported by the 1994 mechanical sieve data. Based on the information presented in the *1994 Condit Study*, the lower basin included about 51% of the sediments (approximately 1,122,000 cubic yards).

The DMEF requirement for a homogeneous Low Management Area Ranking DMMU was one sample per 100,000 cubic yards. Accordingly, 12 samples were proposed for the 1,122,000 cubic yards of sediment.

In December 2006, Kleinfelder (formerly Squier Associates and Squier | Kleinfelder) conducted additional sediment sampling in the lower basin of Northwestern Lake in order to obtain current data on the chemical characterization of the fine-grained sediments. A total of 15 probes were advanced into the fine-grained sediments for the collection of 12 project and three quality control samples. The analytical results were compared to the screening levels provided in the USACOE's *Dredged Material Evaluation Framework, Lower Columbia River Management Area,* November 1998. The Sampling and Analysis Plan developed for the 2006 phase of sediment sampling was approved by the USACOE in August 2006.

The data that was collected by the implementation of the 2006 SAP was intended to satisfy the requirements of the USACOE in accordance with the applicable Tier IIB and Tier III testing guidelines as presented in the DMEF. However, RSET introduced the

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Interim Final of the NWRSEF in September 2006. The NWRSEF provides more stringent fresh water screening criteria, compared to marine screening criteria, and for those screening criterion to be divided into two discrete levels (SL1 and SL2). The mercury concentrations reported for four of the 12 project sediment samples and the three duplicate samples collected in December 2006 exceeded the SL2 criterion (0.75 mg/Kg) for mercury.

Supplemental sediment sampling and analysis were performed in July of 2007 to confirm sediment mercury concentrations, establish mercury background levels, and assess bioaccumulation as requested by members of the RSET. Ten samples were collected from Northwestern Lake region and the White Salmon River region. Sample results indicated the presence of mercury in fine-grained sediments impounded by the dam. The mercury appeared to be from natural sources. Additional sediment was collected from Northwestern Lake and from the Little White Salmon River (near the fish hatchery) for the purpose of a bioaccumulation study of mercury. Clam and worm tissue tested after exposure to the sediments in a laboratory, indicated that mercury was accumulating in worm tissue but not clam tissues. Fish tissues collected from specimens captured in Northwestern Lake were also found to have accumulated mercury.

However, the sediment sample collected as a reference sample from the Little White Salmon River did not contain the same percentage of fine-grained sediments as did the sample from Northwestern Lake. Therefore, RSET requested another bioaccumulation study be performed with sediment collected at the In-Lieu Fishing Access Site. The In-Lieu Fishing Access Site sediments appear to be more characteristically similar to the sediment obtained from Northwestern Lake.

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3.0 SAMPLING AND ANALYSIS TASKS

The following section discusses the tasks that will be performed during the sediment sampling at the In-Lieu Fishing Access Site.

3.1 IN-LIEU FISHING ACCESS SITE SAMPLING

Three surface sediment samples and 15 gallons of surface sediment will be collected. The sample locations will closely approximate the sampling locations accessed on July 17, 2007 (SP5-071707) and January 15, 2007 (B5-011507). Both sampling events were focused in the embayment identified as the U.S. Department of the Interior's Bureau of Indian Affairs (BIA's) In-Lieu Fishing Access Site.

Adequate sample volume will be collected from the location to provide for the proposed tests. In order to accomplish this, a sediment-filled, bottom dredge will be emptied into a clean, dedicated, 5-gallon bucket immediately after retrieval. When an adequate volume of sediment has been obtained, the sediments will be transferred to the appropriate containers. The sampling containers will be clearly labeled with: the project name, sample identification, type of analysis to be performed, and date and time; and referenced by entry into a log book.

3.1.1 First Phase of Laboratory Analysis

Three sediment samples will be collected and tested for the following:

- Mercury by EPA Method 7471A
- Grain size determination using ASTM D422 and ASTM D2487
- Total Organic Carbon (TOC) by ASTM D 4129-98M

Grain size will be evaluated using the following sieve sizes: 5-inch; 2.5-inch; 1.25-inch; 0.63-inch; 0.31-inch; and numbers 5, 10, 18, 35, 60, 120, and 230. The fine-grained fraction (finer than No. 230 sieve) will be classified using hydrometer analysis. Hydrogen peroxide will not be used in preparation for grain-size analysis. Sediment classification designation will be made in accordance with Unified Soil Classification System, ASTM D 2487. Water content will be evaluated in accordance with ASTM D 2216.

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3.2 IN-LIEU FISHING ACCESS SITE BIOACCUMULATION STUDY

3.2.1 Target Species

The bioaccumulation study will be limited to *Lumbriculus* (worms) tissue as stated in Kleinfelder's proposal to PacifiCorp Energy dated December 20, 2007. To accomplish this, the following tasks will be performed:

The 15 gallons of sediment collected from the vicinity of the Underwood In-Lieu Fishing Access Site will be transported to Northwestern Aquatic Sciences of Newport, Oregon (NWAS) for the exposure phase of the bioaccumulation evaluation.

NWAS will conduct the exposure portion of the bioaccumulation evaluation using the sediments from the In-Lieu Fishing Access Site vicinity on an imported population of the worm *Lumbriculus*. The exposure portion of the bioaccumulation test will last for 28 days. The exposures will be conducted according to EPA Method 100.3 and the protocols described in EPA document 600/R-99-064.

3.2.2 Laboratory Analysis

Five sets of *Lumbriculus* will provide the appropriate controls and replicates. The harvested worms will be transported to Brooks Rand's laboratory in Seattle, Washington under proper shipment guidelines and other protocols for analysis of mercury content. The analysis for mercury will be conducted in accordance with EPA Method 1631 Appendix – Total Mercury in Tissue. The laboratory's report will include a detailed narrative, raw / instrument data, preparation sheets, and quality assurance (QA) review information.

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4.0 SAMPLING SCHEDULE AND OTHER PROCEDURES

The following section describes the field activities and procedures during and after sediment sampling.

4.1 FIELD SAMPLING SCHEDULE

The sampling schedule is not currently set, but is anticipated to take place immediately after receiving approval from the RSET review panel. An updated sampling schedule will be set after approval of this SAP.

4.2 FIELD NOTES

Field notes will be maintained during sampling operations. Included in the field notes will be the following information:

- Names of the sample equipment operator and person(s) collecting and logging the sediment samples
- Weather conditions
- Date and time of collection of each sample
- The sample station number
- Descriptions of sample
- Any deviation from the approved sampling plan

For each sample, the following data will be recorded on the field log:

- Physical sediment description in accordance with the U.S. Soil Classification System, ASTM D 2487 (includes sediment type, density/consistency of sediment, color)
- Odor
- Visual stratifications and lenses
- Vegetation
- Debris
- Biological activity (e.g., detritus, shells, tubes, bioturbation, live or dead organisms)
- Presence of oil sheen
- Any other distinguishing characteristics or features

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4.3 Sample Station Positioning

The locations of the sample points will be measured using a portable global positioning system (GPS). The locations of the sample points will be shown on the site plan. If the sample point is over water, water depths to the mudline at the sample location will be measured directly by a weighted cloth or steel tape.

4.4 Decontamination

Following sample collection, sample collection devices will be thoroughly cleaned according to the following procedure:

- Wash with brush and trisodium phosphate or non-phosphate detergent
- Tap water rinse
- Rinse with distilled water

4.5 Sample Transport and Chain-of-Custody Procedures

After sample containers have been filled, they will be packed on ice in coolers. The cooler will be delivered to a qualified laboratory. Chain-of-custody procedures will commence in the field and will track delivery of the samples to the laboratory. Specific procedures are as follows:

- Individual sample containers will be packed to prevent breakage.
- The cooler will be clearly labeled with sufficient information (name of project, time and date container was sealed, person sealing the cooler, and Kleinfelder's office name and address) to enable positive identification.
- A sealed envelope containing chain-of-custody forms will be enclosed in a plastic bag and taped to the inside lid of the cooler.
- Signed and dated chain-of-custody seals will be placed on all coolers prior to removal from the site.
- Upon transfer of sample possession to the testing laboratory, the persons transferring custody of the coolers will sign the chain-of-custody form. Upon receipt of samples at the laboratory, the shipping container seal will be broken, and the receiver will record the condition of the samples.

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5.0 LABORATORY PHYSICAL AND CHEMICAL ANALYSIS

The In-Lieu Fishing Access Site sediment samples will only be analyzed for the parameters listed in Section 3.

5.1 LABORATORY ANALYSIS PROTOCOLS

Laboratory testing procedures will be conducted in general accordance with the RSET's Recommended Analytical Methods (*Northwest Regional Sediment Evaluation Framework, Interim Final*, September 2006, Table 7-2).

5.1.1 Chain-of-Custody

A chain-of-custody record for each set of samples will be maintained throughout all sampling activities and will accompany samples during shipment to the laboratory. Information tracked by the chain-of-custody records in the laboratory includes: sample identification number, date and time of sample receipt, analytical parameters required, and final disposition of the sample.

5.1.2 Limits of Detection

Northwest Regional Sediment Evaluation Framework, Interim Final, September 2006, Table 7-2 includes the recommended Sample Quantification Limits (SQLs) for each analyte. For those tests where the laboratory's SQL's exceed the RSET-recommended SQLs, the laboratory Method Detection Limits (MDLs) will be used. For purposes of comparison with the chemical parameters shown in Table 7-2, laboratory SQLs / MDLs of all tested chemicals will be below the stated RSET Sediment Quality Guidelines. Failure to achieve this may result in a requirement to reanalyze. The testing laboratory will be specifically cautioned to comply with the detection limit requirements.

5.1.3 Analysis Method Protocols

Sediment analysis protocols will follow the recommendations presented in RSET's Table 7-2.

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5.2 Laboratory Written Report

A written report will be prepared by the analytical laboratory documenting the activities associated with sample analyses. At a minimum, the following will be included in the report:

- Results of the laboratory analyses and quality control (QC) parameters
- Protocols used during analyses
- Chain-of-custody procedures, including explanation of any deviation from those identified herein
- Location and availability of the data
- As appropriate, this SAP may be referenced in describing protocols

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6.0 REPORTING

Reporting the results of the sediment sampling and analysis will be completed as described in the following sections.

6.1 QUALITY ASSURANCE (QA) REPORT

The project quality assurance representative will prepare a quality assurance report based upon activities involved with the field sampling and review of the laboratory analytical data. The QA/QC report will be incorporated into the Final Report.

6.2 FINAL REPORT

A written report will be prepared by Kleinfelder documenting the activities associated with collection, transportation of samples, and chemical and physical analyses of the samples. The chemical and physical analysis laboratory reports will be included as appendices. The laboratory QC reports will be incorporated by reference. At a minimum, the following will be included in the final report:

- Type of sampling equipment used
- Protocols used during sampling and testing and an explanation of any deviations from the sampling plan protocols
- Descriptions of each sample
- Locations where the sediment samples were collected
- A plan view of the project showing the field sampling locations
- Chain of-custody procedures used and explanation of any deviations from the sampling plan procedures
- Description of sampling procedures
- Final QA report
- Chemical and physical testing data and a comparison to the Sediment Qualty Guidelines shown in Table 7-1 of the Northwest Regional Sediment Evaluation Framework, Interim Final, September 2006.

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7.0 REFERENCES

Kleinfelder, 2007. *Sediment Sampling and Analysis Report, Northwestern Lake, Condit Hydroelectric Project. FERC Project 2342, White Salmon, Washington,* March.

Kleinfelder, 2007. *Supplemental Sediment Sampling and Analysis Report, Northwestern Lake, Condit Hydroelectric Project. FERC Project 2342, White Salmon, Washington,* July.

Kleinfelder, December 20, 2007. *Proposal for Sampling In-Lieu Fishing Access Site for Evaluating Mercury Bioaccumulation, White Salmon River, Washington.*

Squier Associates, 1994. *Condit Hydroelectric Project (FERC Project No. 2342) Northwestern Lake Sediment Characterization Study, White Salmon, Washington*, April.

Squier Associates, 1997. *Additional Geotechnical Exploration and Laboratory Testing at the Condit Hydroelectric Project,* November.

Squier | Kleinfelder, 2005. *Suitability Evaluation of Northwestern Lake Sediment Characterization Study.*

United States Army Corps of Engineers (USACOE) et al., 1998. *Dredged Material Evaluation Framework, Lower Columbia River Management Area,* November.

USACOE et al., 2006. *Interim Final Sediment Evaluation Framework For The Pacific Northwest*, September.

USACOE, 2006. *April 12, 2006, Draft Letter to PacifiCorp Hydro Licensing / Hydro Resources.*

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8.0 LIMITATIONS

We have prepared this plan for use by PacifiCorp Energy, their authorized agents, and regulatory agencies for specific application to this site. If, during future site operations, subsurface conditions are encountered which vary appreciably from those described herein, Kleinfelder should be notified for review of the recommendations of this plan, and revision of such, if necessary.

This plan may be used only by PacifiCorp Energy, their authorized agents, and regulatory agencies and only for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both on- and off-site), or other factors may change over time and could materially affect our recommended sampling scheme. Therefore, this plan should not be relied upon after 24 months from its date of issue. Kleinfelder should be notified if use of the plan is delayed by more than 24 months from the date of this plan so that a review of site conditions can be made, and recommendations revised, if appropriate.

Any party other than PacifiCorp Energy, their authorized agents, and regulatory agencies who wishes to use this plan shall notify Kleinfelder of such intended use. Based on the intended use of the plan, Kleinfelder may require that additional work be performed and that an updated plan be issued. Non-compliance with any of these requirements by the clients or anyone else will release Kleinfelder from any liability resulting from the use of this plan by any unauthorized party.

No warranty, expressed or implied, is made.

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CENWP-PM-E

Memorandum for: Portland District Regulatory

Date: May 9, 2008

Subject: Decision Document for the Sediment and Analysis Plan for the In-Lieu Site for for NWP-2004-523 – Condit Dam Removal

The applicant is requesting a permit to allow sediments from behind Condit Dam to be released into White Salmon River and the Columbia River. Available data indicated that mercury is associated with the fines in the sediments at levels that exceed screening levels. Data gathered within the White Salmon River, its tributaries, and nearby watersheds indicate that the mercury may come from a natural source. Bioassays indicate no acute toxicity associated with the mercury, but bioaccumulation testing indicates mercury is available and will accumulate to levels that could cause risk to upper trophic levels (wildlife and humans).

The applicant submitted a Sampling and Analysis Plan (SAP) for the In-lieu site. This was sent to the PRG for review because the testing will be conducted prior to the requested sampling and analysis of sediments at pre/post dam removal monitoring sites, since if bioaccumulation behind the dam is significantly greater than at the In Lieu site, then the material behind the dam may not be suitable for release.

The PRG reviewed the SAP and found that is meets the SEF guidance as submitted and the applicant may proceed with sampling.

The PRG team members that reviewed your project were: James McMillan, Portland District Corps of Engineers; Dan Gambetta, National Marine Fisheries Service and Laura Inouye, Washington Department of Ecology.

Marci Cook
PRG Coordinator

Washington
Department of
FISH and
WILDLIFE

HYDRAULIC PROJECT APPROVAL

RCW 77.55.021 - Appeal pursuant to Chapter 34.05

Southwest
2108 Grand Boulevard
Vancouver, WA 98661
(360) 696-6211

Issue Date: May 05, 2008
Project Expiration Date: October 01, 2008

Control Number: 107362-5
FPA/Public Notice #: N/A

PERMITTEE	AUTHORIZED AGENT OR CONTRACTOR
Pacificorp ATTENTION: Arianna Poindexter 825 NE Multnomah Suite 1500 Portland, OR 97232 503-813-5513 Fax: 503-813-6659	

Project Name: White Salmon River Sediment Sampling

Project Description: Sediment samples will be taken from the White Salmon River near its mouth.

PROVISIONS

1. Work shall be accomplished per plans and specifications approved by the Washington Department of Fish and Wildlife as detailed in the 4/28/2008 email from Arianne Poindexter, except as modified by this Hydraulic Project Approval. A copy of these plans shall be available on site during construction.

2. Work below the ordinary high water line shall only occur between March 7, 2008 and October 10, 2008.

3. Drilling equipment shall be well-maintained and in good repair to prevent the loss of lubricants, grease, and any other deleterious materials from entering the lake.

4. Drill spoils and cutting brought up to the barge shall not be released to the lake.

5. Drill cuttings shall be deposited in a location where they will not re-enter the lake either directly or due to erosion.

6. The drill string shall operate within a temporary pipe casing.

7. All containers storing fuel or other deleterious substances on the barge shall be secured during drilling operations to prevent incidental spills.

8. Extreme care shall be exercised to minimize the loss of fine sediment into the lake during drilling and soil sampling efforts.

9. A non-petroleum organic drilling lubricant shall be used during this project to protect water quality and fish resources.

10. Wastewater from the drilling process shall not be allowed to directly enter or leach into the lake.

11. If at any time, as a result of project activities, fish are observed in distress, a fish kill occurs, or water quality problems develop (including equipment leaks or spills), immediate notification shall be made to the Washington Department of Ecology at 1-800-258-5990, and to the Area Habitat Biologist listed below.

12. Every effort shall be taken during all phases of this project to ensure that sediment-laden water is not allowed to enter the lake.

13. Extreme care shall be taken to ensure that no petroleum products, hydraulic fluid, fresh cement, sediments, sediment-laden water, chemicals, or any other toxic or deleterious materials are allowed to enter or leach into the lake.

PROJECT LOCATIONS

Location #1 Mouth of White Salmon River

WORK START: May 07, 2008					WORK END: October 01, 2008	
WRIA: 29.0160	Waterbody: White Salmon River				Tributary to: Columbia River	
1/4 SEC: SW 1/4	Section: 23	Township: 03 N	Range: 10 E	Latitude: N 45.72937	Longitude: W 121.52868	County: Klickitat
Location #1 Driving Directions						

APPLY TO ALL HYDRAULIC PROJECT APPROVALS

This Hydraulic Project Approval pertains only to those requirements of the Washington State Hydraulic Code, specifically Chapter 77.55 RCW (formerly RCW 77.20). Additional authorization from other public agencies may be necessary for this project. The person(s) to whom this Hydraulic Project Approval is issued is responsible for applying for and obtaining any additional authorization from other public agencies (local, state and/or federal) that may be necessary for this project.

This Hydraulic Project Approval shall be available on the job site at all times and all its provisions followed by the person(s) to whom this Hydraulic Project Approval is issued and operator(s) performing the work.

This Hydraulic Project Approval does not authorize trespass.

The person(s) to whom this Hydraulic Project Approval is issued and operator(s) performing the work may be held liable for any loss or damage to fish life or fish habitat that results from failure to comply with the provisions of this Hydraulic Project Approval.

Failure to comply with the provisions of this Hydraulic Project Approval could result in a civil penalty of up to one hundred dollars per day and/or a gross misdemeanor charge, possibly punishable by fine and/or imprisonment.

Issue Date: May 05, 2008 | Control Number: 107362-5

Project Expiration Date: October 01, 2008 | FPA/Public Notice #: N/A

All Hydraulic Project Approvals issued pursuant to RCW 77.55.021 (EXCEPT agricultural irrigation, stock watering or bank stabilization projects) or 77.55.141 are subject to additional restrictions, conditions or revocation if the Department of Fish and Wildlife determines that new biological or physical information indicates the need for such action. The person(s) to whom this Hydraulic Project Approval is issued has the right pursuant to Chapter 34.04 RCW to appeal such decisions. All agricultural irrigation, stock watering or bank stabilization Hydraulic Project Approvals issued pursuant to RCW 77.55.021 may be modified by the Department of Fish and Wildlife due to changed conditions after consultation with the person(s) to whom this Hydraulic Project Approval is issued: PROVIDED HOWEVER, that such modifications shall be subject to appeal to the Hydraulic Appeals Board established in RCW 77.55.301.

APPEALS INFORMATION

If you wish to appeal the issuance or denial of, or conditions provided in a Hydraulic Project Approval, there are informal and formal appeal processes available.

A. INFORMAL APPEALS (WAC 220-110-340) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021, 77.55.141, 77.55.181, and 77.55.291: A person who is aggrieved or adversely affected by the following Department actions may request an informal review of:

(A) The denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval; or

(B) An order imposing civil penalties. A request for an INFORMAL REVIEW shall be in WRITING to the Department of Fish and Wildlife HPA Appeals Coordinator, 600 Capitol Way North, Olympia, Washington 98501-1091 and shall be RECEIVED by the Department within 30 days of the denial or issuance of a Hydraulic Project Approval or receipt of an order imposing civil penalties. If agreed to by the aggrieved party, and the aggrieved party is the Hydraulic Project Approval applicant, resolution of the concerns will be facilitated through discussions with the Area Habitat Biologist and his/her supervisor. If resolution is not reached, or the aggrieved party is not the Hydraulic Project Approval applicant, the Habitat Technical Services Division Manager or his/her designee shall conduct a review and recommend a decision to the Director or his/her designee. If you are not satisfied with the results of this informal appeal, a formal appeal may be filed.

B. FORMAL APPEALS (WAC 220-110-350) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021 (EXCEPT agricultural irrigation, stock watering or bank stabilization projects) or 77.55.291:
A person who is aggrieved or adversely affected by the following Department actions may request a formal review of:

(A) The denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval;

(B) An order imposing civil penalties; or

(C) Any other 'agency action' for which an adjudicative proceeding is required under the Administrative Procedure Act, Chapter 34.05 RCW.

A request for a FORMAL APPEAL shall be in WRITING to the Department of Fish and Wildlife HPA Appeals Coordinator, shall be plainly labeled as 'REQUEST FOR FORMAL APPEAL' and shall be RECEIVED DURING OFFICE HOURS by the Department at 600 Capitol Way North, Olympia, Washington 98501-1091, within 30-days of the Department action that is being challenged. The time period for requesting a formal appeal is suspended during consideration of a timely informal appeal. If there has been an informal appeal, the deadline for requesting a formal appeal shall be within 30-days of the date of the Department's written decision in response to the informal appeal.

C. FORMAL APPEALS OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 77.55.021 (agricultural irrigation, stock watering or bank stabilization only), 77.55.141, 77.55.181, or 77.55.241: A person who is aggrieved or adversely affected by the denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval may request a formal appeal. The request for FORMAL APPEAL shall be in WRITING to the Hydraulic Appeals Board per WAC 259-04 at Environmental Hearings Office, 4224 Sixth Avenue SE, Building Two - Rowe Six, Lacey, Washington 98504; telephone 360/459-6327.

D. FORMAL APPEALS OF DEPARTMENT ACTIONS TAKEN PURSUANT TO CHAPTER 43.21L RCW: A person who is aggrieved or adversely affected by the denial or issuance of a Hydraulic Project Approval, or the conditions or provisions made part of a Hydraulic Project Approval may request a formal appeal. The FORMAL APPEAL shall be in

accordance with the provisions of Chapter 43.21L RCW and Chapter 199-08 WAC. The request for FORMAL APPEAL shall be in WRITING to the Environmental and Land Use Hearings Board at Environmental Hearings Office, Environmental and Land Use Hearings Board, 4224 Sixth Avenue SE, Building Two - Rowe Six, P.O. Box 40903, Lacey, Washington 98504; telephone 360/459-6327.

E. FAILURE TO APPEAL WITHIN THE REQUIRED TIME PERIODS results in forfeiture of all appeal rights. If there is no timely request for an appeal, the department action shall be final and unappealable.

ENFORCEMENT: Sergeant Webb (38) P3

Habitat Biologist Tim Rymer	360-906-6729	Tim R. Rymer	for Director WDFW

CC:

1317 South 13th Avenue Kelso, Washington 98626 (360) 577-7222 (360) 636-1068 fax

Columbia Analytical Services INC
An Employee - Owned Company

August 18, 2008 Analytical Report for Service Request No: K0807504

Philip Nerenberg
Apex Laboratories
12232 S.W. Garden Place
Tigard, OR 97223

RE: A808094

Dear Philip:

Enclosed are the results of the rush sample submitted to our laboratory on August 12, 2008. For your reference, these analyses have been assigned our service request number K0807504.

All analyses were performed according to our laboratory's quality assurance program. Where applicable, the methods cited conform to the Methods Update Rule (effective 4/11/2007), which relates to the use of analytical methods for the drinking water and waste water programs. The test results meet requirements of the NELAC standards. Exceptions are noted in the case narrative report where applicable. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please call if you have any questions. My extension is 3281. You may also contact me via Email at PDivvela@caslab.com.

Respectfully submitted,

Columbia Analytical Services, Inc.

Pradeep Divvela
Project Chemist 08/18/08

PD/ln

NELAP Accredited ACIL Seal of Excellence Award 100% Recycled

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Inorganic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result.
E	The result is an estimate amount because the value exceeded the instrument calibration range.
J	The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.
U	The compound was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
i	The MRL/MDL has been elevated due to a matrix interference.
X	See case narrative.

Metals Data Qualifiers

#	The control limit criteria is not applicable. See case narrative.
B	The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.
E	The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M	The duplicate injection precision was not met.
N	The Matrix Spike sample recovery is not within control limits. See case narrative.
S	The reported value was determined by the Method of Standard Additions (MSA).
U	The compound was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
W	The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i	The MRL/MDL has been elevated due to a matrix interference.
X	See case narrative.
*	The duplicate analysis not within control limits. See case narrative.
+	The correlation coefficient for the MSA is less than 0.995.

Organic Data Qualifiers

*	The result is an outlier. See case narrative.
#	The control limit criteria is not applicable. See case narrative.
A	A tentatively identified compound, a suspected aldol-condensation product.
B	The analyte was found in the associated method blank at a level that is significant relative to the sample result.
C	The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D	The reported result is from a dilution.
E	The result is an estimate amount because the value exceeded the instrument calibration range.
J	The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.
N	The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P	The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results (25% for CLP Pesticides).
U	The compound was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
i	The MRL/MDL has been elevated due to a chromatographic interference.
X	See case narrative.

Additional Petroleum Hydrocarbon Specific Qualifiers

F	The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H	The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O	The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y	The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z	The chromatographic fingerprint does not resemble a petroleum product.

Columbia Analytical Services, Inc.
Kelso, WA
State Certifications, Accreditations, and Licenses

Program	Number
Alaska DEC UST	UST-040
Arizona DHS	AZ0339
Arkansas - DEQ	88-0637
California DHS	2286
Colorado DPHE	-
Florida DOH	E87412
Hawaii DOH	-
Idaho DHW	-
Indiana DOH	C-WA-01
Louisiana DEQ	3016
Louisiana DHH	LA050010
Maine DHS	WA0035
Michigan DEQ	9949
Minnesota DOH	053-999-368
Montana DPHHS	CERT0047
Nevada DEP	WA35
New Jersey DEP	WA005
New Mexico ED	-
North Carolina DWQ	605
Oklahoma DEQ	9801
Oregon - DHS	WA200001
South Carolina DHEC	61002
Utah DOH	COLU
Washington DOE	C1203
Wisconsin DNR	998386840
Wyoming (EPA Region 8)	-

Case Narrative

5

COLUMBIA ANALYTICAL SERVICES, INC.

Client:	Apex Laboratories	**Service Request No.:**	K0807504
Project:	A808094	**Date Received:**	08/12/2008
Sample Matrix:	Sediment		

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of Columbia Analytical Services, Inc. (CAS). This report contains analytical results for samples designated for Tier III validation deliverables including summary forms and all of the associated raw data for each of the analyses. When appropriate to the method, method blank results have been reported with each analytical test.

Sample Receipt

One sediment sample was received for analysis at Columbia Analytical Services on 08/12/2008. The samples were received in good condition and consistent with the accompanying chain of custody form. The sample was stored in a refrigerator at 4°C upon receipt at the laboratory.

General Chemistry Parameters

No anomalies associated with the analysis of these samples were observed.

Total Metals

No anomalies associated with the analysis of these samples were observed.

Approved by _____ **Date** 08/18/08

Chain of Custody Documentation

7

SUBCONTRACT ORDER

Apex Laboratories

A808094

K0807504

SENDING LABORATORY:

Apex Laboratories
12232 S.W. Garden Place
Tigard, OR 97223
Phone: (503) 718-2323
Fax: (503) 718-0333
Project Manager: Philip Nerenberg

RECEIVING LABORATORY:

Columbia Analytical Services
1317 S. 13th Avenue
Kelso, WA 98626
Phone :(360) 577-7222
Fax: (360) 636-1068

Relog from A805225

Sample Name: ILFSA-052108 **Soil** **Sampled: 05/21/08 13:00** (A808094-01)

Analysis	Due	Expires	Comments
Dry Weight	08/14/08 17:00	11/17/08 13:00	
Subcontract Outside	08/14/08 17:00	11/17/08 13:00	hg 7471
Total Organic Carbon	08/14/08 17:00	11/17/08 13:00	ASTM D4129
Containers Supplied:			
(A)4 oz Glass Jar			

SAME as K0706398.

Released By	Date	Received By	Date
Fed Ex	8/11/8	Fed Ex	8/11/8
Fed Ex		Received ABYM via CDS	8/12/08 0900

Columbia Analytical Services, Inc.
Cooler Receipt and Preservation Form

PC PD

Client / Project: Arex Service Request K08 7504

Received: 5/12/08 Opened: 5/12/08 By: [illegible]

1. Samples were received via? *US Mail* *Fed Ex* *UPS* *DHL* *GH* *GS* *PDX* *Courier* *Hand Delive*
2. Samples were received in: (circle) *Cooler* *Box* *Envelope* *Other* _____ *NA*
3. Were custody seals on coolers? NA Y N If yes, how many and where? _____
   If present, were custody seals intact? Y N If present, were they signed and dated? Y
4. Is shipper's air-bill filed? If not, record air-bill number: _____ NA Y
5. **Temperature of cooler(s) upon receipt (°C):** 1.5
   Temperature Blank (°C): 6.1
6. If applicable, list Chain of Custody Numbers:
7. Packing material used. *Inserts* *Baggies* *Bubble Wrap* *Gel Packs* *Wet Ice* *Sleeves* *Other* _____
8. Were custody papers properly filled out (ink, signed, etc.)? NA Y N
9. **Did all bottles arrive in good condition (unbroken)?** *Indicate in the table below.* NA Y N
10. Were all sample labels complete (i.e analysis, preservation, etc.)? NA Y N
11. Did all sample labels and tags agree with custody papers? *Indicate in the table below* NA Y N
12. **Were appropriate bottles/containers and volumes received for the tests indicated?** NA Y N
13. Were the pH-preserved bottles tested* received at the appropriate pH? *Indicate in the table below* NA Y N
14. Were VOA vials and 1631 Mercury bottles received without headspace? *Indicate in the table below.* NA Y N
15. **Are CWA Microbiology samples received with >1/2 the 24hr. hold time remaining from collection?** NA Y N
16. Was C12/Res negative? NA Y N

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Sample ID	Bottle Count	Bottle Type	Out of Temp	Head-space	Broken	pH	Reagent	Volume added	Reagent Lot Number	Initials

*Does not include all pH preserved sample aliquots received. See sample receiving SOP (SMO-GEN).

Additional Notes, Discrepancies, & Resolutions: _____

Total Solids

10

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client: Apex Laboratories
Project: A808094
Sample Matrix: Sediment

Service Request: K0807504

Total Solids

Prep Method: NONE
Analysis Method: 160.3M
Test Notes:

Units: PERCENT
Basis: Wet

Sample Name	Lab Code	Date Collected	Date Received	Date Analyzed	Result	Result Notes
ILFSA-052108	K0807504-001	05/21/2008	08/12/2008	08/13/2008	67.6	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	Apex Laboratories	**Service Request:**	K0807504
Project:	A808094	**Date Collected:**	05/21/2008
Sample Matrix:	Sediment	**Date Received:**	08/12/2008
		Date Analyzed:	08/13/2008

Duplicate Sample Summary
Total Solids

Prep Method:	NONE	**Units:**	PERCENT
Analysis Method:	160.3M	**Basis:**	Wet
Test Notes:			

Sample Name	Lab Code	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
ILFSA-052108	K0807504-001	67.6	67.3	67.5	<1	

General Chemistry Parameters

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client : Apex Laboratories
Project Name : NA
Project Number : A808094
Sample Matrix : SEDIMENT

Service Request : K0807504
Date Collected : 05/21/08
Date Received : 08/12/08

Carbon, Total Organic (TOC)

Prep Method : METHOD
Analysis Method : ASTM D4129-82M
Test Notes :

Units : Percent
Basis : Dry

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Result	Result Notes
ILFSA-052108	K0807504-001	0.05	0.04	1	8/13/2008	08/14/08	1.20	
Method Blank	K0807504-MB	0.05	0.04	1	8/13/2008	08/14/08	ND	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	Apex Laboratories	**Service Request :**	K0807504
Project Name :	NA	**Date Collected :**	NA
Project Number :	A808094	**Date Received :**	NA
Sample Matrix :	SEDIMENT	**Date Prepared :**	NA
		Date Analyzed :	08/14/08

Duplicate Summary
Inorganic Parameters

Sample Name :	Batch QC	Units :	Percent
Lab Code :	K0806927-001DUP	Basis :	Dry
Test Notes :			

Analyte	Prep Method	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Carbon, Total Organic (TOC)	METHOD	ASTM D4129-82M	0.05	1.10	1.25	1.18	13	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client : Apex Laboratories
Project Name : NA
Project Number : A808094
Sample Matrix : SEDIMENT

Service Request : K0807504
Date Collected : NA
Date Received : NA
Date Prepared : NA
Date Analyzed : 08/14/08

Matrix Spike Summary
Inorganic Parameters

Sample Name : Batch QC
Lab Code : K0806927-001MS
Test Notes :

Units : Percent
Basis : Dry

Analyte	Prep Method	Analysis Method	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Carbon, Total Organic (TOC)	METHOD	ASTM D4129-82M	0.05	5.47	1.10	6.50	99	75-114	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	Apex Laboratories	**Service Request :**	K0807504
Project Name :	NA	**Date Collected :**	NA
Project Number :	A808094	**Date Received :**	NA
Sample Matrix :	SEDIMENT	**Date Prepared :**	NA
		Date Analyzed :	08/14/08

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Lab Control Sample	Units :	Percent
Lab Code :	K0807504-LCS	Basis :	Dry
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Carbon, Total Organic (TOC)	METHOD	ASTM D4129-82M	0.36	0.40	111	74-123	

Columbia Analytical Services

- Cover Page -
INORGANIC ANALYSIS DATA PACKAGE

Client: Apex Laboratories
Project Name:
Project No.: A808094

Service Request: K0807504

Sample Name:	Lab Code:
ILFSA-052108	K0807504-001
ILFSA-052108D	K0807504-001D
ILFSA-052108S	K0807504-001S
Method Blank	K0807504-MB

Comments:

Approved By: _____ **Date:** 3/15/08

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client:	Apex Laboratories	**Service Request:**	K0807504
Project No.:	A808094	**Date Collected:**	5/21/08
Project Name:	NA	**Date Received:**	8/12/08
Matrix:	SEDIMENT	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: ILFSA-052108 **Lab Code:** K0807504-001

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Mercury	7471A	0.088	0.009	4.0	08/14/08	08/15/08	1.200		

% Solids: 67.6

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client:	Apex Laboratories	**Service Request:**	K0807504
Project No.:	A808094	**Date Collected:**	
Project Name:	NA	**Date Received:**	
Matrix:	SEDIMENT	**Units:**	mg/Kg
		Basis:	DRY

Sample Name: Method Blank **Lab Code:** K0807504-MB

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Mercury	7471A	0.020	0.002	1.0	08/14/08	08/15/08	0.002	U	

% Solids: 100.0

Comments:

Metals

- 2a -

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Client: Apex Laboratories Service Request: K0807504

Project No.: A808094

Project Name: NA

ICV Source: Inorganic Ventures CCV Source: CAS MIXED

Concentration Units: ug/L

Analyte	Initial Calibration			Continuing Calibration					Method
	True	Found	%R(1)	True	Found	%R(1)	Found	%R(1)	
Mercury	5.00	5.06	101	5.00	5.16	103	5.16	103	7471A

Metals

- 2a -

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Client: Apex Laboratories Service Request: K0807504

Project No.: A808094

Project Name: NA

ICV Source: Inorganic Ventures CCV Source: CAS MIXED

Concentration Units: ug/L

Analyte	Initial Calibration True	Initial Calibration Found	Initial Calibration %R(1)	Continuing Calibration True	Continuing Calibration Found	Continuing Calibration %R(1)	Continuing Calibration Found	Continuing Calibration %R(1)	Method
Mercury				5.00	5.04	101	5.02	100	7471A

Metals

- 2a -

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Client: Apex Laboratories Service Request: K0807504

Project No.: A808094

Project Name: NA

ICV Source: Inorganic Ventures CCV Source: CAS MIXED

Concentration Units: ug/L

Analyte	Initial Calibration			Continuing Calibration					Method
	True	Found	%R(1)	True	Found	%R(1)	Found	%R(1)	
Mercury				5.00	5.17	103	5.07	101	7471A

Metals

- 2a -

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Client: Apex Laboratories Service Request: K0807504

Project No.: A808094

Project Name: NA

ICV Source: Inorganic Ventures CCV Source: CAS MIXED

Concentration Units: ug/L

Analyte	Initial Calibration True	Initial Calibration Found	Initial Calibration %R(1)	Continuing Calibration True	Continuing Calibration Found	Continuing Calibration %R(1)	Continuing Calibration Found	Continuing Calibration %R(1)	Method
Mercury				5.00	5.21	104			7471A

Metals
- 2b -
CRDL STANDARD FOR AA AND ICP

Client: Apex Laboratories Service Request: K0807504

Project No.: A808094

Project Name: NA

Concentration Units: ug/L

Analyte	CRDL Standard for AA			CRDL Standard for ICP				
				Initial			Final	
	True	Found	%R	True	Found	%R	Found	%R
Mercury	0.20	0.20	100					

Metals

- 3 -

BLANKS

Client: Apex Laboratories Service Request: K0807504

Project No.: A808094

Project Name: NA

Preparation Blank Matrix (soil/water): WATER

Preparation Blank Concentration Units (ug/L or mg/kg): UG/L

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L) 1	C	2	C	3	C	Method
Mercury	-0.020	B	0.020	U	0.020	U	0.020	U	7471A

Metals

- 3 -

BLANKS

Client: Apex Laboratories Service Request: K0807504

Project No.: A808C94

Project Name: NA

Preparation Blank Matrix (soil/water): WATER

Preparation Blank Concentration Units (ug/L or mg/kg): UG/L

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L) 1	C	2	C	3	C	Method
Mercury			-0.020	B	0.020	U	0.020	U	7471A

Metals

- 3 -

BLANKS

Client: Apex Laboratories Service Request: K0807504

Project No.: A808094

Project Name: NA

Preparation Blank Matrix (soil/water): WATER

Preparation Blank Concentration Units (ug/L or mg/kg): UG/L

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L) 1	C	2	C	3	C	Method
Mercury			0.020	U					7471A

Metals

- 5A -

SPIKE SAMPLE RECOVERY

Client: Apex Laboratories
Service Request: K0807504
Project No.: A808094
Units: MG/KG
Project Name: NA
Basis: DRY
Matrix: SEDIMENT
% Solids: 67.6

Sample Name: ILFSA-052108S
Lab Code: K0807504-001S

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Mercury	64 - 127	2.290		1.200		1.11	98.2		7471A

An empty field in the Control Limit column indicates the control limit is not applicable

Metals

- 5B -

POST SPIKE SAMPLE RECOVERY

Client: Apex Laboratories

Service Request: K0807504

Project No.: A808094

Units: UG/L

Project Name: NA

Basis: DRY

Matrix: WATER

Sample Name: ILFSA-052108A

Lab Code: K0807504-001A

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Mercury	85 - 115	7.090		2.720		5.0	87		7471A

Metals

- 6 -

DUPLICATES

Client: Apex Laboratories

Service Request: K0807504

Project No.: A808094

Units: MG/KG

Project Name: NA

Basis: DRY

Matrix: SEDIMENT

% Solids: 67.6

Sample Name: ILFSA-052108D

Lab Code: K0807504-001D

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Mercury	30	1.200		1.200		0.0		7471A

An empty field in the Control Limit column indicates the control limit is not applicable.

Metals

- 7 -

LABORATORY CONTROL SAMPLE

Client: Apex Laboratories Service Request: K0807504

Project No.: A808094

Project Name: NA

Aqueous LCS Source: Solid LCS Source: ERA D045540

Analyte	Aqueous (ug/L) True	Aqueous (ug/L) Found	Aqueous (ug/L) %R	Solid (mg/kg) True	Solid (mg/kg) Found	Solid (mg/kg) C	Solid (mg/kg) Limits		Solid (mg/kg) %R
Mercury				1.77	1.630		76	121	92.1

APEX LABS

CHAIN OF CUSTODY

Lab # _____ COC 1 of 1

12232 S.W. Garden Place, Tigard, OR 97223 Ph: 503-718-2323 Fax: 503-718-0333

Company: Kleinfelder | Project Mgr: Pete Strand | Project Name: Condit | Project # 94175/7.1

Address: 15050 SW Koll Pkwy Beaverton OR | Phone: 503 614 9447 | Fax: | Email:

Sampled by: CW EJ

ANALYSIS REQUEST

SAMPLE ID	LAB ID #	DATE	TIME	MATRIX	# OF CONTAINERS	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	BTEX	8260 RBDM VOCs	8260 Halo VOCs	8260 VOCs	8270 SIM PAHs	8082 PCBs	8081 Chlor. Pest	RCRA Metals (8)	Priority Metals (13)	Al, Sb, As, Ba, Be, Cd Ca, Cr, Co, Cu, Fe, Pb Hg, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Tl, V, Zn	TCLP Metals (8)	1200- COLS	1200-Z	Mercury EPA Method 7471A	TOC Asmd 415.9-7BM					
ILFSA-052108		5-21	1200																			X	X					

Normal Turn Around Time (TAT) = 5-10 Business Days

TAT Requested (circle): 24 HR 48 HR 72 HR 4 DAY 5 DAY Other: _____

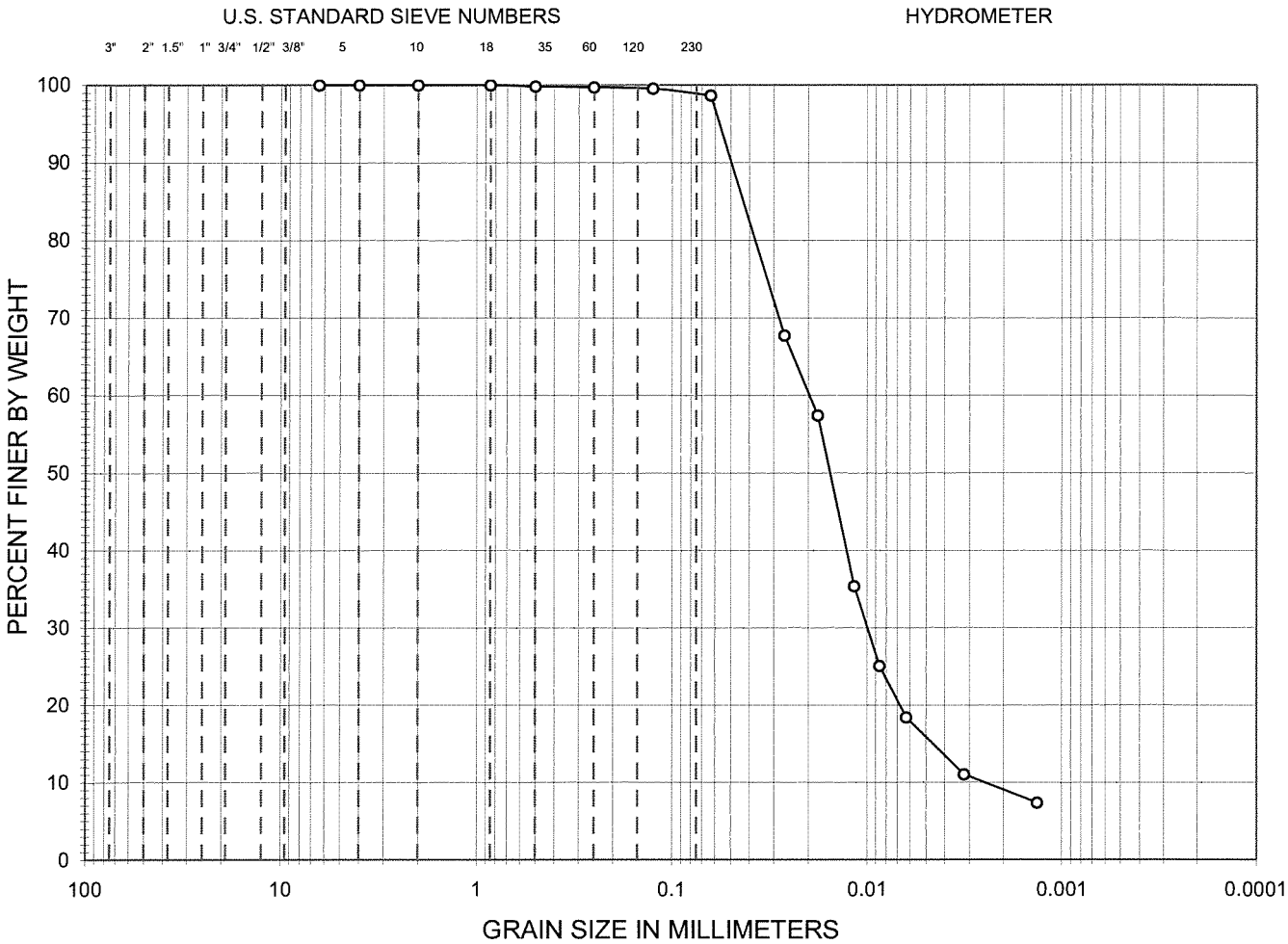
SAMPLES ARE HELD FOR 30 DAYS

SPECIAL INSTRUCTIONS:

RELINQUISHED BY:		RECEIVED BY:	RELINQUISHED BY:		RECEIVED BY:
Signature:	Date: 5/21/08	Signature:	Signature:	Date:	Signature:
Printed Name: Eric Jones	Time:	Printed Name:	Printed Name:	Time:	Printed Name:
Company: Kleinfelder		Company: APEX	Company:		Company:

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

GRAVEL		SAND			FINES	
coarse	fine	coarse	medium	fine	Silt	Clay



Sample No.	Boring	Depth (ft)	Passing 200 (%)	USCS
ILFAS-052108	N/A	N/A	98.7	ML

Sample Description	Dark Grey-Brown SILT with Clay and Trace Organics

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

KLEINFELDER
Bright People. Right Solutions.

CHECKED BY:	RPG	TECH:	RPG
PROJECT NO:	94175	DATE:	5/30/2008

GRADATION TEST RESULTS

Condit In-Lieu Sampling

White Salmon, Wa

Report of Biota Analysis Mercury

Project: Lumbriculus Variegatus Tissue
Samples Collected: May 28, 2008 and June 25, 2008
Report Date: August 6, 2008

Prepared for:
Peter Stroud
Kleinfelder
15050 SW Koll Parkway, Suite L
Beaverton, OR 97006

Brooks Rand Labs
Project Reference: KLE-BE0801
Project ID: 0828032

3958 6th Ave. NW
Seattle WA 98107
P: 206-632-6206
F: 206-632-6017
E: brl@brooksrand.com
www.brooksrand.com

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Case Narrative

Shipping and Receiving

Brooks Rand Labs (BRL) received three biota samples on July 9, 2008 at 9:00 AM in a cooler with ice at a temperature of 3.3 degrees Celsius. The *Chain-of-Custody* (COC) form total mercury (THg) and percent total solids (%TS). The samples were stored securely in a freezer within a locked storage room. The samples were received and stored according to BRL standard operating procedures (SOP) and EPA methodology.

Preservation and Holding Time

All method requirements for preservation and holding time were satisfied.

Total Mercury by EPA Method 1631, Appendix (BR-0002)

The samples were homogenized prior to digestion and analysis. A homogenization blank was taken from the equipment used for this process, and the result of this blank is included in this report. Samples were prepared and analyzed in accordance with EPA Method 1631. Samples were digested in nitric acid (HNO_3) and sulfuric acid (H_2SO_4), and then further oxidized with bromine monochloride (BrCl). Samples were analyzed with stannous chloride ($SnCl_2$) reduction, single gold amalgamation and cold vapor atomic fluorescence spectroscopy (CVAFS) detection using a BRL Model III CVAFS Mercury Analyzer. The results were method blank corrected as described in the calculations section of the relevant BRL SOP(s) and may have been evaluated using reporting limits that have been adjusted to account for sample aliquot size. Please refer to the *Sample Results* page for sample-specific MDLs, MRLs, and other details.

Sequence 0800653

The first calibration point (Cal1) and the second calibration point (Cal2) both produced low results. The analytical traps used (Traps B7 and B8) were tested and showed continued low recoveries. The traps were retired from use. The calibration points were reanalyzed as Cal6 and Cal7 and included in the calibration without qualification.

CCV4 was analyzed as a check of an analytical trap. The result was low and as such the trap was removed from use. CCV4, while labeled in the sequence as a CCV, does not serve as calibration verification in the sequence. The failure of CCV4 in no way affects the QC of this sequence. As a result it has not been reported and no results have been qualified based on its results.

The matrix spike/matrix spike duplicate (MS/MSD) set was spiked above the typical level of 1-5 times the native sample result. A post spike was analyzed at an appropriate concentration. All

quality assurance samples had recoveries that fell within the acceptance criteria. The MS/MSD results, along with the post-spike results were reported without qualification.

We certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. In addition, BRL, an accredited laboratory (FL LAB ID E87982), certifies that the reported results of all analyses for which BRL is NELAP accredited meet all NELAP requirements. For more information please see the *Report Information* page in your report. Please feel free to contact us if you have any questions regarding this report.

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Report Information

Laboratory Accreditations

BRL is accredited by the *National Environmental Laboratory Accreditation Program* (NELAP) through the State of Florida Department of Health, Bureau of Laboratories (E87982) and is certified to perform many environmental analyses. BRL is also certified by many other states to perform environmental analyses. For a current list of our accreditations/certifications, please visit our website at http://www.brooksrand.com/default.asp?contentID=586. Results reported relate only to the samples listed in the report.

Common Abbreviations

BLK	method blank	**MS**	matrix spike
BRL	Brooks Rand Labs	**MSD**	matrix spike duplicate
BS	laboratory fortified blank	**NR**	non-reportable
CAL	calibration standard	**PS**	post preparation spike
CCV	continuing calibration verification	**REC**	percent recovery
CRM	certified reference material	**RPD**	relative percent difference
D	dissolved fraction	**RSD**	relative standard deviation
DUP	duplicate	**SCV**	secondary calibration verification
ICV	initial calibration verification	**SOP**	standard operating procedure
MDL	method detection limit	**SRM**	standard reference material
MRL	method reporting limit	**T**	total recoverable fraction

Definition of Data Qualifiers

(Effective 6/12/08)

B Detected by the instrument, the result is > the MDL but ≤ the MRL. Result is reported and considered an estimate.

E An estimated value due to the presence of interferences. A full explanation is presented in the narrative.

H Holding time and/or preservation requirements not met. Result is estimated.

J Estimated value. A full explanation is presented in the narrative.

J-M Duplicate precision (RPD) for associated QC sample was not within acceptance criteria. Result is estimated.

J-N Spike recovery for associated QC sample was not within acceptance criteria. Result is estimated.

M Duplicate precision (RPD) was not within acceptance criteria. Result is estimated.

N Spike recovery was not within acceptance criteria. Result is estimated.

R Rejected, unusable value. A full explanation is presented in the narrative.

U Result is ≤ the MDL or client requested reporting limit (CRRL). Result reported as the MDL or CRRL.

These qualifiers are based on those previously utilized by Brooks Rand, Ltd., those found in the EPA SOW ILM03.0, Exhibit B, Section III, pg. B-18, and the USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses; USEPA; July 2002. These supersede all previous qualifiers ever employed by BRL.

Organization:	Kleinfelder	**BRL Work Order:**	0828032
Contact:	David King	**BRL Project Reference:**	KLE-BE0801
Report Date:	July 30, 2008	**BRL Project Manager:**	Citron Choice

ANALYTICAL REPORT FOR SAMPLES

Sample ID	BRL ID	Sampled	Received	Matrix
NAS 1817G	0828032-01	06/25/2008	07/09/2008	Biota
NAS 1818G	0828032-02	06/25/2008	07/09/2008	Biota
NAS 1729G	0828032-03	06/25/2008	07/09/2008	Biota
HB-B081104-Hg	0828032-04	07/15/2008	07/09/2008	DIW

0828032

BATCH SUMMARY FOR SAMPLES

Analyte/Method	Prepared	Analyzed	Batch	Sequence
Hg by EPA Method 1631, Appendix	07/24/2008	07/25/2008	B081138	0800653
%TS by EPA Method 160.3	07/23/2008	07/28/2008	B081139	N/A

0828032

SAMPLE RESULTS

Method	Analyte	Total or Dissolved	Result	Qualifier	MDL	MRL	Units	Batch	Sequence
0828032-01 Biota NAS 1817G									
EPA Method 1631, Appendix	Hg		10.6		0.37	0.93	ng/g	B081138	0800653
0828032-02 Biota NAS 1818G									
EPA Method 1631, Appendix	Hg		186		1.94	4.84	ng/g	B081138	0800653
0828032-03 Biota NAS 1729G									
EPA Method 1631, Appendix	Hg		1.33		0.04	0.10	ng/g	B081138	0800653
0828032-04 DIW HB-B081104-Hg									
EPA Method 1631, Appendix	Hg		0.004	U	0.004	0.01	ng/g	B081138	0800653

0828032

SAMPLE RESULTS

Method	Analyte	Total or Dissolved	Result	Qualifier	MDL	MRL	Units	Batch	Sequence
0828032-01 Biota NAS 1817G									
EPA Method 160.3	%TS		11.65		0.30	1.00	%	B081139	N/A
0828032-02 Biota NAS 1818G									
EPA Method 160.3	%TS		13.88		0.30	1.00	%	B081139	N/A
0828032-03 Biota NAS 1729G									
EPA Method 160.3	%TS		13.63		0.30	1.00	%	B081139	N/A

BROOKS RAND LABS
MEANINGFUL METALS DATA

0828032

QUALITY ASSURANCE SUMMARY

Accuracy and Precision

Batch: B081138 **Method: EPA Method 1631, Appendix** **SOP: BR-0002** **Matrix: Biota**

Analyte	Sample Value	Spike Value	Result	Units	% Recovery	% Recovery Limits	Duplicate RPD	RPD Limits
Duplicate (0828032-01)			B081138-DUP3					
Hg	10.7		10.1	ng/g			6	30
Matrix Spike (0828032-01)			B081138-MS3					
Hg	10.7	910.7	1030	ng/g	112	70-130		
Matrix Spike Duplicate (0828032-01)			B081138-MSD3					
Hg	10.7	952.4	1070	ng/g	111	70-130	4	30
Post Spike (0828032-01)			B081138-PS1					
Hg	10.7	37.24	52.0	ng/g	111	77-123		
Certified Reference Material (0830015, DORM-3)			B081138-SRM2					
Hg		382.0	311.1	ng/g	81	75-125		
Certified Reference Material (0822035, NIST 1547 - Peach			B081138-SRM3					
Hg		31.00	29.94	ng/g	97	75-125		

Batch: B081139 **Method: EPA Method 160.3** **SOP: BR-1501** **Matrix: Biota**

Analyte	Sample Value	Spike Value	Result	Units	% Recovery	% Recovery Limits	Duplicate RPD	RPD Limits
Duplicate (0828032-03)			B081139-DUP1					
%TS	13.63		13.19	%			3	15

0828032

QUALITY ASSURANCE SUMMARY

Method Blanks/Detection Limits

Batch: B081138 **Method: EPA Method 1631, Appendix** **SOP: BR-0002** **Matrix: Biota**

Analyte	Result	Units
Hg		
B081138-BLK1	0.04	ng/g
B081138-BLK2	0.04	ng/g
B081138-BLK3	0.02	ng/g
B081138-BLK4	0.00800	ng/g

	Average	Average Limits	Standard Deviation	StDev Limits	MDL	MRL
Method Blank Summary	0.03	0.08	0.02	0.03	0.04	0.10

Batch: B081139 **Method: EPA Method 160.3** **SOP: BR-1501** **Matrix: Biota**

Analyte	Result	Units
%TS		
B081139-BLK1	-0.14	%
B081139-BLK2	-0.12	%

	Average	Average Limits	Standard Deviation	StDev Limits	MDL	MRL
Method Blank Summary		0.60		0.20	0.30	1.00

0828032

Sequence: 0800653 **Method:** EPA Method 1631, Appendix **SOP:** BR-0002 **Matrix:** Biota

0800653-CAL3

Analyte	Result	True Value	% Recovery
Hg	489.8	500.0	98

0800653-CAL4

Analyte	Result	True Value	% Recovery
Hg	2566	2500	103

0800653-CAL5

Analyte	Result	True Value	% Recovery
Hg	10030	10000	100

0800653-CAL6

Analyte	Result	True Value	% Recovery
Hg	25.57	25.00	102

0800653-CAL7

Analyte	Result	True Value	% Recovery
Hg	97.07	100.0	97

0800653-CCV1

Analyte	Result	True Value	% Recovery	% Recovery Limits
Hg	393.4	500.0	79	77-123

0800653-CCV2

Analyte	Result	True Value	% Recovery	% Recovery Limits
Hg	405.8	500.0	81	77-123

0800653-CCV3

Analyte	Result	True Value	% Recovery	% Recovery Limits
Hg	459.2	500.0	92	77-123

0800653-CCV5

Analyte	Result	True Value	% Recovery	% Recovery Limits
Hg	394.0	500.0	79	77-123

0828032

Sequence: 0800653 **Method:** EPA Method 1631, Appendix **SOP:** BR-0002 **Matrix:** Biota

0800653-CCV6

Analyte	Result	True Value	% Recovery	% Recovery Limits
Hg	431.9	500.0	86	77-123

0800653-ICV1

Analyte	Result	True Value	% Recovery	% Recovery Limits
Hg	1457	1601	91	85-115

ANALYSIS SEQUENCE

0800653

Brooks Rand Labs

Instrument: THG-05

Lab Number	Batch #	Analysis	Order	STD ID	Source ID	BRL Project #	Due	Comments
0800653-IBL1	0800653	QC	1		-			
0800653-IBL2	0800653	QC	2		-			
0800653-IBL3	0800653	QC	3		-			
0800653-IBL4	0800653	QC	4		-			
0800653-CAL1	0800653	QC	5	0829004	-			
0800653-CAL2	0800653	QC	6	0829005	-			
0800653-CAL3	0800653	QC	7	0828020	-			
0800653-CAL4	0800653	QC	8	0829007	-			
0800653-CAL5	0800653	QC	9	0829008	-			
0800653-ICV1	0800653	QC	10	0829010	-			
B081138-BLK1	B081138	QC	11		-			
B081138-BLK2	B081138	QC	12		-			
0800653-CCB1	0800653	QC	13		-			
B081138-BS1	B081138	QC	14		-			
0800653-CAL6	0800653	QC	15	0829004	-			
0800653-CAL7	0800653	QC	16	0829005	-			
B081138-SRM1	B081138	QC	17		-			
B081138-SRM2	B081138	QC	18		-			
B081138-SRM3	B081138	QC	19		-			
0828032-04	B081138	Hg-B-70:30-CVAFS	20			KLE-BE0801	8/4/2008	
0800653-CCV1	0800653	QC	21	0829009	-			
0800653-CCV2	0800653	QC	22	0829009	-			
B081138-BLK3	B081138	QC	23		-			
B081138-BLK4	B081138	QC	24		-			
0827019-05	B081138	Hg-B-70:30-CVAFS	25			STM-CH0801	7/28/2008	Perform MS/MSD
0829003-11	B081138	Hg-B-70:30-CVAFS	26			WSP-WE0801	8/6/2008	

ANALYSIS SEQUENCE

0800653

Brooks Rand Labs

Instrument: THG-05

Lab Number	Batch #	Analysis	Order	STD ID	Source ID	BRL Project #	Due	Comments
0827019-03	B081138	Hg-B-70:30-CVAFS	27			STM-CH0801	7/31/2008	Perform MS/MSD
0827019-04	B081138	Hg-B-70:30-CVAFS	28			STM-CH0801	7/31/2008	Perform MS/MSD
0828032-01	B081138	Hg-B-70:30-CVAFS	29			KLE-BE0801	8/4/2008	
0828032-02	B081138	Hg-B-70:30-CVAFS	30			KLE-BE0801	8/4/2008	
0828032-03	B081138	Hg-B-70:30-CVAFS	31			KLE-BE0801	8/4/2008	
0829003-06	B081138	Hg-B-70:30-CVAFS	32			WSP-WE0801	8/6/2008	
0829003-07	B081138	Hg-B-70:30-CVAFS	33			WSP-WE0801	8/6/2008	
0829003-08	B081138	Hg-B-70:30-CVAFS	34			WSP-WE0801	8/6/2008	
0829003-09	B081138	Hg-B-70:30-CVAFS	35			WSP-WE0801	8/6/2008	
0829003-10	B081138	Hg-B-70:30-CVAFS	36			WSP-WE0801	8/6/2008	
0827019-03RE1	B081138	Hg-B-70:30-CVAFS	37			STM-CH0801	7/31/2008	Added 7/25/2008 by MSU
0827019-04RE1	B081138	Hg-B-70:30-CVAFS	38			STM-CH0801	7/31/2008	Added 7/25/2008 by MSU
0828032-01RE1	B081138	Hg-B-70:30-CVAFS	39			KLE-BE0801	8/4/2008	Added 7/25/2008 by MSU
0828032-03RE1	B081138	Hg-B-70:30-CVAFS	40			KLE-BE0801	8/4/2008	Added 7/25/2008 by MSU
B081138-DUP1	B081138	QC	41		0827019-03RE1			
B081138-MS1	B081138	QC	42		0827019-03RE1			
B081138-MSD1	B081138	QC	43		0827019-03RE1			
B081138-DUP2	B081138	QC	44		0827019-04RE1			
B081138-MS2	B081138	QC	45		0827019-04RE1			
B081138-MSD2	B081138	QC	46		0827019-04RE1			
B081138-DUP3	B081138	QC	47		0828032-01RE1			
B081138-MS3	B081138	QC	48		0828032-01			
B081138-MSD3	B081138	QC	49		0828032-01			
B081138-PS1	B081138	QC	50		0828032-01RE1			
B081138-PS2	B081138	QC	51		0827019-03RE1			
B081138-PS3	B081138	QC	52		0827019-04RE1			

ANALYSIS SEQUENCE

0800653

Brooks Rand Labs

Instrument: THG-05

Lab Number	Batch #	Analysis	Order	STD ID	Source ID	BRL Project #	Due	Comments
0800653-CCV3	0800653	QC	53	0829009	-			
B081138-PS4	B081138	QC	54		0827019-04RE1			
0800653-CCV4	0800653	QC	55	0829009	-			
0800653-CCV5	0800653	QC	56	0829009	-			
0829003-10RE1	B081138	Hg-B-70:30-CVAFS	57			WSP-WE0801	8/6/2008	Added 7/25/2008 by MSU
0800653-CCV6	0800653	QC	58	0829009	-			

Brooks Rand Labs

THg Biota Prep Benchsheet

Prepped By: MSU/RWB
Prep Date: 7/24/2008

Batch: B081138

Sample ID	Sample Mass (g)
B081138-BLK1	—
B081138-BLK2	—
B081138-BLK3	—
B081138-BLK4	—
0827019-03	1.002
B081138-DUP1	1.013
B081138-MS1	1.055
B081138-MSD1	1.004
0827019-04	1.046
B081138-DUP2	1.045
B081138-MS2	1.058
B081138-MSD2	1.012
0828032-01	1.074
B081138-DUP3	1.050
B081138-MS3	1.098

Sample ID	Sample Mass (g)
B081138-MSD3	1.050
0828032-02	1.033
0828032-03	1.034
0828032-04	10.186
0827019-05	10.171
0829003-06	.997
0829003-07	1.026
0829003-08	1.044
0829003-09	1.024
0829003-10	1.051
0829003-11	10.182
B081138-BS1	—
B081138-SRM1	0.200
B081138-SRM2	.200
B081138-SRM3	.199

Sample ID	Sample Mass (g)

Batch QC ID	Source	Spike vol (uL)	Spike conc (ng/L)	Spike ID	Spike Witness
DUP/MS/MSD1	0827019-03	200	10ng/mL	0829002	07/24/08 MSU
DUP/MS/MSD2	0827019-04	200	10ng/mL	↓	↓
DUP/MS/MSD3	0828032-01	1000	1000ng/mL	0816013	↓
BS1	NA	100	1ng/mL	0829003	↓
SRM1	SRM966 Lvl2	200	31.4 ug/L	0805035	NA
SRM2	DORM-3	~~200mg~~	0.3820mg/kg	0830015	↓
SRM3	NIST 1547	~~200mg~~	0.03100mg/kg.	0822035	↓

MWB 07-24-08

Reagent	ID
7 mL HNO_3	0824630
3 mL H_2SO_4	0802057
0.5 mL BrCl	0826043

Comments:

Target Temp/Time 1: 70 C/1 hour
Target Temp/Time 2: 90-100 C/3 hrs
Measured Temp/Time 1: 73°C
Measured Temp/Time 2: 100°C

Final Dilution Vol: 40mL

Hg Analysis Sheet: T-Hg / Other: _____ Page 1 of 3

Sequence: 0800653 Batch(es): B081138

Analyst: MSU Date: 07/25/08 Instrument ID: BR-05

10ng/mL std ID: 0829002 1ng/mL std ID: 0829003 ICV std ID: 0829001

$NH_2OH \cdot HCl$ #: 0828033 $SnCl_2$ #: 0829034A

Initial offset: 10090 Initial PMT: 505

Run #	Split Bottle	Trap	Bubb.	Brooks Rand Sample ID	Analy. Vol. (mL)	Dilution Factor	Analysis comments / For spiked QC: Source sample, standard ID, and spiked volume (mL)
1	1	B3	1	SEQ-IBL1	---		
2	2	D4	2	SEQ-IBL2	---		Odd peak shape. Peak 1 <10% of actual peak. not re-analyzed.
3	3	D5	3	SEQ-IBL3	---		
4	4	B6	4	SEQ-IBL4	---		
5	1	B7	1	SEQ-CAL1	0.025		1ng/mL
6	2	B8	2	SEQ-CAL2	0.100		1ng/mL
7	3	B9	3	SEQ-CAL3	0.050		10ng/mL
8	4	B10	4	SEQ-CAL4	0.250		10ng/mL
9	1	B11	1	SEQ-CAL5	1.00		10ng/mL
10	2	B3	2	SEQ-ICV1	1.00		NIST 1641d
11	3	D4	3	B081138-BLK1	10.00		B081138
12	4	D5	4	↓ -BLK2	↓		pmt: 504 offset: 10073
13	1	B6	1	SEQ-CCB1	---		
14	2	B7	2	B081138-BLK3	10.00		
15	3	B8	3	-BLK4			
16	4	B9	4	↓ -BS1	↓		
	1		1	B081138-SRM1	5.00		
	2		2	-SRM2	1.00		
	3		3	↓ -SRM3	5.00	MSU 07/25/08	
	4		4	0828032-04	10.00		
17	1	B10	1	SEQ-CAL6	0.025		
18	2	B11	2	↓ -CAL7	0.100		
19	3	B3	3	B081138-SRM1	5.00		
20	4	D4	4	↓ -SRM2	1.00		

Comments: * Traps B7 and B8 will be tested w/ CCV. Bubbler check not performed on 1 & 2 since CAL5 and CCV passed w/ good recovery.

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Hg Analysis Sheet: T-Hg / Other: ____ Page 2 of 3

Sequence: 0800653 Analyst: MSU Date: 07/25/08

Run #	Split Bottle	Trap	Bubb.	Brooks Rand Sample ID	Analy. Vol. (mL)	Dilution Factor	Analysis comments / For spiked QC: Source sample, standard ID, and spiked volume (mL)
21	1	D5	1	B081138-SRM3	5.00		
22	2	B6	2	0828032-04	10.00		
23	3	B7	3	SEQ-CCV1	0.050		trap check, 78% recovery; trap retired.
24	4	B8	4	↓ -CCV2	↓		↓, 81%; holding off using it til regular CCV results.
25	1	G12	1	B081138-BLK3	10.00		re-analyzed because it was analyzed w/ suspected
26	2	B9	2	↓ -BLK4			traps. ↓
27	3	B10	3	0827019-05			
28	4	B11	4	0829003-11	↓		
29	1	B3	1	0827019-03	1.00		<PQL, re-analyzed.
30	2	D4	2	↓ -04	↓		↓
31	3	D5	3	0828032-01	0.200		<5xPQL, re-analyzed.
32	4	B6	4	↓ -02	↓		
33	1	G12	1	↓ -03	↓		<PQL, re-analyzed.
34	2	B9	2	0829003-06	1.00		
35	3	B10	3	-07			
36	4	B11	4	-08			
37	1	B3	1	-09			
38	2	D4	2	↓ -10	↓		
39	3	D5	3	0827019-03RE1	10.00		
40	4	B6	4	↓ -04RE1	↓		
41	1	G12	1	0828032-01RE1	MSU 7/25/08 1.00		
42	2	B9	2	↓ -03RE1	5.00		
43	3	B10	3	B081138-DUP1	10.00		
44	4	B11	4	-MS1			
45	1	B3	1	-MSD1			
46	2	B4 D4	2	-DUP2			
47	3	MSU 7/24/08 B5 D5	3	-MS2			
48	4	B6	4	↓ -MSD2	↓		
49	1	G12	1	B081138-DUP3	1.00		
50	2	B9	2	-MS3	0.200		
51	3	B10	3	-MSD3	↓		
52	4	B11	4	↓ -PS1	1.00		Native: 0828032-01RE1 +1000pg (0.100 mL of 10ng/mL)

Comments: B8 retired.

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Hg Analysis Sheet: (T-Hg) / Other: ____ Page 3 of 3

Sequence: 0800653 Analyst: MSV Date: 7/25/08

Run #	Split Bottle	Trap	Bubb.	Brooks Rand Sample ID	Analy. Vol. (mL)	Dilution Factor	Analysis comments / For spiked QC: Source sample, standard ID, and spiked volume (mL)
53	1	B3	1	B081138 - PS2	10.00		Native: 0827019-03RE1 +125pg (0.125mL of 1ng/mL)
54	2	D4	2	↓ -PS3	↓		Native: 0827019-04RE1 ↓
55	3	D5	3	SEQ-CCV3	0.050		
56	4	B6	4	BLK1	10.00		RWB Sed IDOC
57	1	G12	1	BLK2			
58	2	B9	2	BLK3			
59	3	B10	3	BLK4			
60	4	B11	4	BS1			
64 62	MSV 7/25/08	G3	1	BS2			
65 ~~69~~ 63		G4	2	BS3			
66 ~~64~~	3	B9	3	BS4			
67 ~~65~~	4	B10	4	BS5	↓		
63	1	D5	1	B081138 - PS4	10.00		Native: 0827019-04RE1 +125pg
62	2	D4	2	SEQ-CCV4	0.050		trap check.
61	3	B6	3	↓ -CCV5	↓		
69 67	MSV 7/25/08 4	G12	4	↓ -CCV6			
68 ~~66~~	1	B11	1	0829003-10RE1	1.00		
70 ~~68~~	2	D5	2	BS6	10.00		
71	3	G5	3	BS7	↓		
72	4	G3	4	BS8	↓		
73	1	G4	1	BS9	10.00		
74	2	B9	2	SRM1	1.00		
75	3	B10	3	SRM2	↓		
76	4	B11	4	SRM3	↓		
77	1	G12	1	SRM4	↓		
78	2	G5	2	CCV8	0.050		
	3		3	B081138 - SRM 4	5.00		
	4		4	~~SEQ-CCV7~~	0.050	MSV	7/25/08

Comments: MSV 7/25/08 ~~#~~ trap #1 B3 retired, ~~B6~~ trap retired. Both traps had passing, but low recoveries. D4 failed trap check. Samples other than QC re-analyzed. MSV 7/25/08

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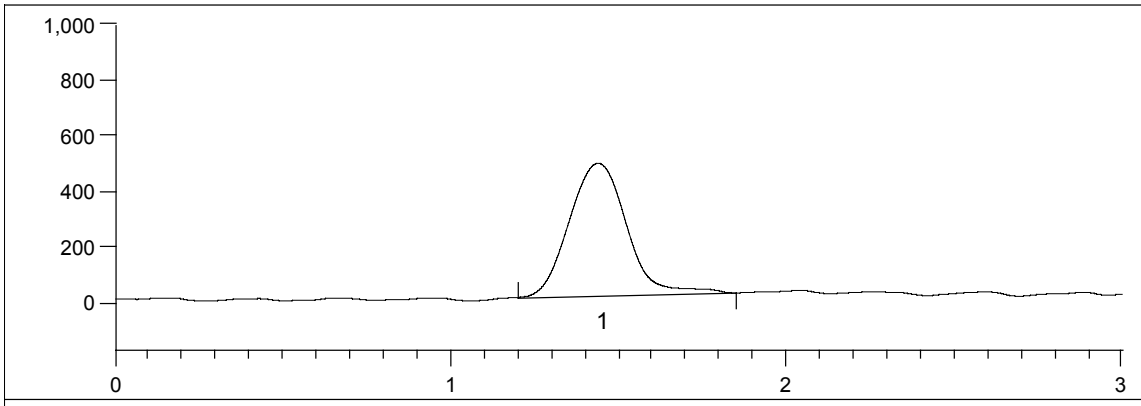
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

Project Number(s): 0800653
Instrument ID: BR-05

Date Analyzed: 7/25/08
Analyst Name: MSU

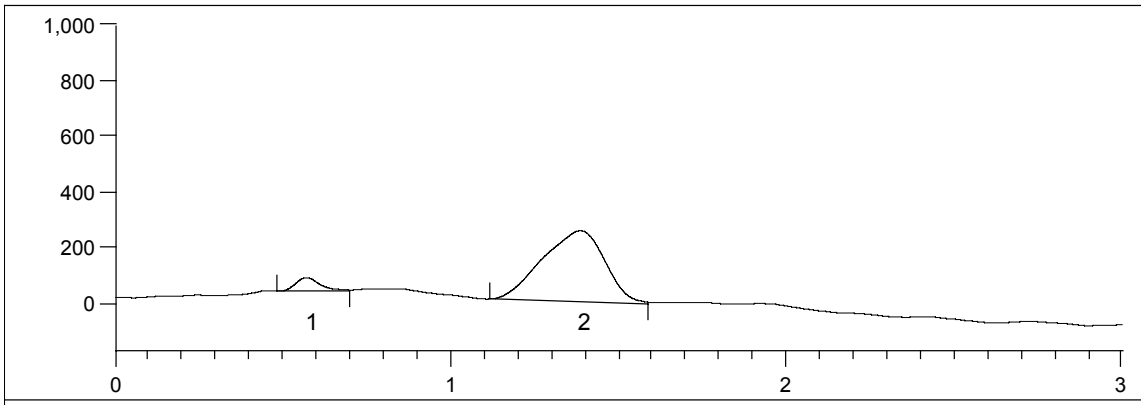


Date: 7/25/08
Time: 10:29 AM

Peak	rt	Area
1	1.43	56,948

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
1		IBL	SEQ-IBL1		1	56,948	4.60		4.60	< 50	accept

Notes

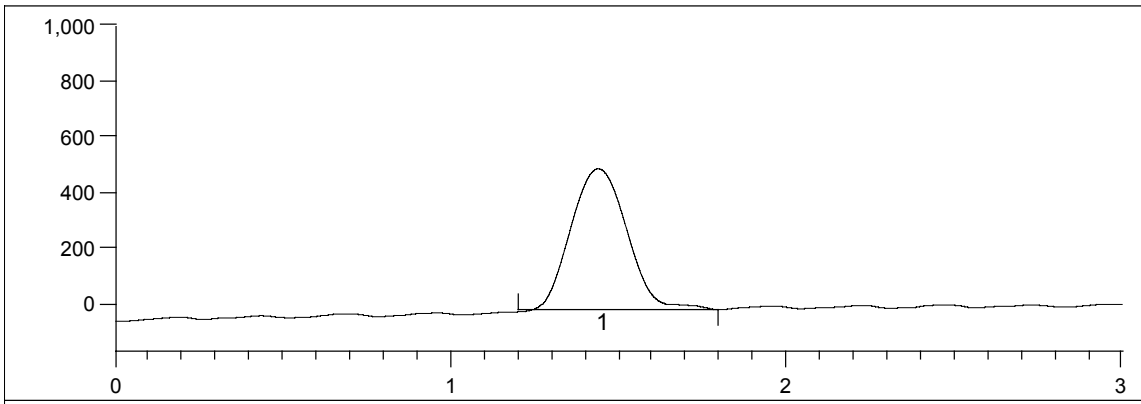


Date: 7/25/08
Time: 10:33 AM

Peak	rt	Area
1	0.56	2,350
2	1.38	32,188

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
2		IBL	SEQ-IBL2		2	32,188	2.60		2.60	< 50	accept

Notes



Date: 7/25/08
Time: 10:38 AM

Peak	rt	Area
1	1.43	60,844

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
3		IBL	SEQ-IBL3		1	60,844	4.91		4.91	< 50	accept

Notes

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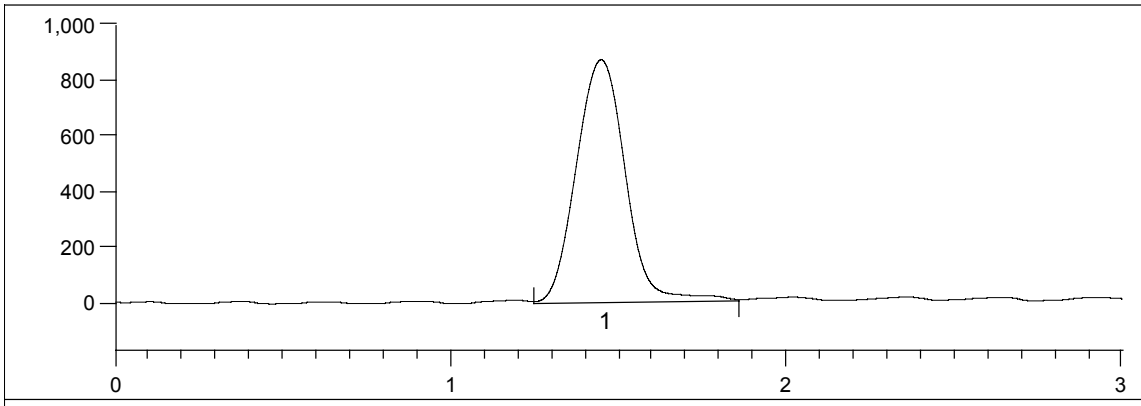
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

Project Number(s): 0800653 **Date Analyzed:** 7/25/08
Instrument ID: BR-05 **Analyst Name:** MSU

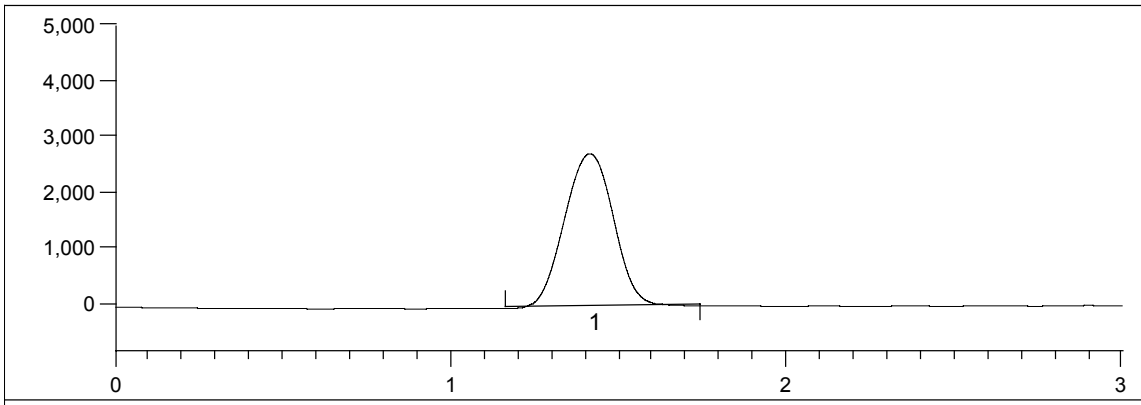


Date: 7/25/08
Time: 10:42 AM

Peak	rt	Area
1	1.44	87,315

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
4		IBL	SEQ-IBL4		1	87,315	7.05		7.05	< 50	accept

Notes

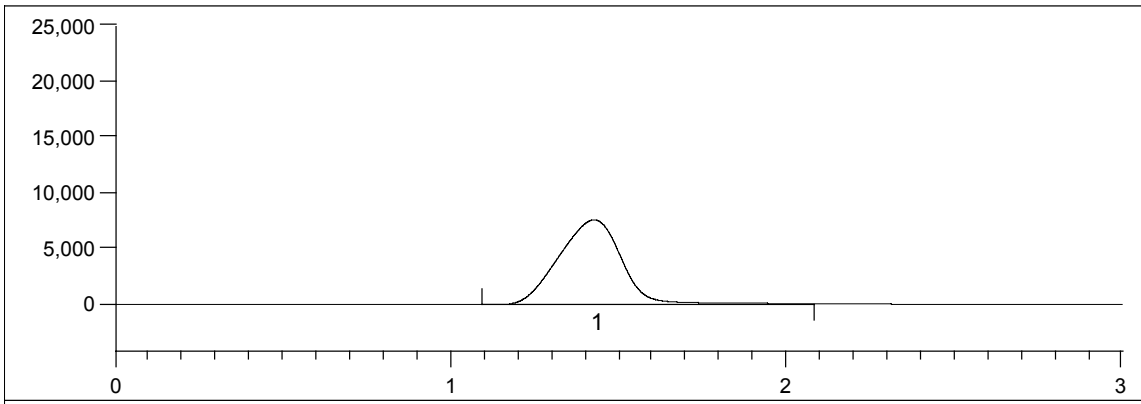


Date: 7/25/08
Time: 10:50 AM

Peak	rt	Area
1	1.41	286,269

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
5		STD	SEQ-CAL1		1	286,269	18.3		73.3	75-125	reject

Notes



Date: 7/25/08
Time: 10:54 AM

Peak	rt	Area
1	1.42	989,019

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
6		STD	SEQ-CAL2		1	989,019	75.1		75.1	75-125	reject

Notes

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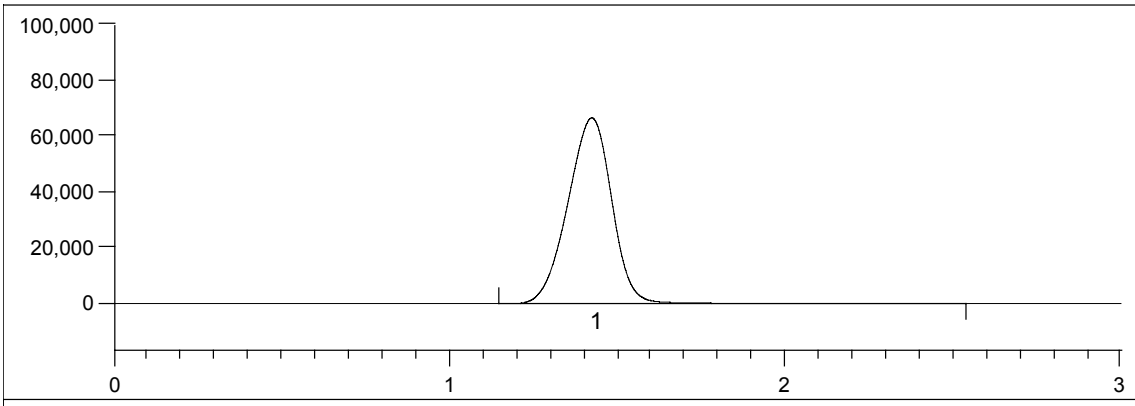
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

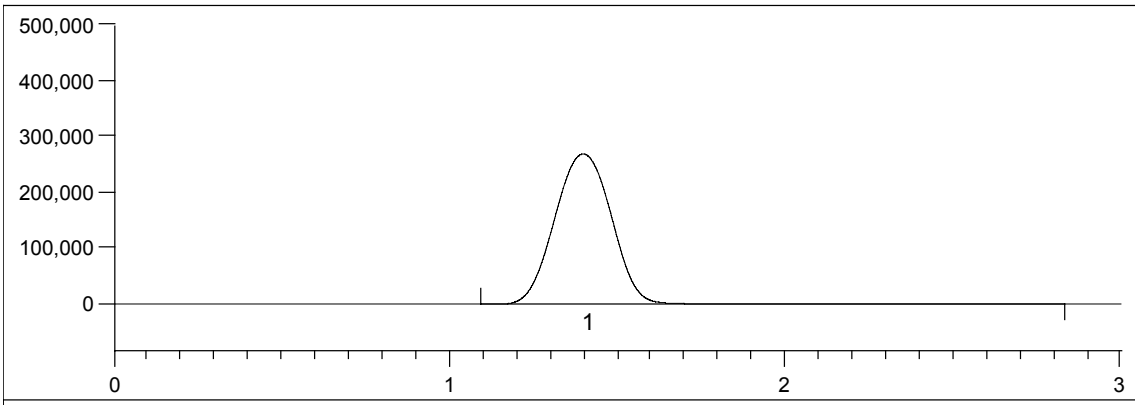
Project Number(s): 0800653 **Date Analyzed:** 7/25/08
Instrument ID: BR-05 **Analyst Name:** MSU



Date: 7/25/08
Time: 10:58 AM

Peak	rt	Area
1	1.42	6,122,830

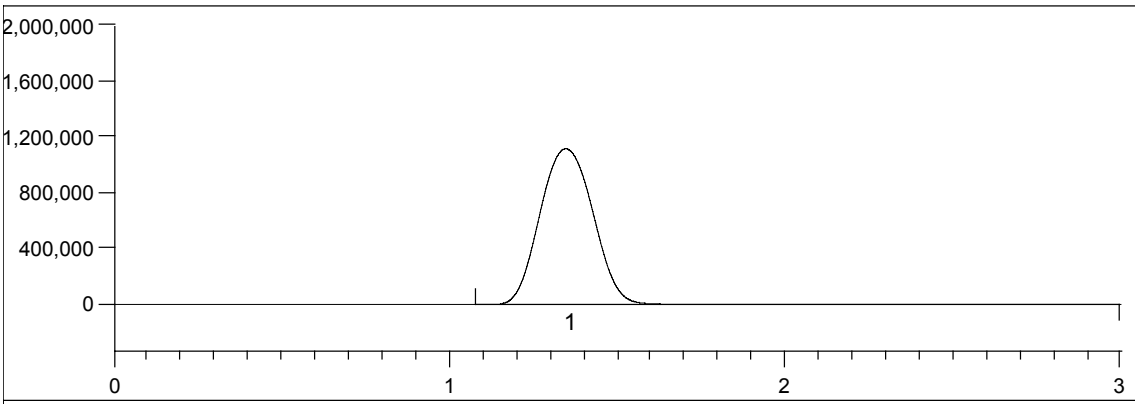
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
7		STD	SEQ-CAL3		1	6,122,830	490.		98.0	75-125	accept
Notes											



Date: 7/25/08
Time: 11:02 AM

Peak	rt	Area
1	1.39	31,824,602

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
8		STD	SEQ-CAL4		1	31,824,602	2,570		103	75-125	accept
Notes											



Date: 7/25/08
Time: 11:12 AM

Peak	rt	Area
1	1.34	124,204,286

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
9		STD	SEQ-CAL5		1	124,204,286	10,000		100.	75-125	accept
Notes											

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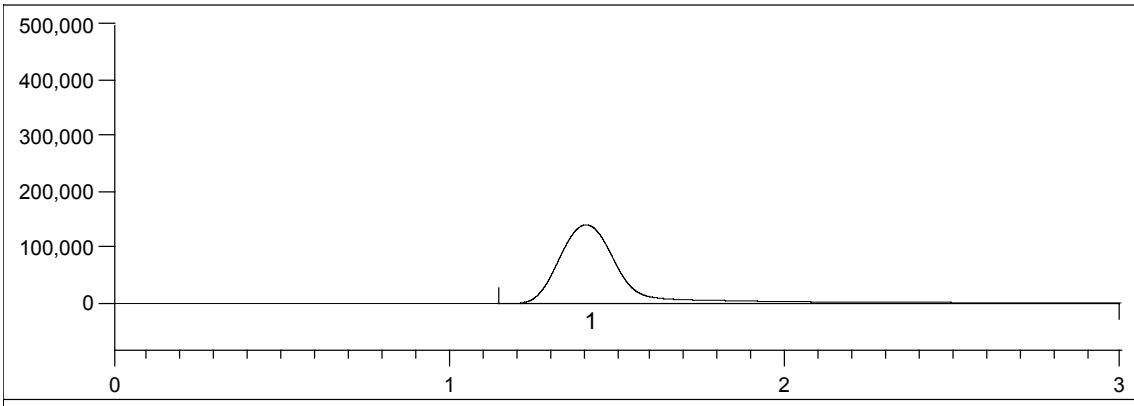
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

Project Number(s): 0800653 **Date Analyzed:** 7/25/08
Instrument ID: BR-05 **Analyst Name:** MSU

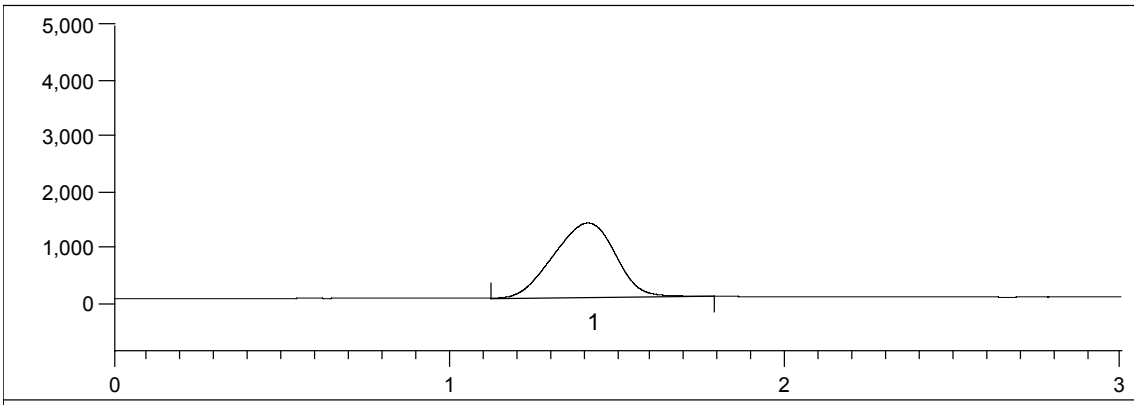


Date: 7/25/08
Time: 11:17 AM

Peak	rt	Area
1	1.40	18,093,608

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
10		ICV	SEQ-ICV1		1	18,093,608	1,460		91.0	85-115	accept

Notes

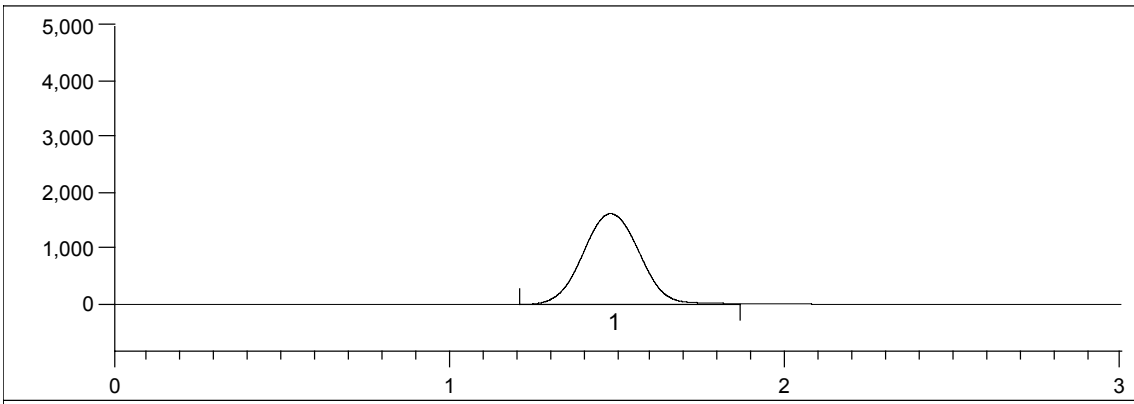


Date: 7/25/08
Time: 11:24 AM

Peak	rt	Area
1	1.41	171,417

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
11		MBA	B081138-BLK1		1	171,417	9.05	0.00	0.00	< 0.14	accept

Notes



Date: 7/25/08
Time: 11:32 AM

Peak	rt	Area
1	1.48	190,317

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
12		MBA	B081138-BLK2		1	190,317	10.6	0.00	0.00	< 0.14	accept

Notes

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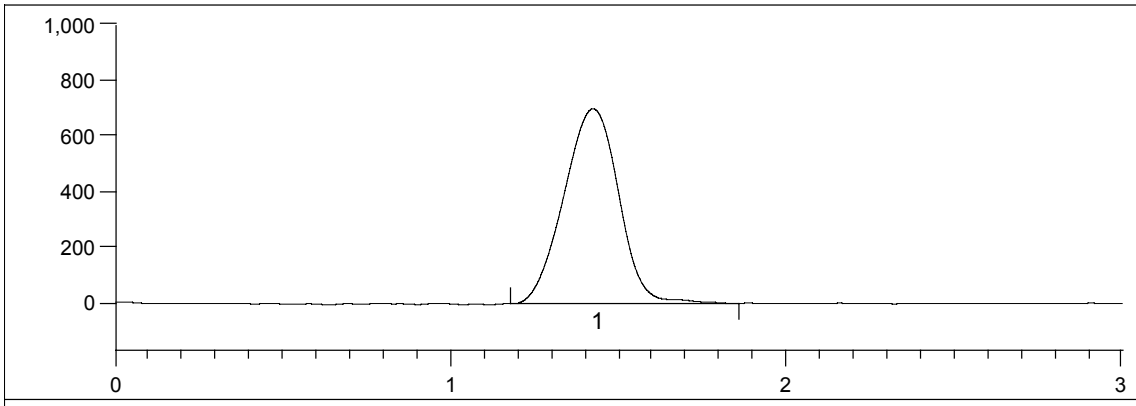
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

Project Number(s): 0800653 **Date Analyzed:** 7/25/08
Instrument ID: BR-05 **Analyst Name:** MSU

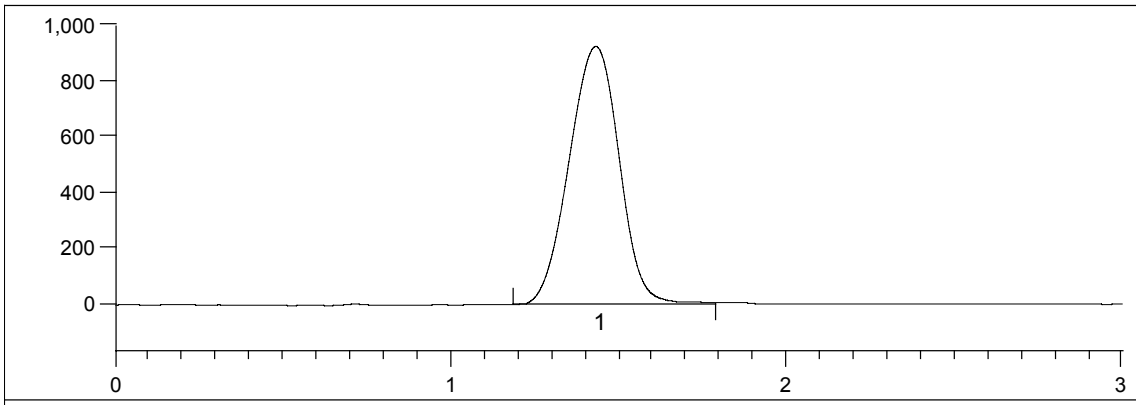


Date: 7/25/08
Time: 11:38 AM

Peak	rt	Area
1	1.42	79,891

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
13		CCB	SEQ-CCB1		1	79,891	6.45		6.45	< 50	accept

Notes

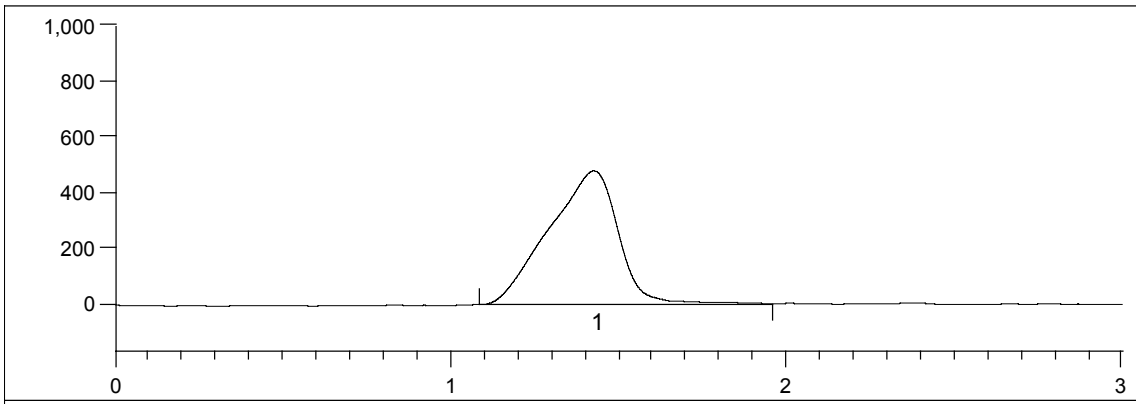


Date: 7/25/08
Time: 11:42 AM

Peak	rt	Area
1	1.43	96,336

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
14		S	BLK3 W/ BAD TRAP		1	96,336	2.99	0.00		< HS	accept

Notes



Date: 7/25/08
Time: 11:46 AM

Peak	rt	Area
1	1.42	69,464

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
15		S	BLK4 W/ BAD TRAP		1	69,464	0.819	0.00		< HS	accept

Notes

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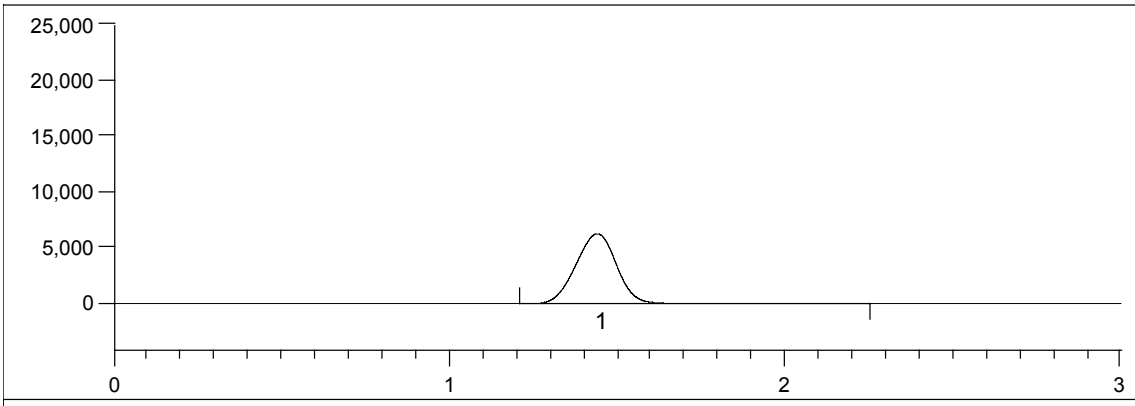
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

Project Number(s): 0800653
Instrument ID: BR-05

Date Analyzed: 7/25/08
Analyst Name: MSU

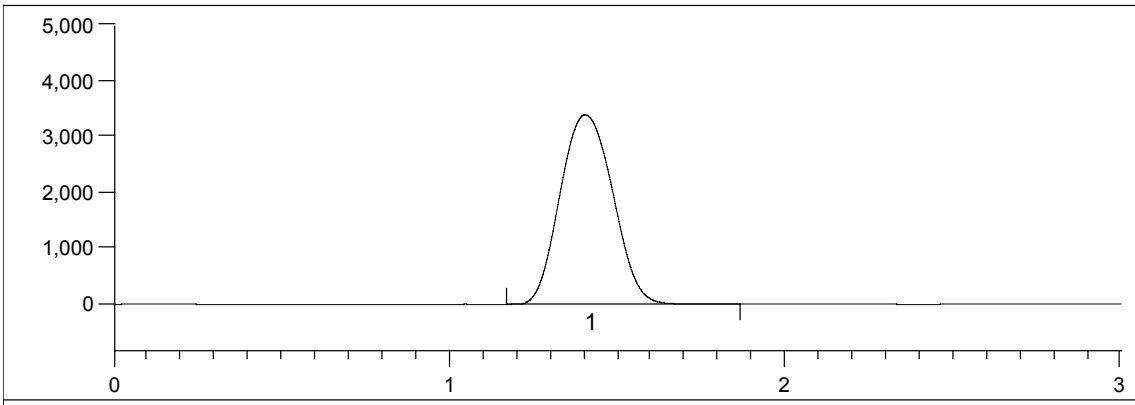


Date: 7/25/08
Time: 11:56 AM

Peak	rt	Area
1	1.44	538,648

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
16		S	B081138-BS1		1	538,648	38.7	0.00		< HS	accept

Notes

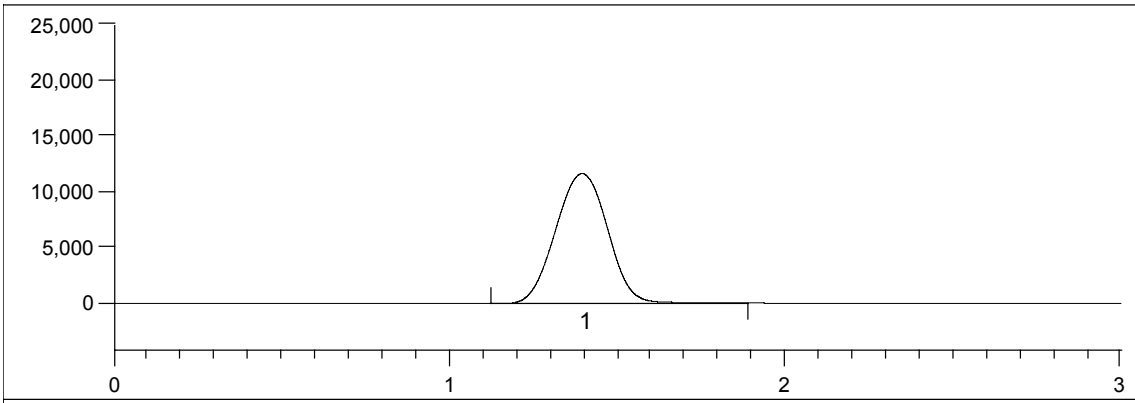


Date: 7/25/08
Time: 12:00 PM

Peak	rt	Area
1	1.40	375,927

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
17		STD	SEQ-CAL6		1	375,927	25.6		102	75-125	accept

Notes



Date: 7/25/08
Time: 12:04 PM

Peak	rt	Area
1	1.39	1,261,040

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
18		STD	SEQ-CAL7		1	1,261,040	97.1		97.1	75-125	accept

Notes

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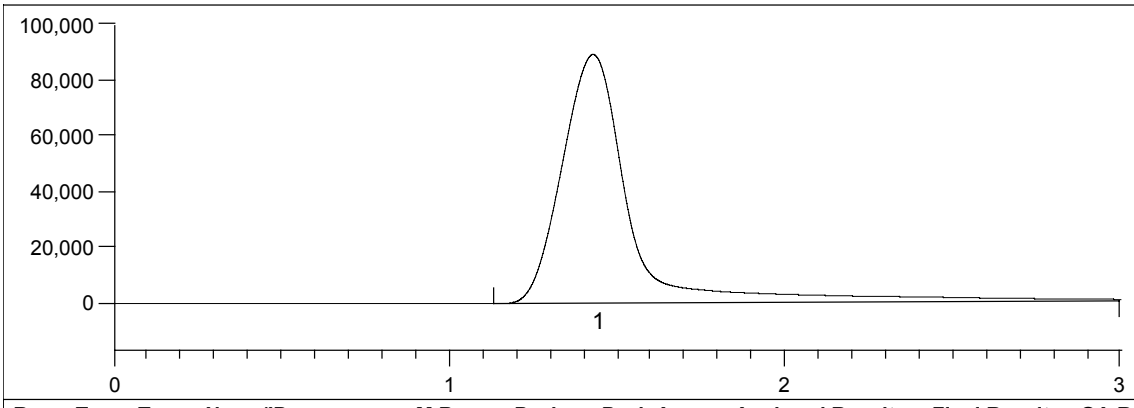
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

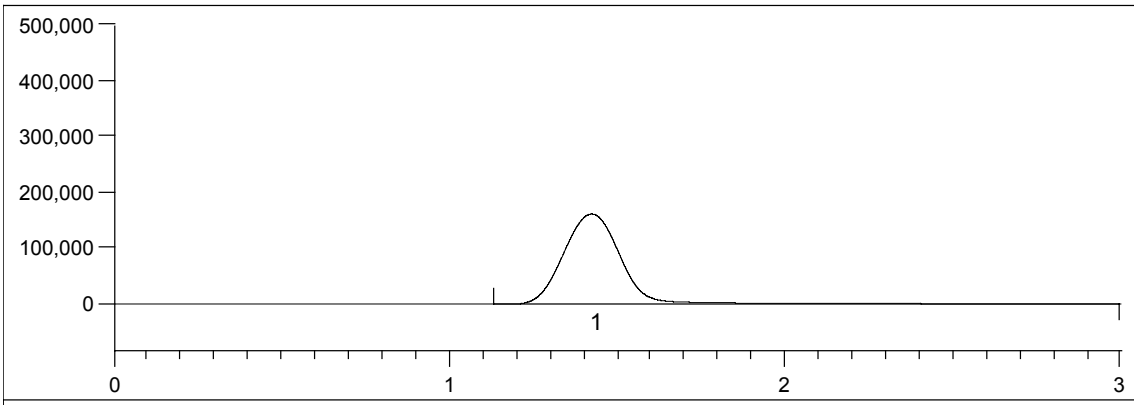
Project Number(s): 0800653 **Date Analyzed:** 7/25/08
Instrument ID: BR-05 **Analyst Name:** MSU



Date: 7/25/08
Time: 12:08 PM

Peak	rt	Area
1	1.42	12,340,447

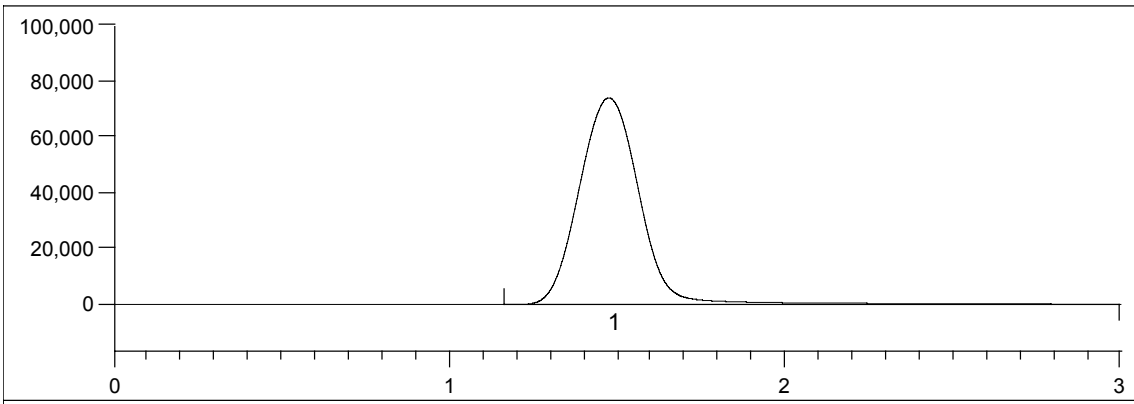
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
19		CRM	B081138-SRM1	MBA	1	12,340,447	992	39.7	126	65-135	accept
Notes											



Date: 7/25/08
Time: 12:13 PM

Peak	rt	Area
1	1.42	19,315,160

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
20		CRM	B081138-SRM2	MBA	1	19,315,160	1,560	311	81.4	65-135	accept
Notes											



Date: 7/25/08
Time: 12:19 PM

Peak	rt	Area
1	1.47	9,278,281

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
21		CRM	B081138-SRM3	MBA	1	9,278,281	745	29.9	96.6	65-135	accept
Notes											

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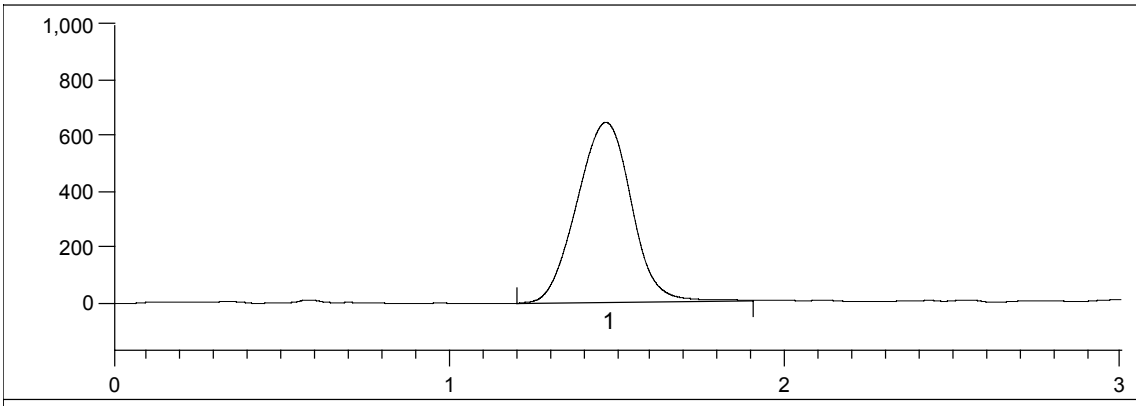
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

Project Number(s): 0800653
Instrument ID: BR-05

Date Analyzed: 7/25/08
Analyst Name: MSU

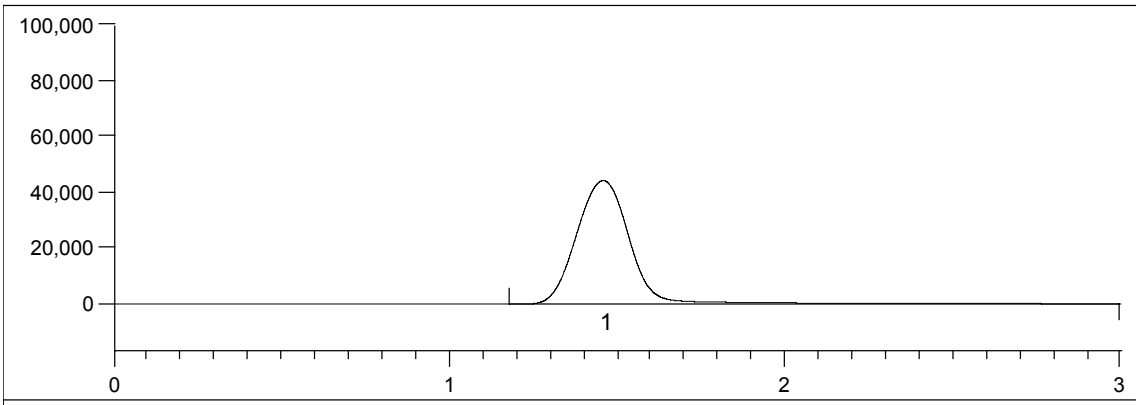


Date: 7/25/08
Time: 12:23 PM

Peak	rt	Area
1	1.46	72,853

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
22		S	0828032-04		1	72,853	1.09	0.00		< HS	accept

Notes

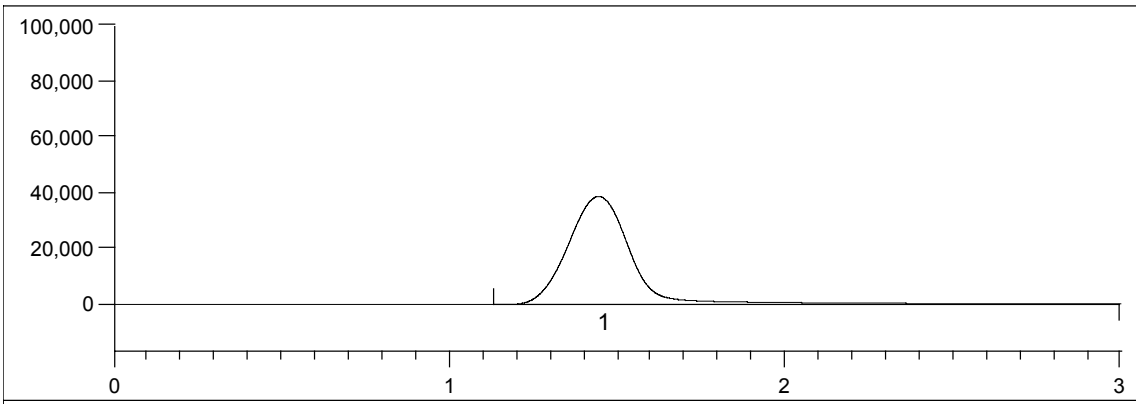


Date: 7/25/08
Time: 12:27 PM

Peak	rt	Area
1	1.45	4,929,163

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
23		CCV	SEQ-CCV1		1	4,929,163	393		78.7	70-130	accept

Notes



Date: 7/25/08
Time: 12:31 PM

Peak	rt	Area
1	1.44	5,083,010

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
24		CCV	SEQ-CCV2		1	5,083,010	406		81.2	70-130	accept

Notes

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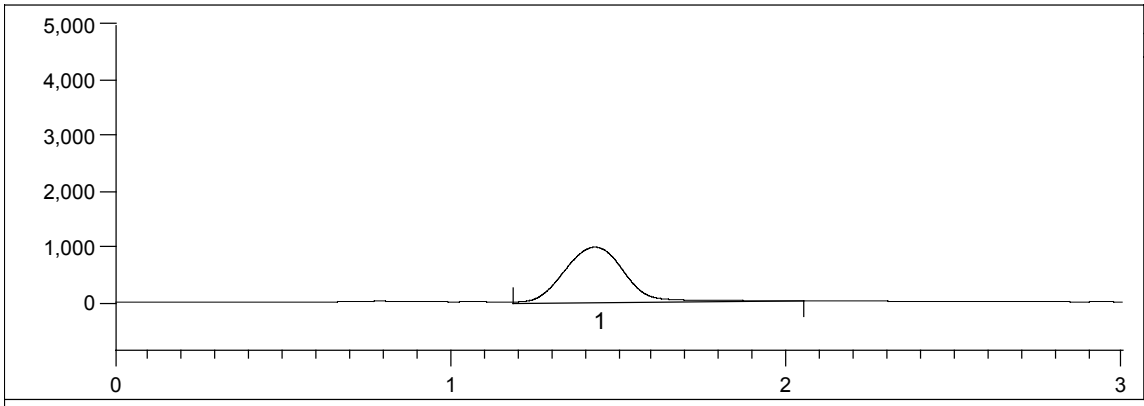
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

Project Number(s): 0800653 **Date Analyzed:** 7/25/08
Instrument ID: BR-05 **Analyst Name:** MSU

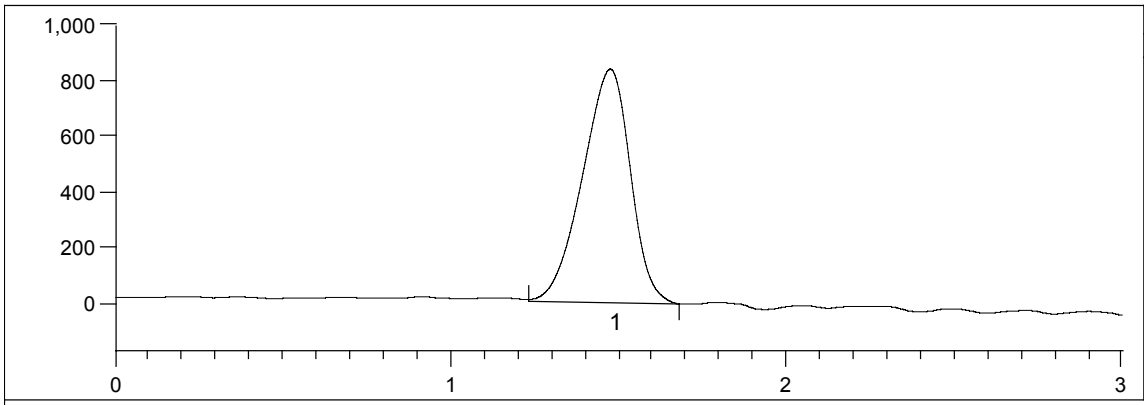


Date: 7/25/08
Time: 12:38 PM

Peak	rt	Area
1	1.42	120,233

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
25		MBA	B081138-BLK3		1	120,233	4.92	0.00	0.00	< 0.14	accept

Notes

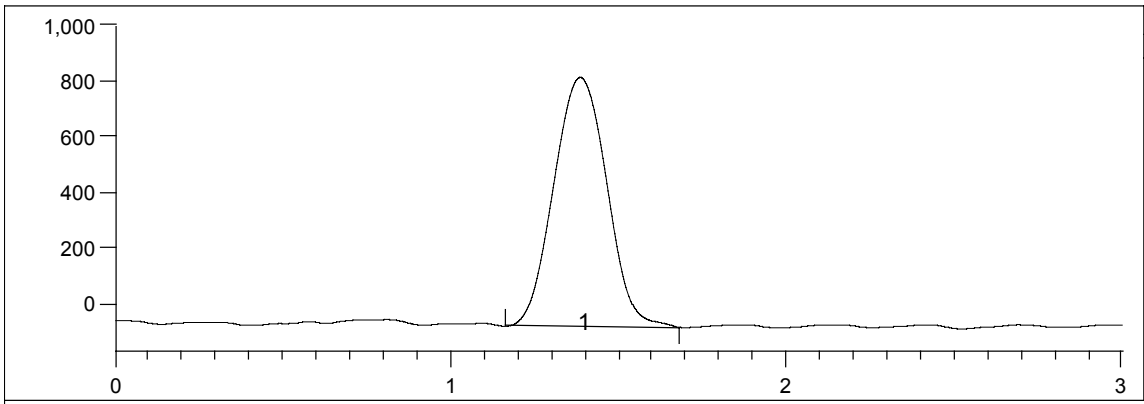


Date: 7/25/08
Time: 12:42 PM

Peak	rt	Area
1	1.47	82,641

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
26		MBA	B081138-BLK4		1	82,641	1.88	0.00	0.00	< 0.14	accept

Notes



Date: 7/25/08
Time: 12:46 PM

Peak	rt	Area
1	1.38	99,183

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
27		S	0827019-05		1	99,183	3.22	0.00		< HS	accept

Notes

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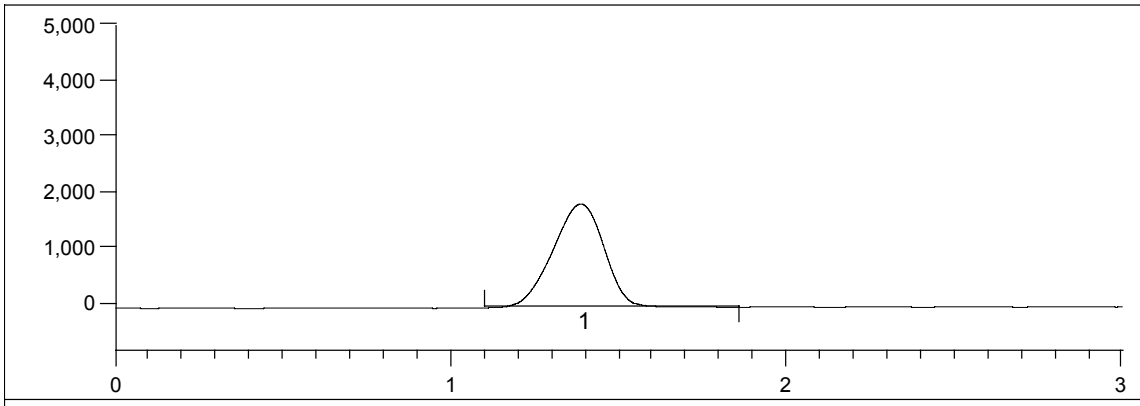
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

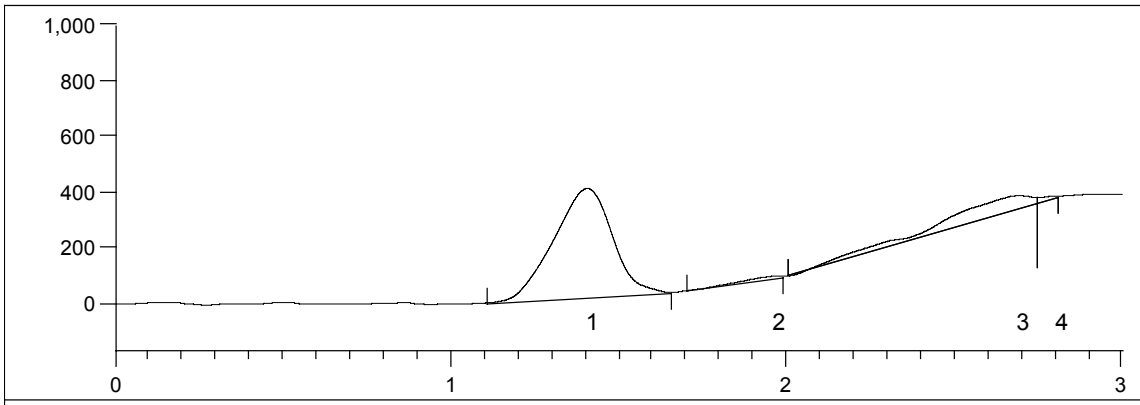
Project Number(s): 0800653 **Date Analyzed:** 7/25/08
Instrument ID: BR-05 **Analyst Name:** MSU



Date: 7/25/08
Time: 12:50 PM

Peak	rt	Area
1	1.38	202,365

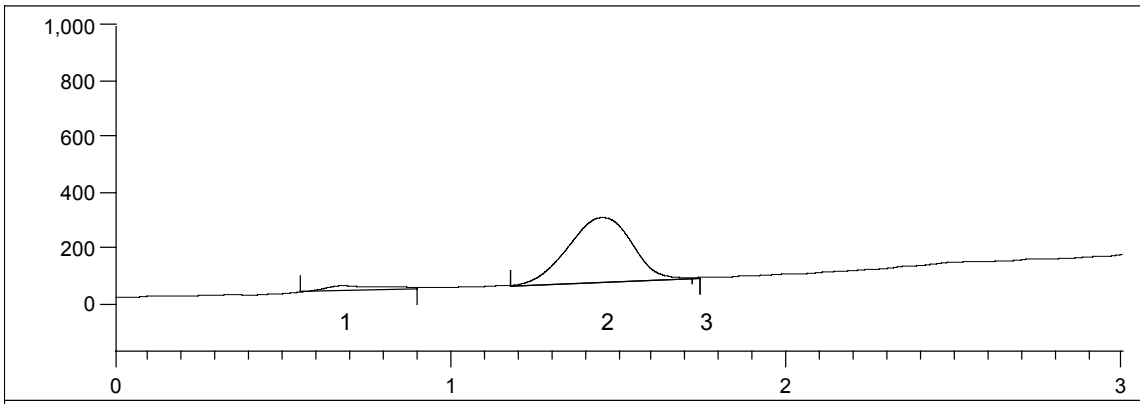
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
28		S	0829003-11		1	202,365	11.6	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 12:58 PM

Peak	rt	Area
1	1.40	47,549
2	1.96	642
3	2.69	11,895
4	2.80	362

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
29		S	0827019-03		1	47,549	-0.951	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 1:03 PM

Peak	rt	Area
1	0.67	1,713
2	1.45	30,243
3	1.74	8

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
30		S	0827019-04		2	30,243	-2.35	0.00		< HS	accept
Notes											

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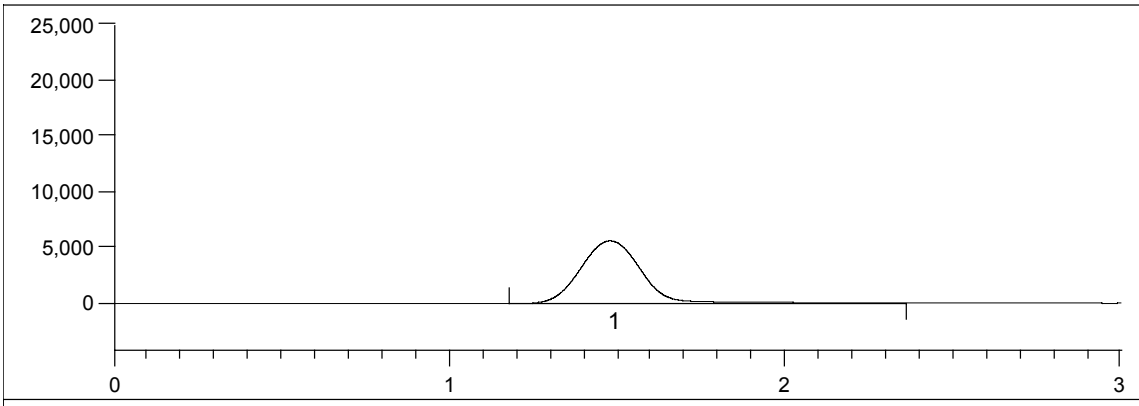
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

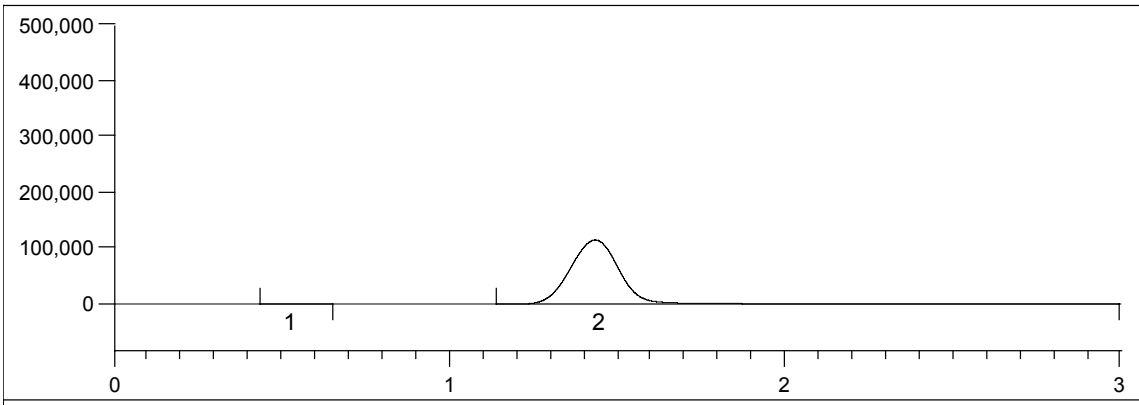
Project Number(s): 0800653 **Date Analyzed:** 7/25/08
Instrument ID: BR-05 **Analyst Name:** MSU



Date: 7/25/08
Time: 1:07 PM

Peak	rt	Area
1	1.47	705,133

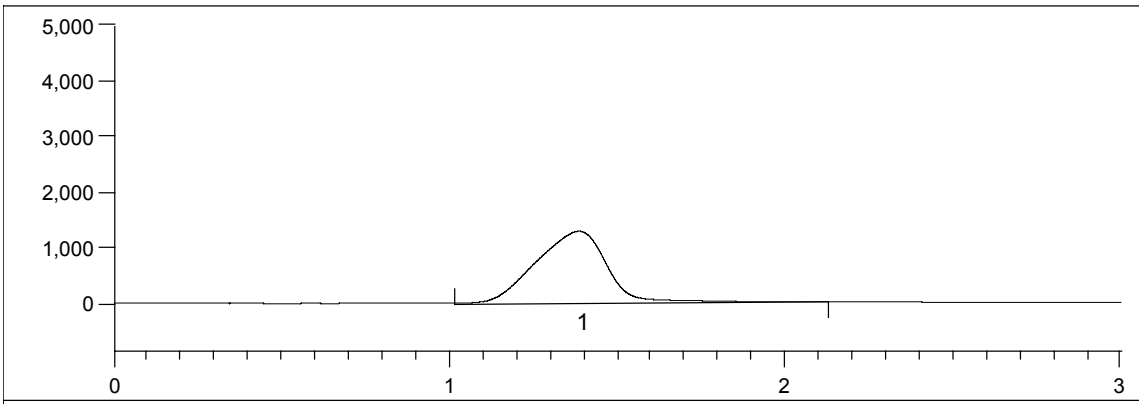
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
31		S	0828032-01		1	705,133	52.2	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 1:12 PM

Peak	rt	Area
1	0.51	872
2	1.43	11,959,894

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
32		S	0828032-02		2	11,959,894	961	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 1:18 PM

Peak	rt	Area
1	1.38	189,589

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
33		S	0828032-03		1	189,589	10.5	0.00		< HS	accept
Notes											

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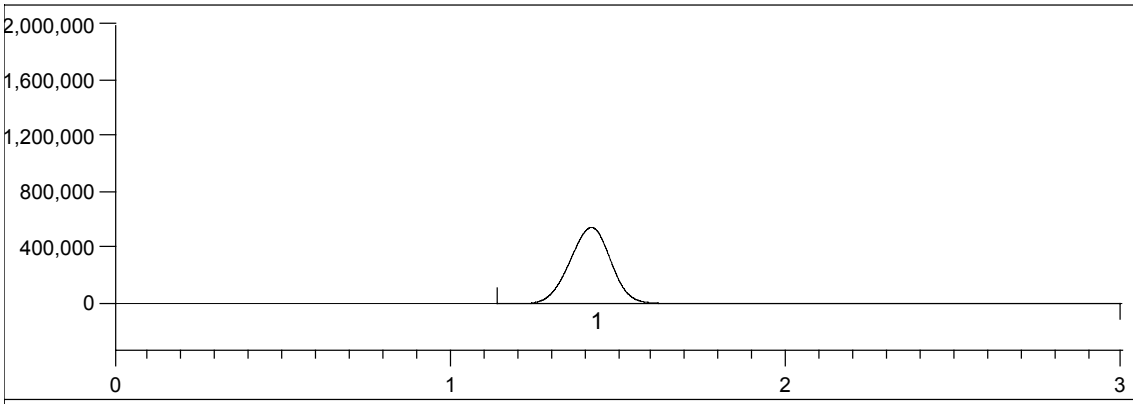
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

Project Number(s): 0800653
Instrument ID: BR-05

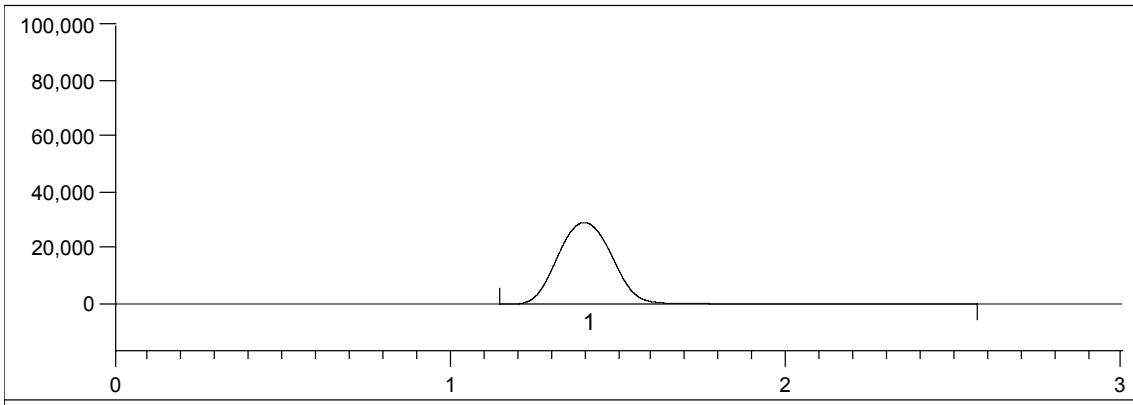
Date Analyzed: 7/25/08
Analyst Name: MSU



Date: 7/25/08
Time: 1:22 PM

Peak	rt	Area
1	1.42	47,516,688

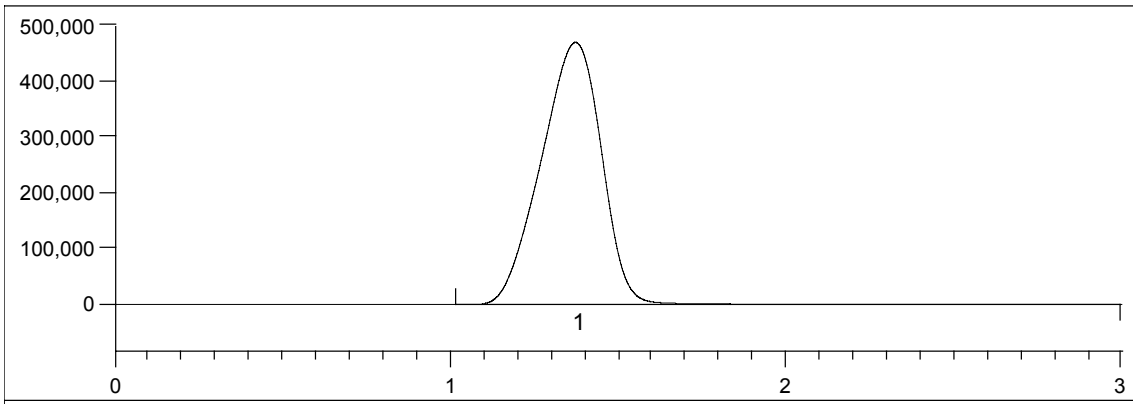
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
34		S	0829003-06		1	47,516,688	3,830	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 1:25 PM

Peak	rt	Area
1	1.39	3,339,251

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
35		S	0829003-07		1	3,339,251	265	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 1:30 PM

Peak	rt	Area
1	1.37	59,320,684

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
36		S	0829003-08		1	59,320,684	4,790	0.00		< HS	accept
Notes											

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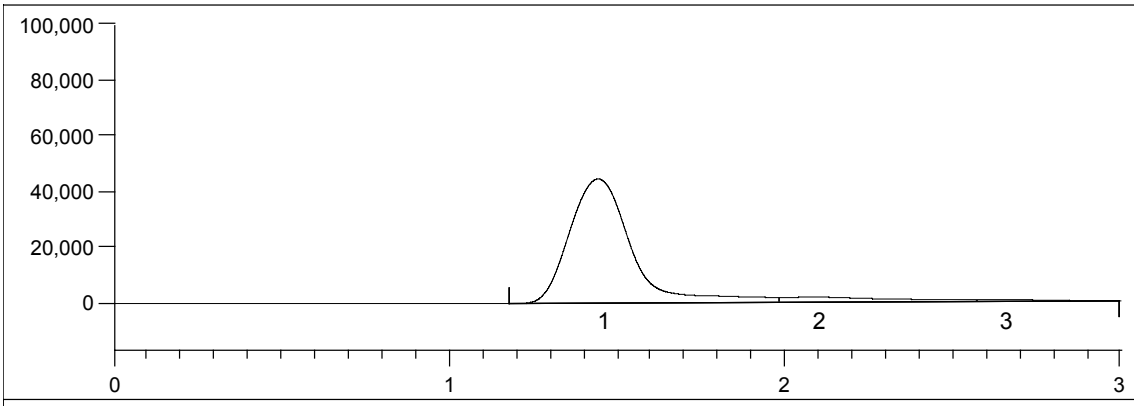
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

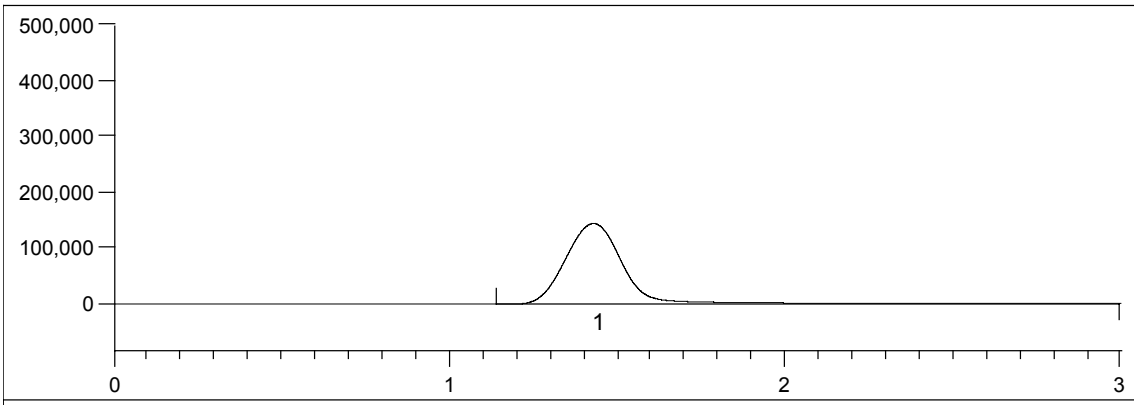
Project Number(s): 0800653 **Date Analyzed:** 7/25/08
Instrument ID: BR-05 **Analyst Name:** MSU



Date: 7/25/08
Time: 1:40 PM

Peak	rt	Area
1	1.44	5,759,909
2	2.08	453,007
3	2.64	105,689

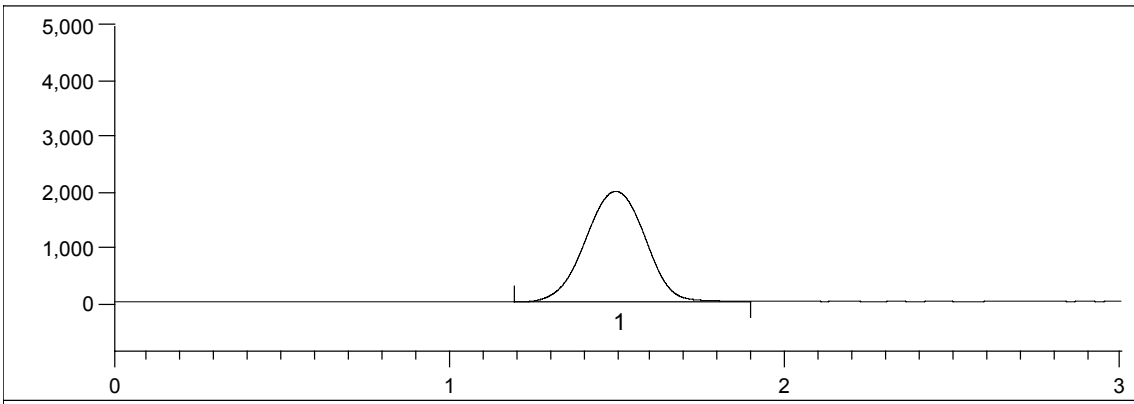
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
37		S	0829003-09		1	5,759,909	460.	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 1:44 PM

Peak	rt	Area
1	1.42	17,471,818

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
38		S	0829003-10		1	17,471,818	1,410	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 1:48 PM

Peak	rt	Area
1	1.49	244,531

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
39		S	0827019-03RE1	MBA	1	244,531	15.0	0.0597		< HS	accept
Notes											

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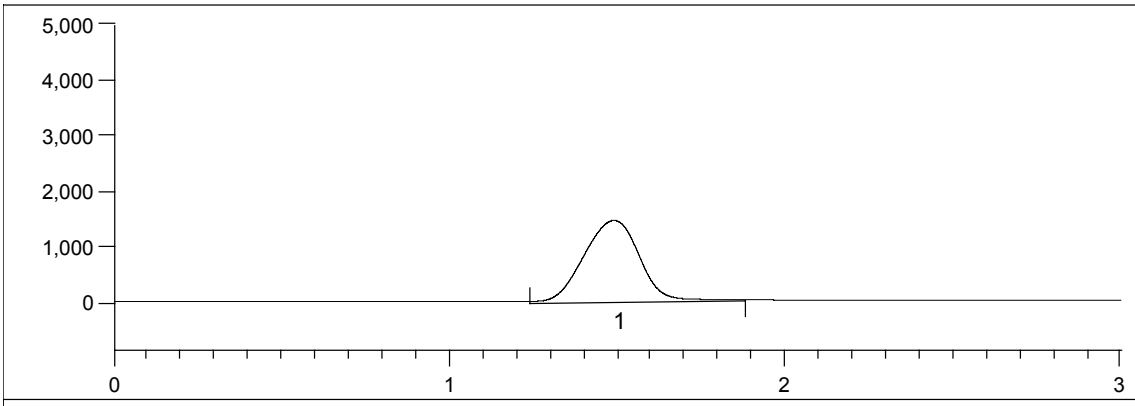
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

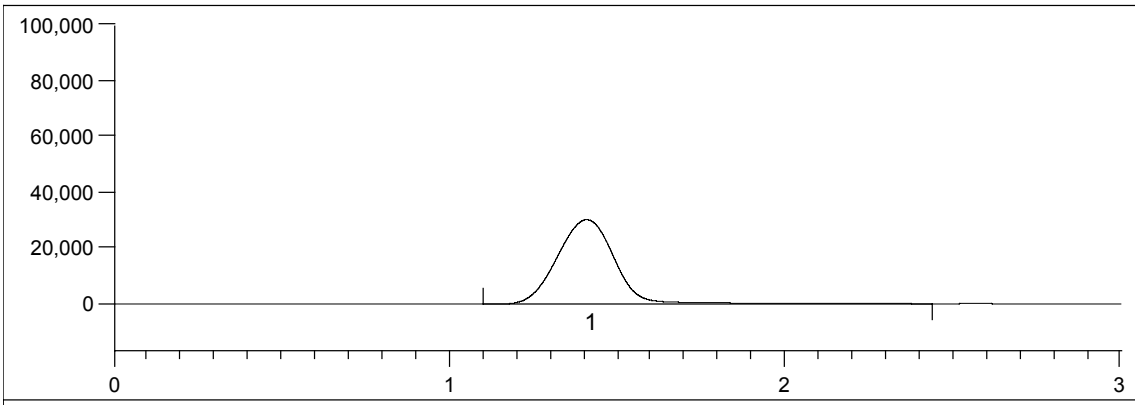
Project Number(s): 0800653 **Date Analyzed:** 7/25/08
Instrument ID: BR-05 **Analyst Name:** MSU



Date: 7/25/08
Time: 1:53 PM

Peak	rt	Area
1	1.48	163,138

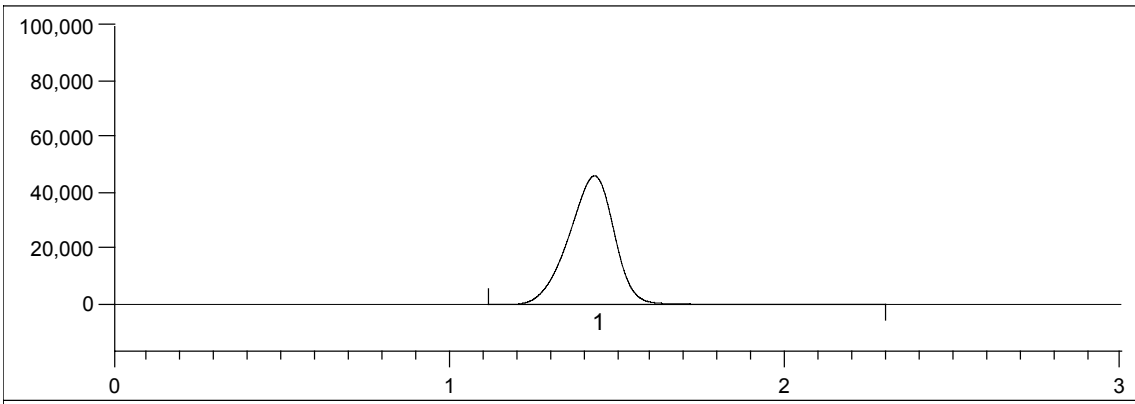
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
40		S	0827019-04RE1	MBA	1	163,138	8.39	0.0321		< HS	accept
Notes											



Date: 7/25/08
Time: 2:01 PM

Peak	rt	Area
1	1.40	3,606,326

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
41		S	0828032-01RE1	MBA	1	3,606,326	287	10.7		< HS	accept
Notes											



Date: 7/25/08
Time: 2:06 PM

Peak	rt	Area
1	1.43	4,396,220

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
42		S	0828032-03RE1		1	4,396,220	350.	0.00		< HS	accept
Notes											

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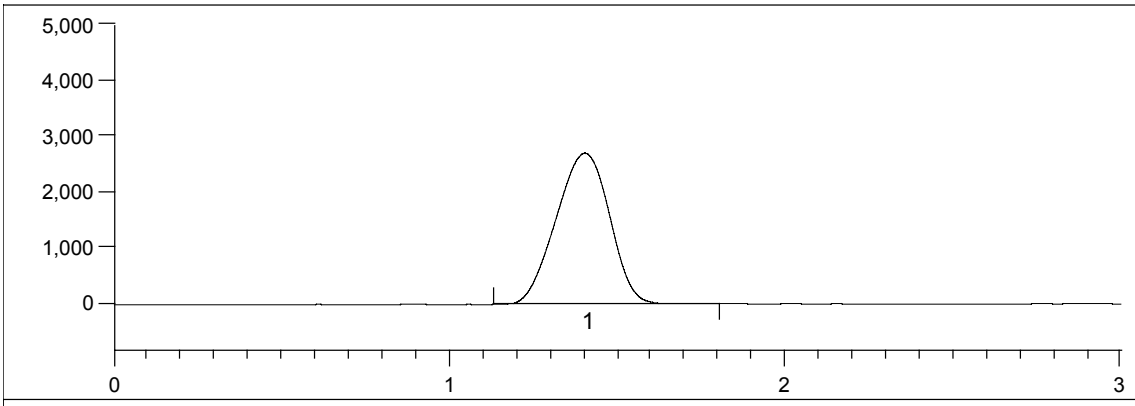
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

Project Number(s): 0800653
Instrument ID: BR-05

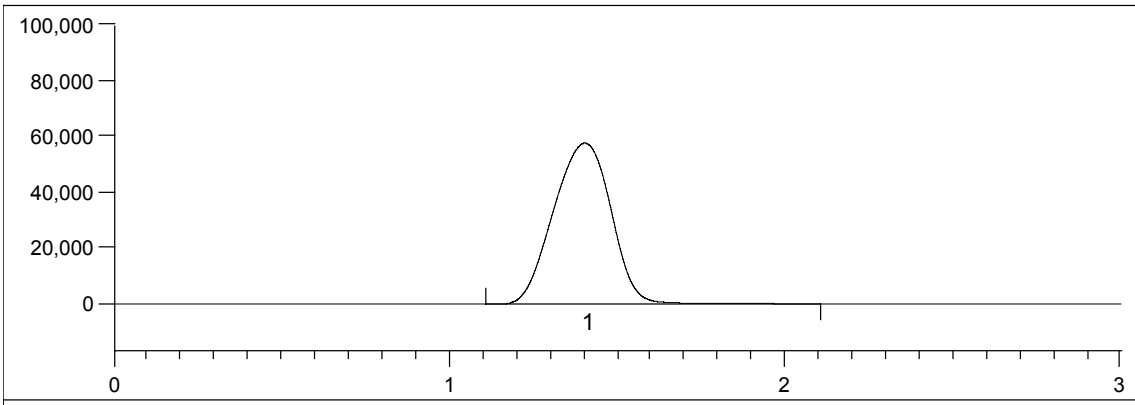
Date Analyzed: 7/25/08
Analyst Name: MSU



Date: 7/25/08
Time: 2:10 PM

Peak	rt	Area
1	1.40	305,105

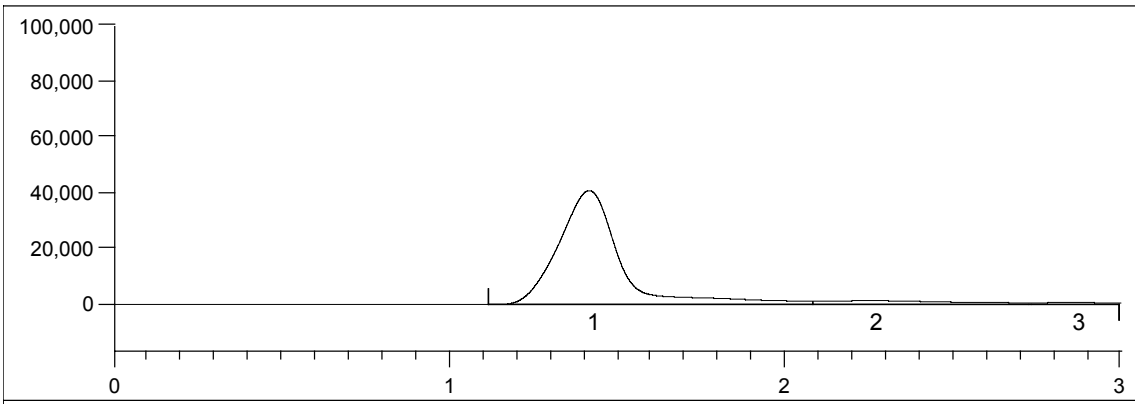
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
43		S	B081138-DUP1	MBA	1	305,105	19.9	0.0784		< HS	reject
Notes											



Date: 7/25/08
Time: 2:14 PM

Peak	rt	Area
1	1.40	6,927,303

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
44		S	B081138-MS1	MBA	1	6,927,303	555	2.10		< HS	reject
Notes											



Date: 7/25/08
Time: 2:23 PM

Peak	rt	Area
1	1.41	5,154,753
2	2.26	253,868
3	2.85	17,650

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
45		S	B081138-MSD1	MBA	1	5,154,753	412	1.58		< HS	reject
Notes											

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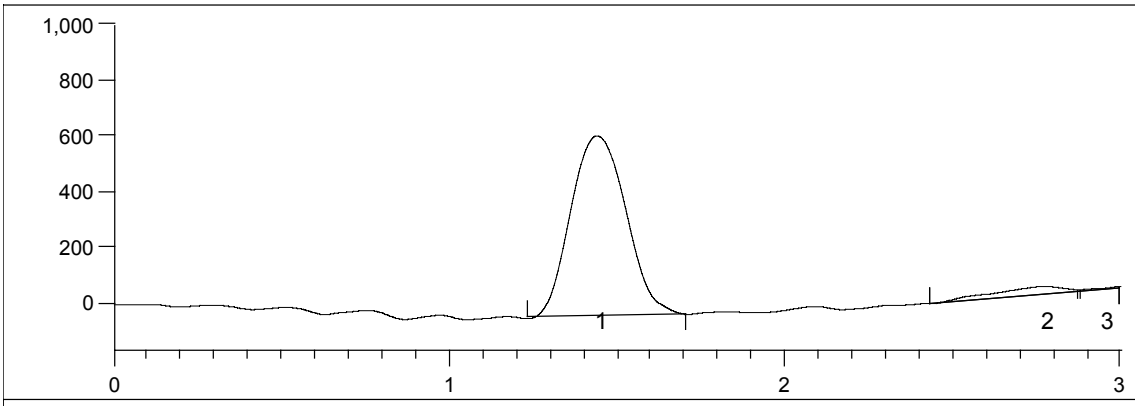
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

Project Number(s): 0800653
Instrument ID: BR-05

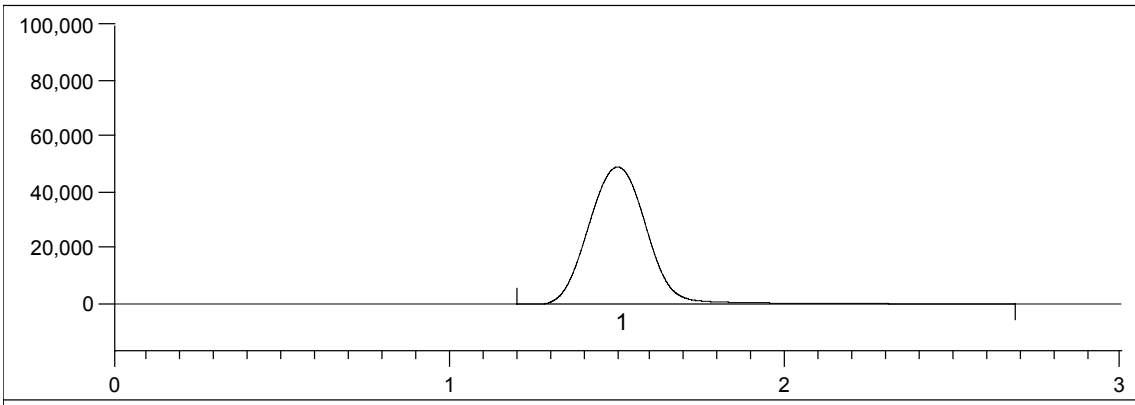
Date Analyzed: 7/25/08
Analyst Name: MSU



Date: 7/25/08
Time: 2:28 PM

Peak	rt	Area
1	1.44	75,378
2	2.76	4,312
3	2.94	87

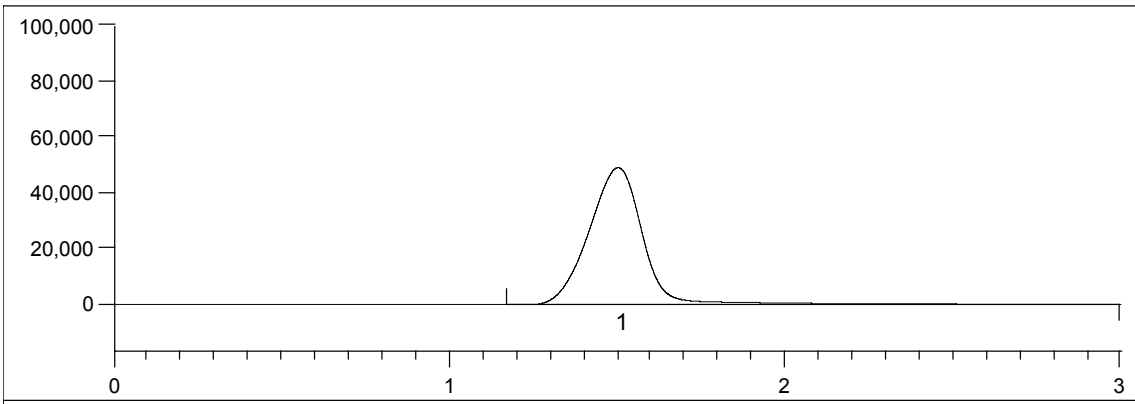
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
46		S	B081138-DUP2	MBA	1	75,378	1.30	0.00496		< HS	reject
Notes											



Date: 7/25/08
Time: 2:33 PM

Peak	rt	Area
1	1.50	6,014,931

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
47		S	B081138-MS2	MBA	1	6,014,931	481	1.82		< HS	accept
Notes											



Date: 7/25/08
Time: 2:37 PM

Peak	rt	Area
1	1.50	5,590,541

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
48		S	B081138-MSD2	MBA	1	5,590,541	447	1.77		< HS	accept
Notes											

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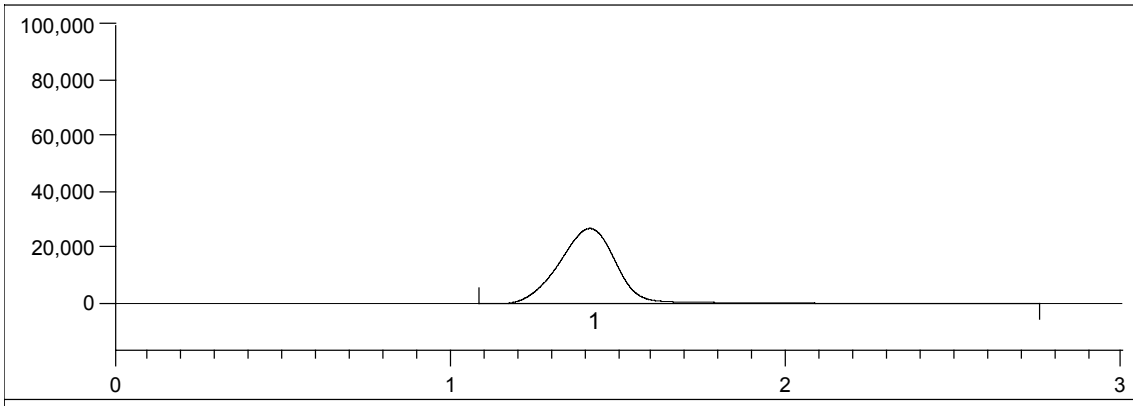
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

Project Number(s): 0800653
Instrument ID: BR-05

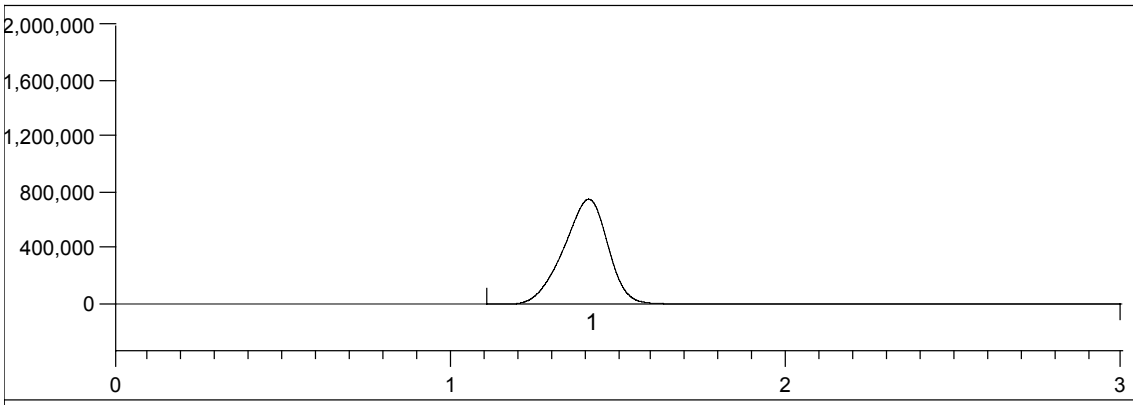
Date Analyzed: 7/25/08
Analyst Name: MSU



Date: 7/25/08
Time: 2:43 PM

Peak	rt	Area
1	1.41	3,345,421

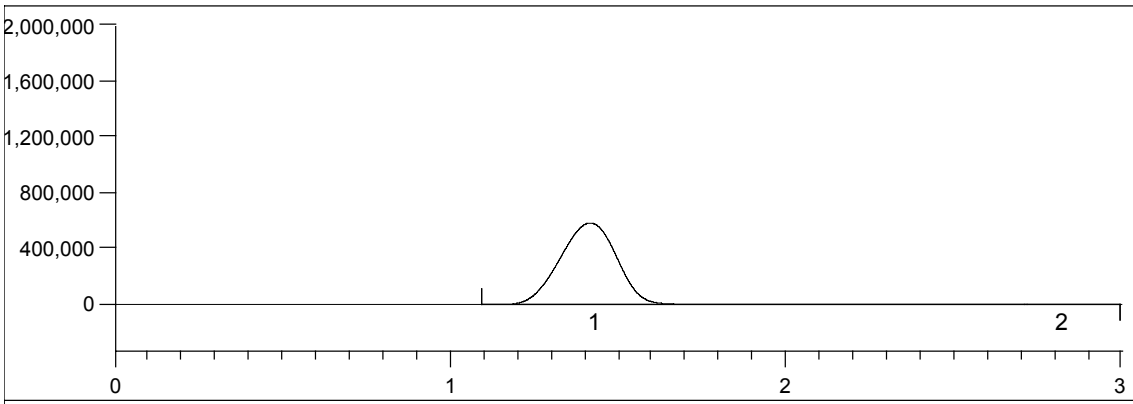
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
49		S	B081138-DUP3	MBA	1	3,345,421	265	10.1		< HS	reject
Notes											



Date: 7/25/08
Time: 2:48 PM

Peak	rt	Area
1	1.41	70,281,620

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
50		S	B081138-MS3	MBA	1	70,281,620	5,670	1,030		< HS	accept
Notes											



Date: 7/25/08
Time: 2:52 PM

Peak	rt	Area
1	1.41	69,621,589
2	2.80	17,043

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
51		S	B081138-MSD3	MBA	1	69,621,589	5,620	1,070		< HS	accept
Notes											

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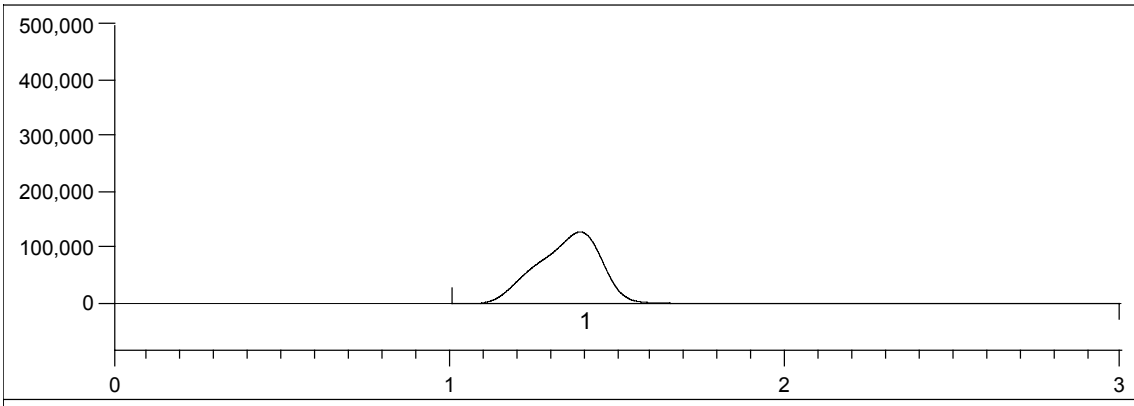
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

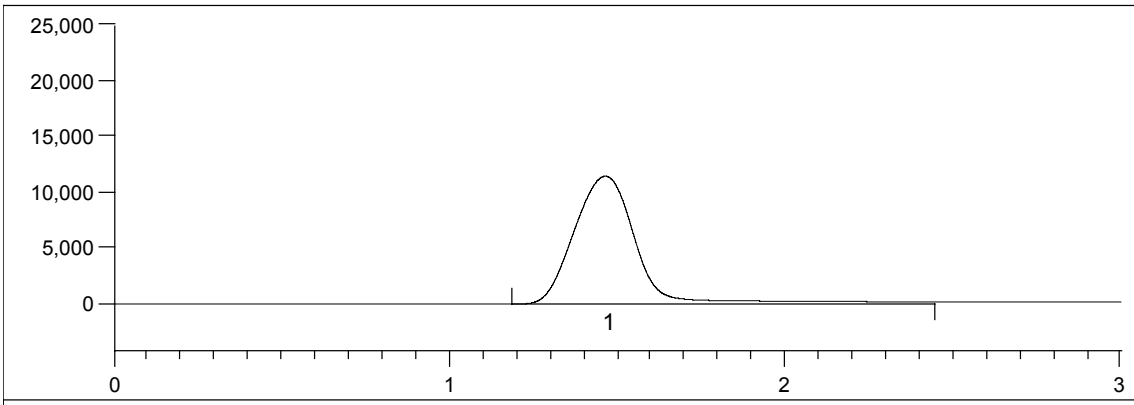
Project Number(s): 0800653 **Date Analyzed:** 7/25/08
Instrument ID: BR-05 **Analyst Name:** MSU



Date: 7/25/08
Time: 2:56 PM

Peak	rt	Area
1	1.38	17,354,721

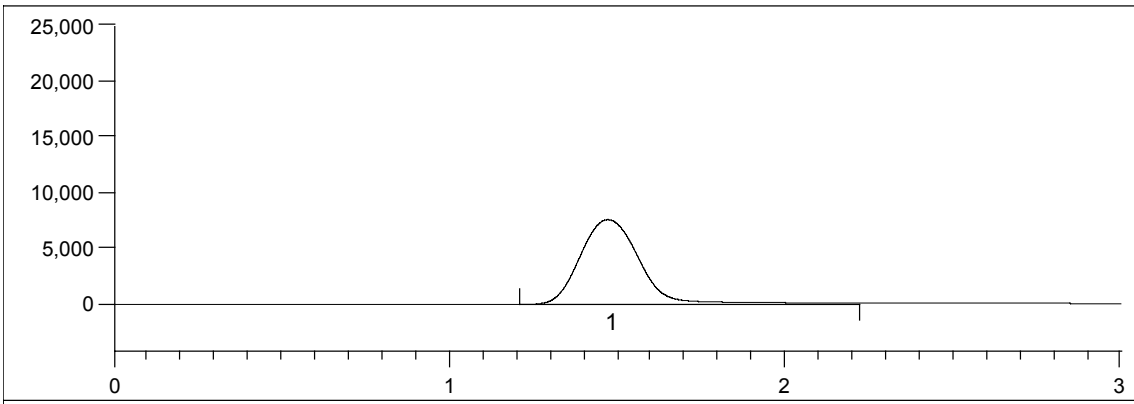
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
52		S	B081138-PS1		1	17,354,721	1,400	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 3:03 PM

Peak	rt	Area
1	1.46	1,430,035

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
53		S	B081138-PS2		1	1,430,035	111	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 3:08 PM

Peak	rt	Area
1	1.47	919,388

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
54		S	B081138-PS3		1	919,388	69.5	0.00		< HS	accept
Notes											

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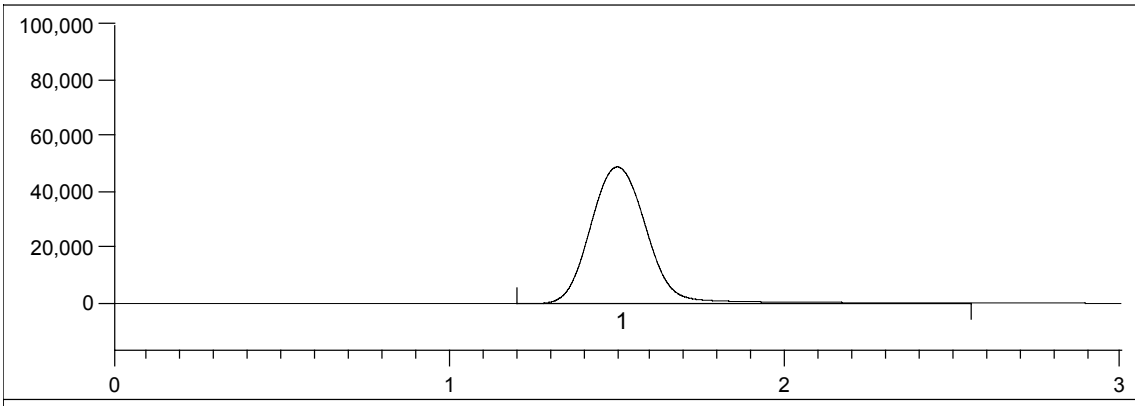
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

Project Number(s): 0800653
Instrument ID: BR-05

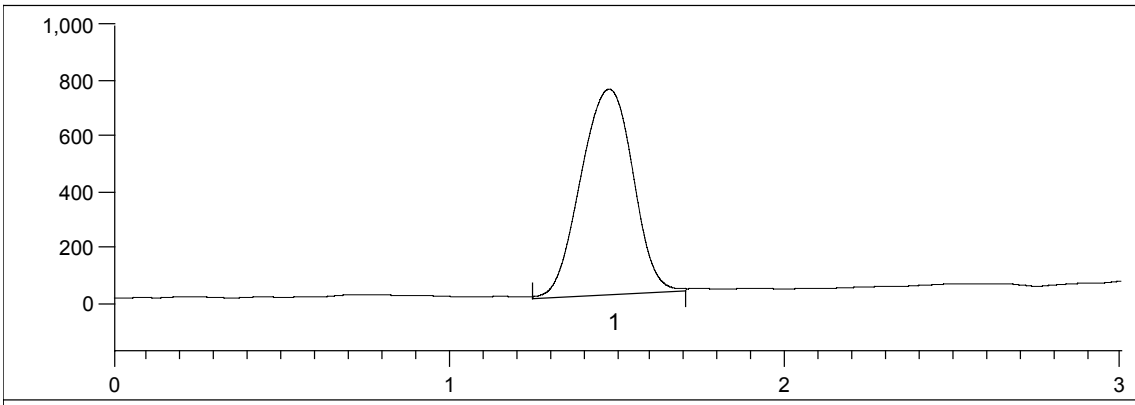
Date Analyzed: 7/25/08
Analyst Name: MSU



Date: 7/25/08
Time: 3:17 PM

Peak	rt	Area
1	1.50	5,744,522

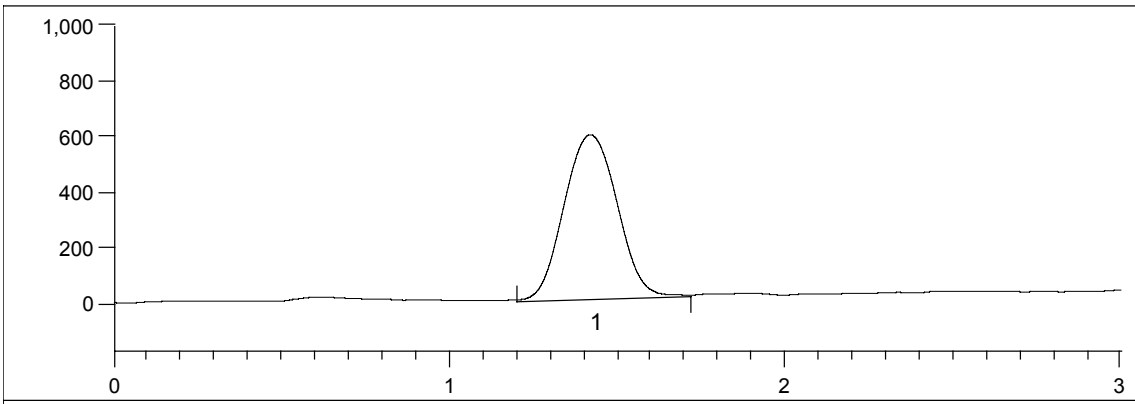
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
55		CCV	SEQ-CCV3		1	5,744,522	459		91.8	70-130	accept
Notes											



Date: 7/25/08
Time: 3:21 PM

Peak	rt	Area
1	1.47	78,243

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
56		S	BLK1		1	78,243	1.53	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 3:26 PM

Peak	rt	Area
1	1.42	64,042

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
57		S	BLK2		1	64,042	0.381	0.00		< HS	accept
Notes											

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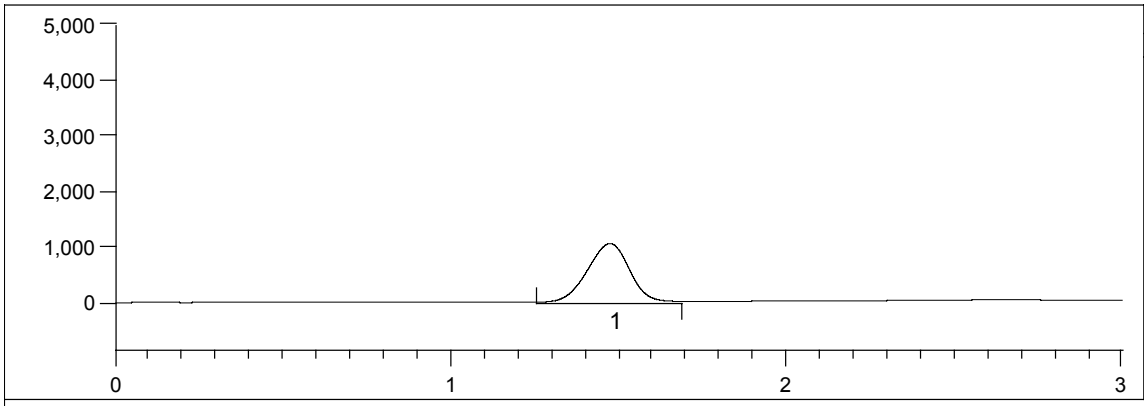
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

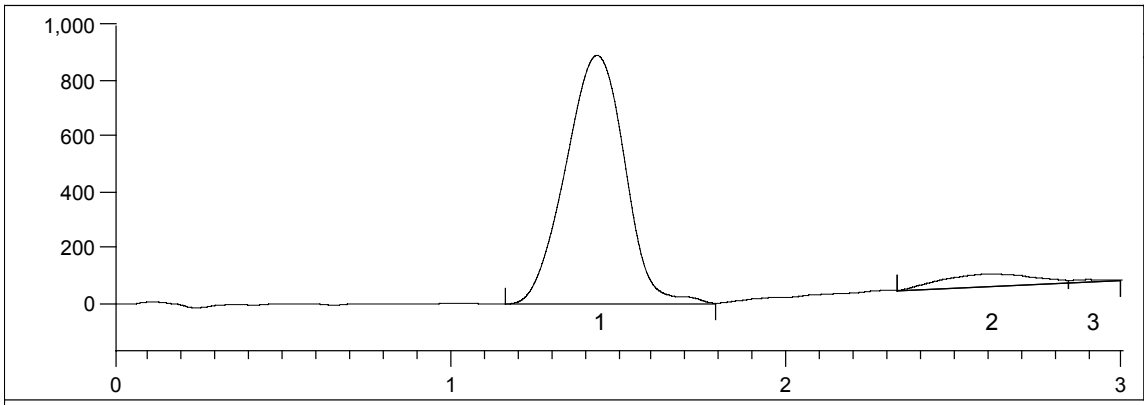
Project Number(s): 0800653 **Date Analyzed:** 7/25/08
Instrument ID: BR-05 **Analyst Name:** MSU



Date: 7/25/08
Time: 3:38 PM

Peak	rt	Area
1	1.47	90,154

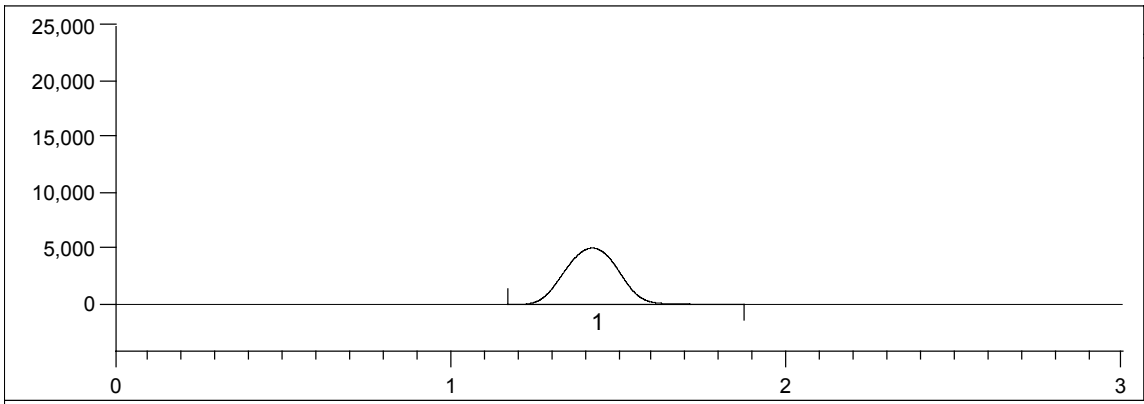
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
58		S	BLK3		1	90,154	2.49	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 3:48 PM

Peak	rt	Area
1	1.43	109,574
2	2.59	8,428
3	2.89	450

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
59		S	BLK4		1	109,574	4.06	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 3:53 PM

Peak	rt	Area
1	1.42	571,154

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
60		S	BS1		1	571,154	41.3	0.00		< HS	accept
Notes											

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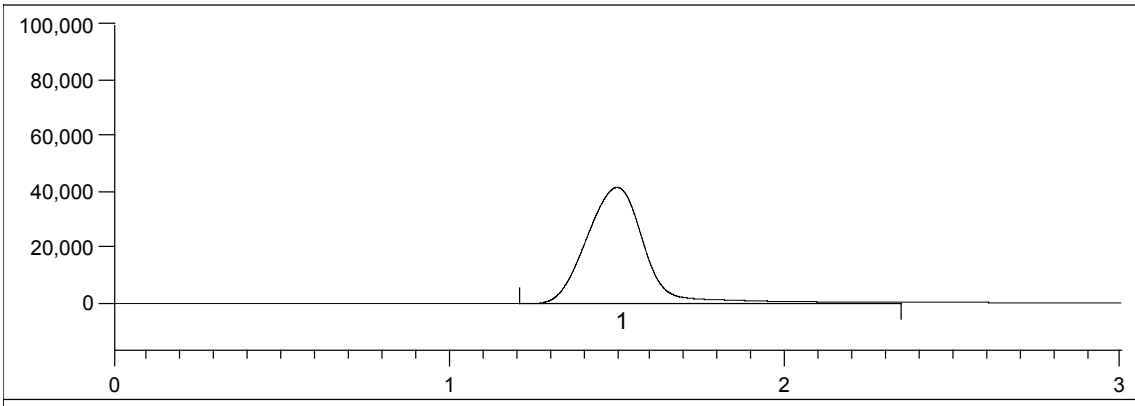
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

Project Number(s): 0800653
Instrument ID: BR-05

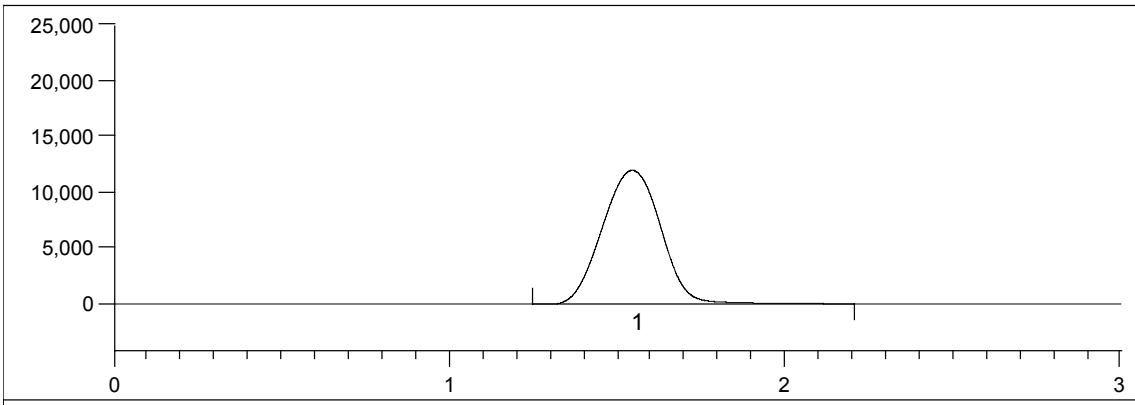
Date Analyzed: 7/25/08
Analyst Name: MSU



Date: 7/25/08
Time: 4:08 PM

Peak	rt	Area
1	1.50	4,937,178

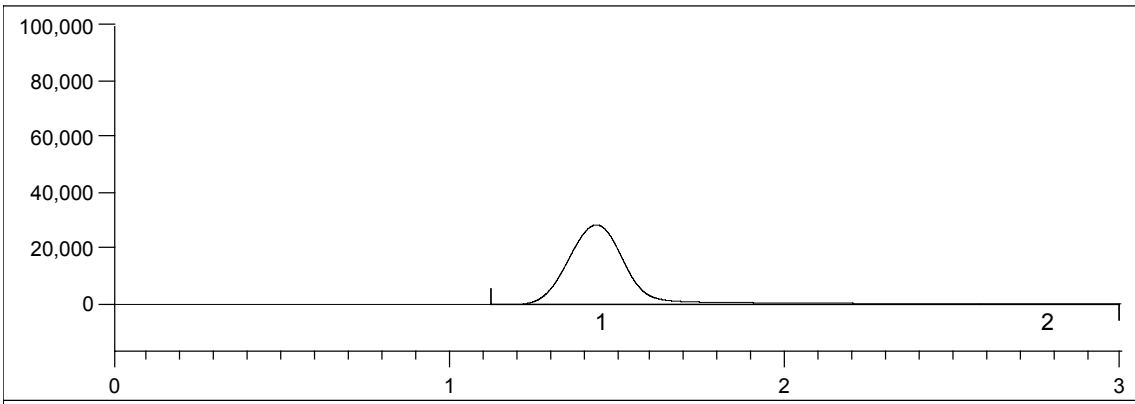
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
61		CCV	SEQ-CCV5		1	4,937,178	394		78.8	70-130	accept
Notes											



Date: 7/25/08
Time: 4:12 PM

Peak	rt	Area
1	1.54	1,473,385

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
62		S	B081138-PS4		1	1,473,385	114	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 4:16 PM

Peak	rt	Area
1	1.43	3,517,957
2	2.76	20,644

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
63		CCV	SEQ-CCV4		1	3,517,957	279		55.9	70-130	reject
Notes											

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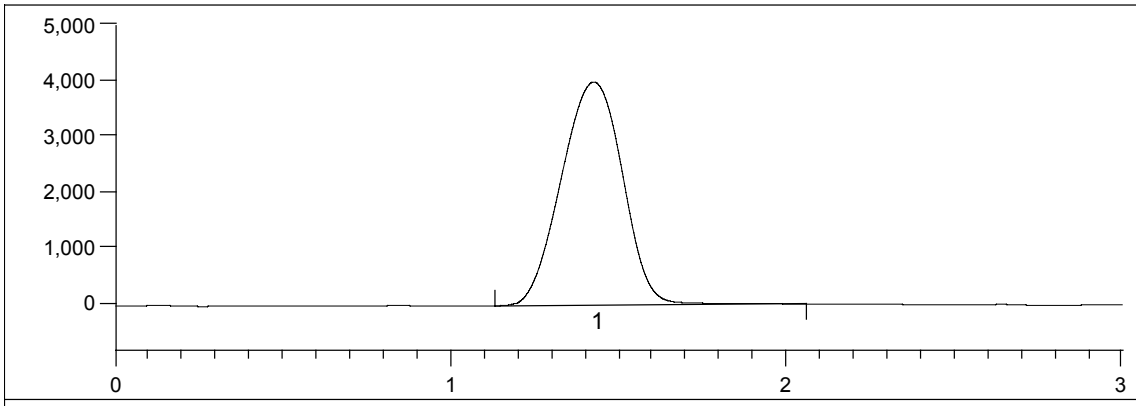
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

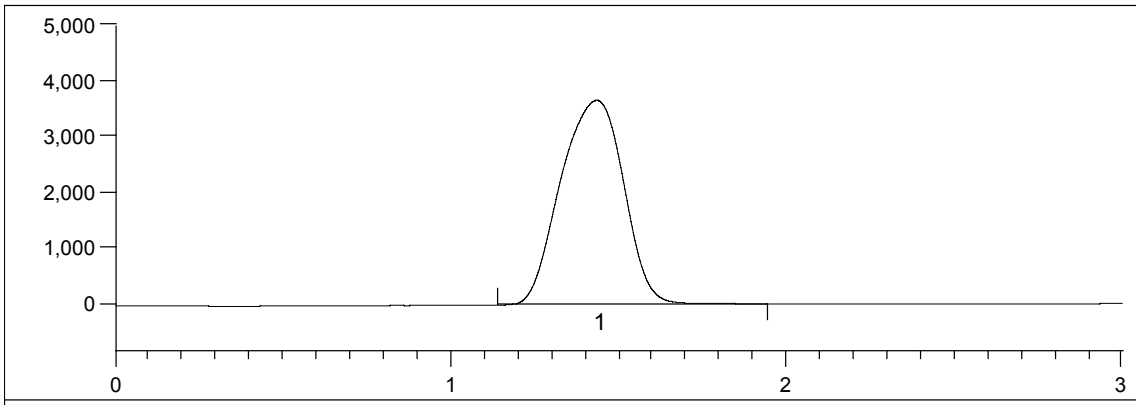
Project Number(s): 0800653 **Date Analyzed:** 7/25/08
Instrument ID: BR-05 **Analyst Name:** MSU



Date: 7/25/08
Time: 4:27 PM

Peak	rt	Area
1	1.42	517,388

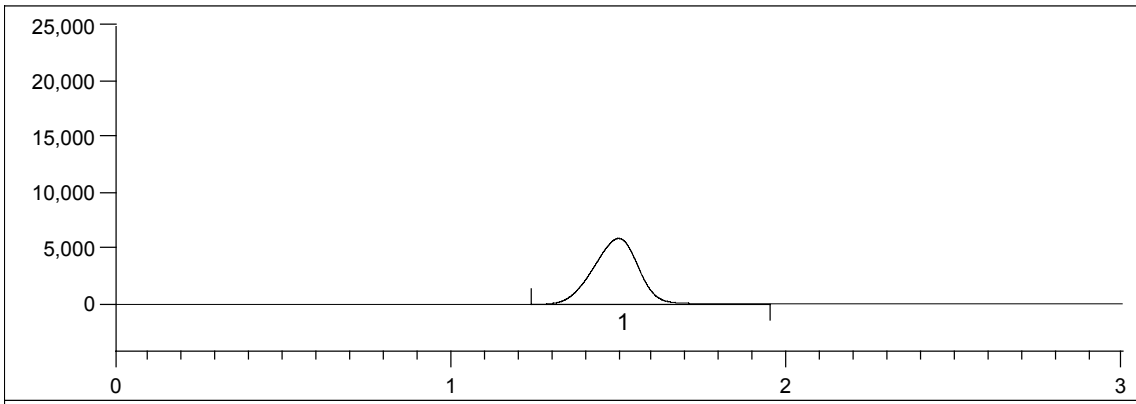
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
64		S	BS2		1	517,388	37.0	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 4:32 PM

Peak	rt	Area
1	1.43	484,017

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
65		S	BS3		1	484,017	34.3	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 4:36 PM

Peak	rt	Area
1	1.50	556,145

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
66		S	BS4		1	556,145	40.1	0.00		< HS	accept
Notes											

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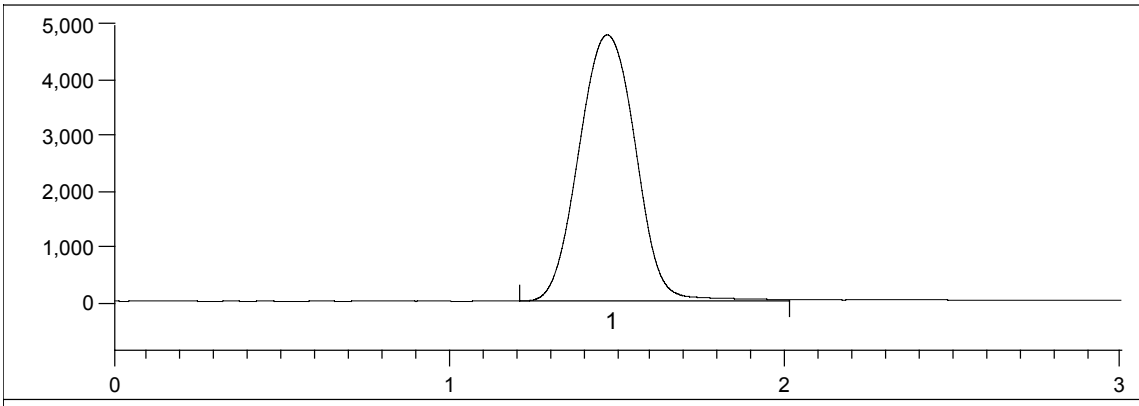
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

Project Number(s): 0800653
Instrument ID: BR-05

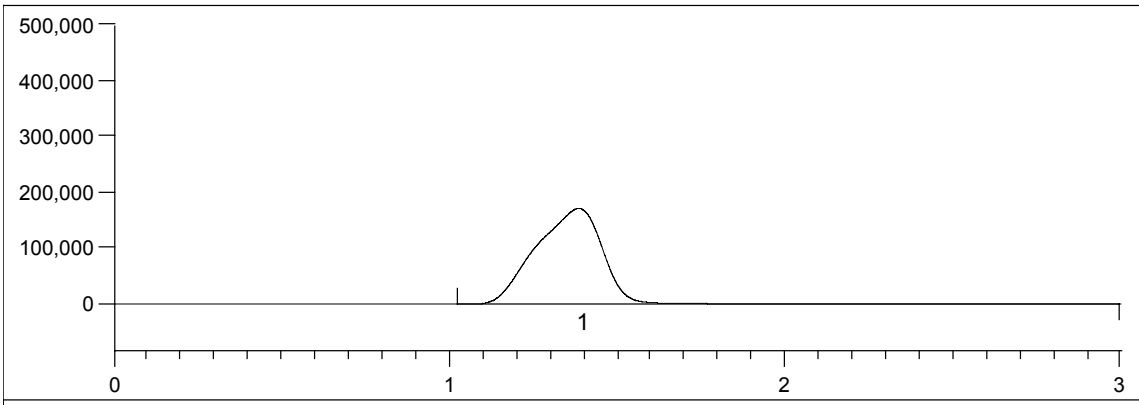
Date Analyzed: 7/25/08
Analyst Name: MSU



Date: 7/25/08
Time: 4:41 PM

Peak	rt	Area
1	1.46	557,194

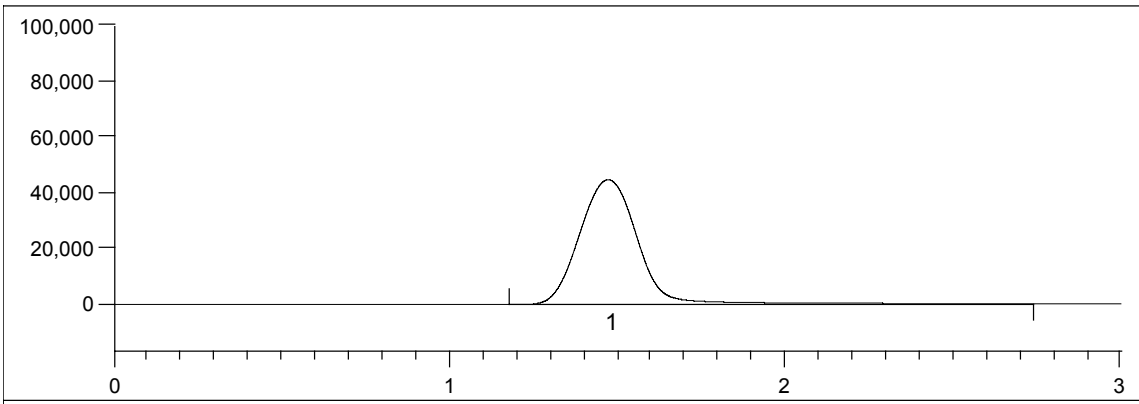
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
67		S	BS5		1	557,194	40.2	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 4:49 PM

Peak	rt	Area
1	1.38	23,886,138

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
68		S	0829003-10RE1		1	23,886,138	1,920	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 4:54 PM

Peak	rt	Area
1	1.47	5,405,987

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
69		CCV	SEQ-CCV6		1	5,405,987	432		86.4	70-130	accept
Notes											

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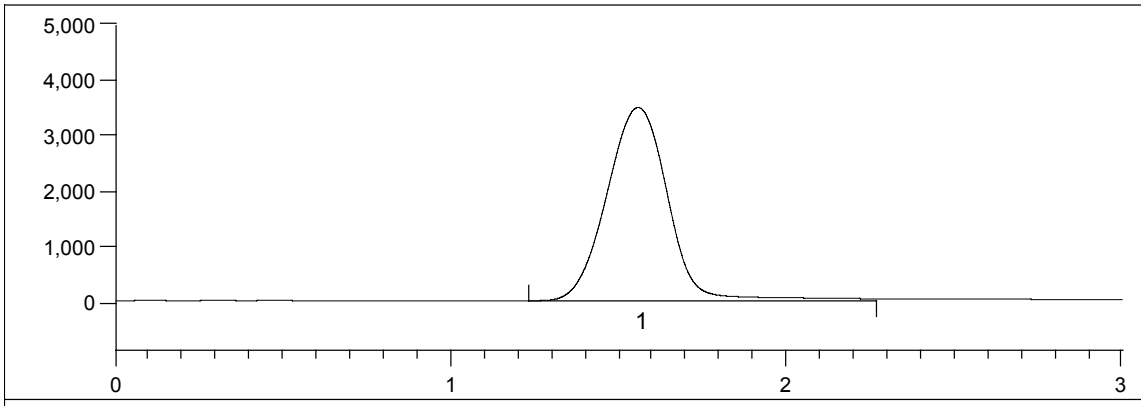
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

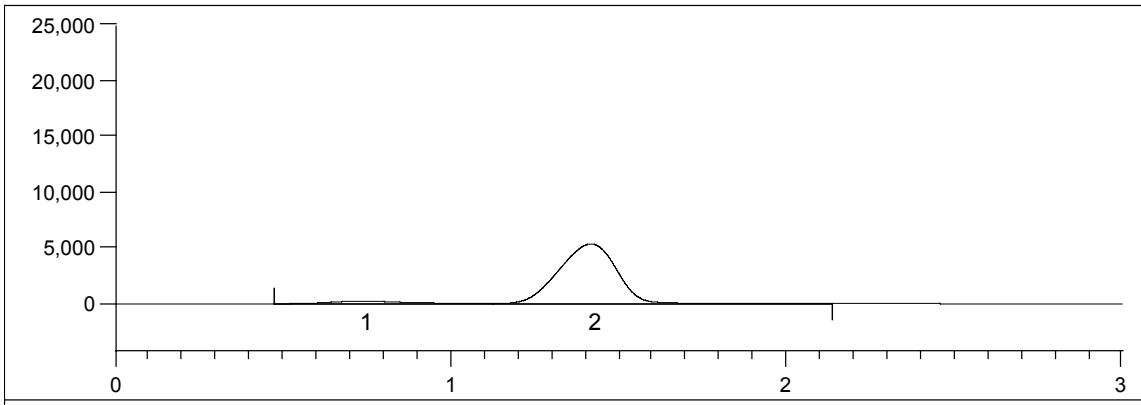
Project Number(s): 0800653 **Date Analyzed:** 7/25/08
Instrument ID: BR-05 **Analyst Name:** MSU



Date: 7/25/08
Time: 4:58 PM

Peak	rt	Area
1	1.55	433,145

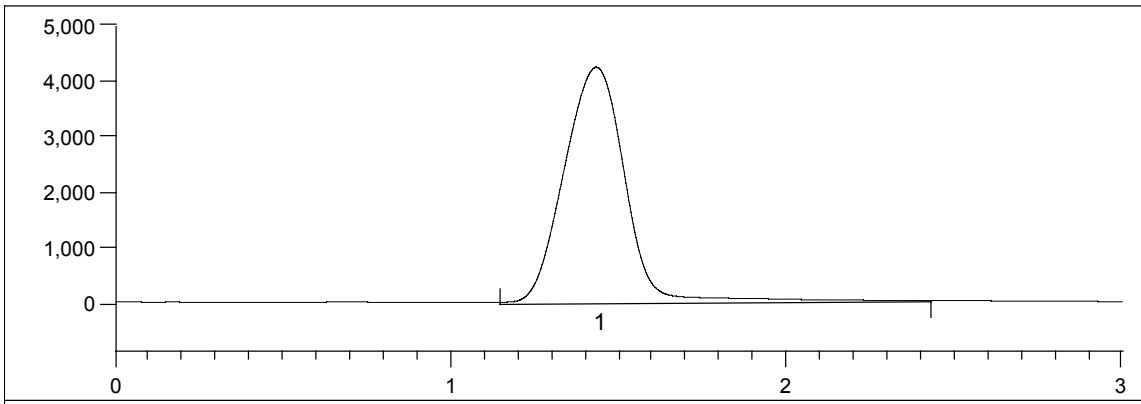
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
70		S	BS6		1	433,145	30.2	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 5:02 PM

Peak	rt	Area
1	0.73	37,138
2	1.41	642,768

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
71		S	BS7		2	642,768	47.1	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 5:06 PM

Peak	rt	Area
1	1.43	527,134

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
72		S	BS8		1	527,134	37.8	0.00		< HS	accept
Notes											

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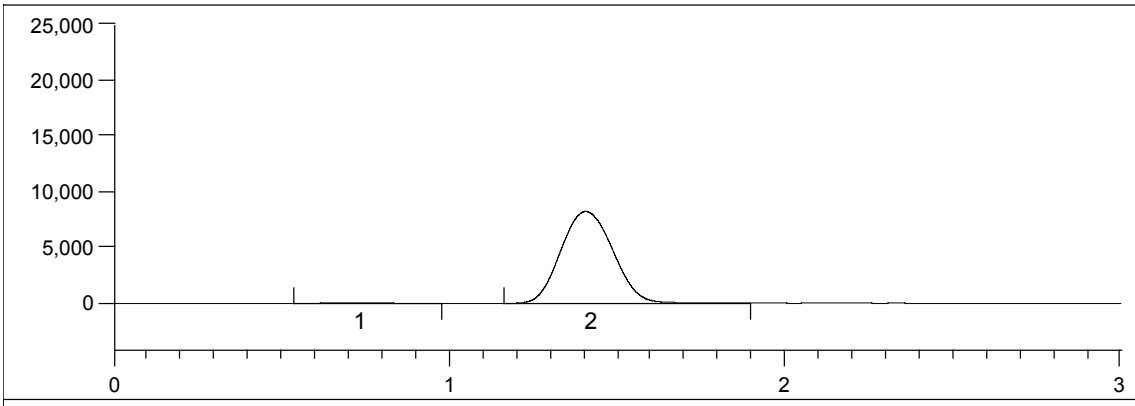
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

Project Number(s): 0800653
Instrument ID: BR-05

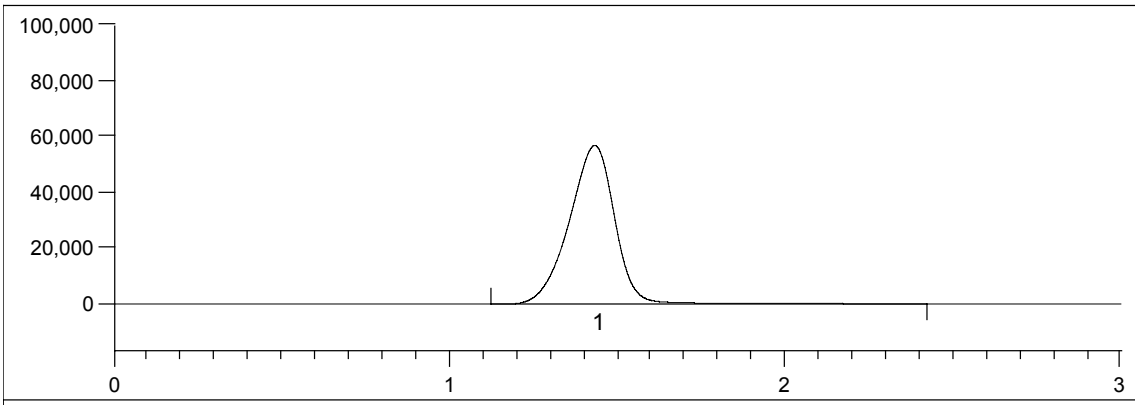
Date Analyzed: 7/25/08
Analyst Name: MSU



Date: 7/25/08
Time: 5:12 PM

Peak	rt	Area
1	0.71	6,006
2	1.40	889,462

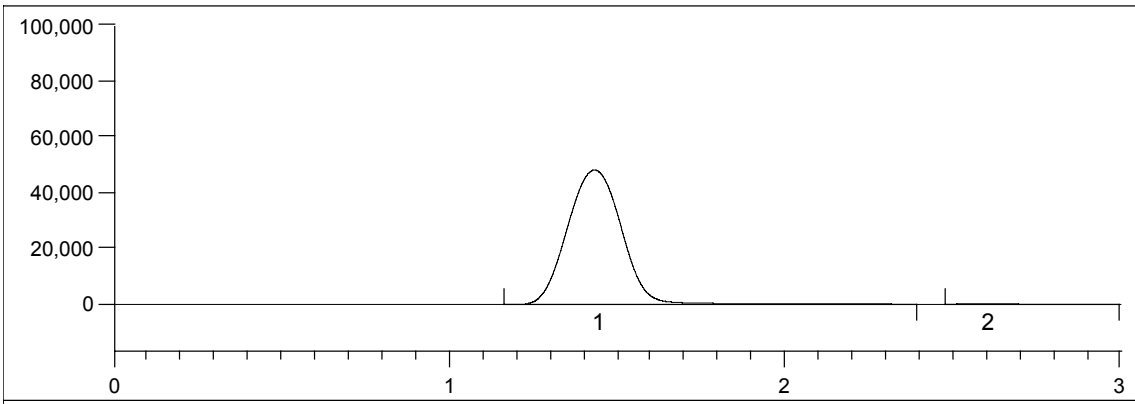
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
73		S	BS9		2	889,462	67.1	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 5:17 PM

Peak	rt	Area
1	1.43	5,398,166

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
74		S	SRM1		1	5,398,166	431	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 5:21 PM

Peak	rt	Area
1	1.43	5,434,204
2	2.59	6,557

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
75		S	SRM2		1	5,434,204	434	0.00		< HS	accept
Notes											

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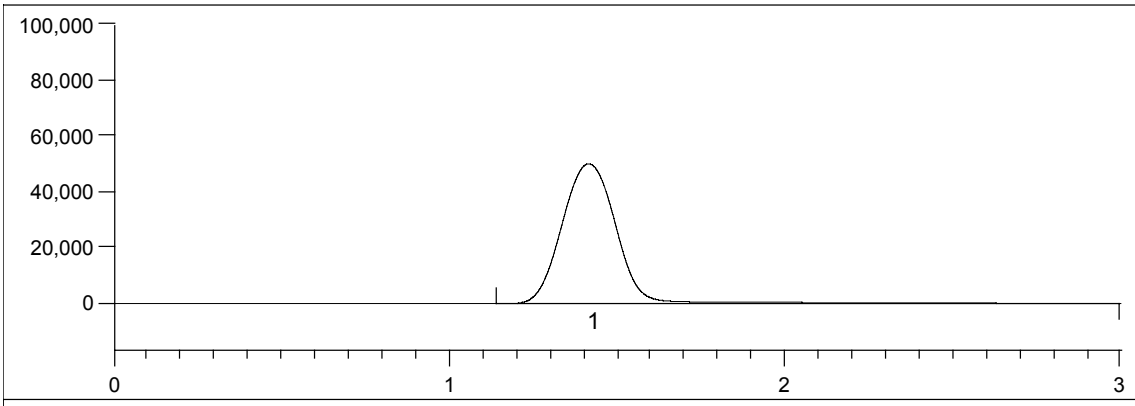
Peak Report

Batch Number: B081138
Method Number: 1631 Mod.

Project Number(s): 0800653
Instrument ID: BR-05

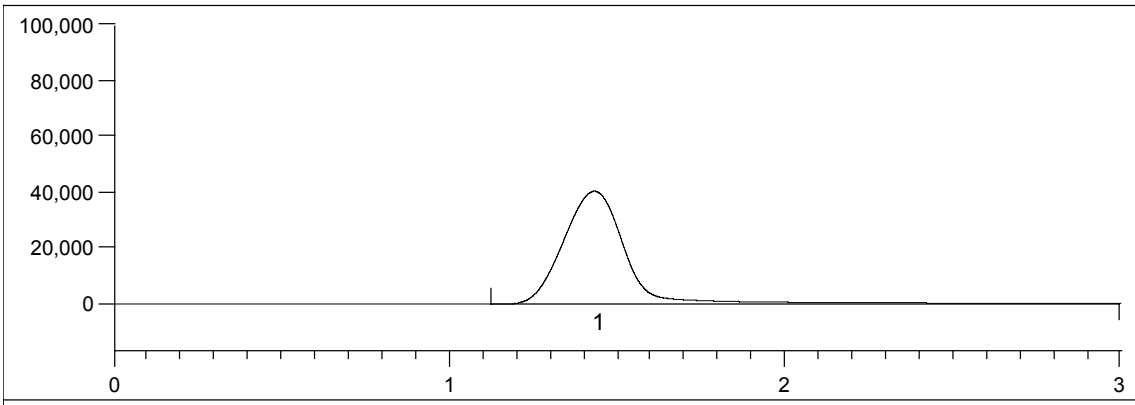
Date Analyzed: 7/25/08
Analyst Name: MSU



Date: 7/25/08
Time: 5:25 PM

Peak	rt	Area
1	1.41	5,691,484

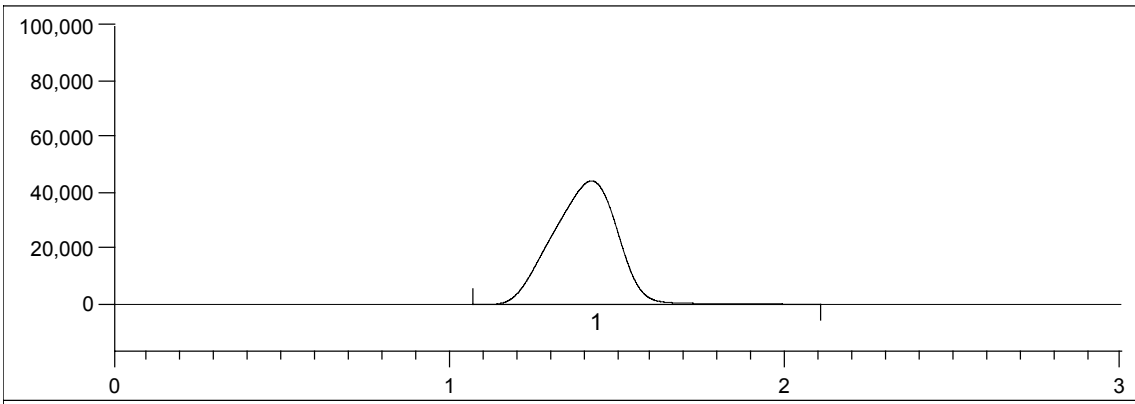
Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
76		S	SRM3		1	5,691,484	455	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 5:30 PM

Peak	rt	Area
1	1.43	5,209,595

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
77		S	SRM4		1	5,209,595	416	0.00		< HS	accept
Notes											



Date: 7/25/08
Time: 5:34 PM

Peak	rt	Area
1	1.42	5,998,429

Run	Trap	Type	Name/ID	M B	Peak	Peak Area	Analyzed Result	Final Result	QA Results	Criteria	Notes
78		CCV	SEQ-CCV7		1	5,998,429	480.		96.0	70-130	accept
Notes											

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Seattle WA 98107
www.brooksrand.com

BROOKS RAND LABS
MEANINGFUL METALS DATA

Phone: 206-632-6206
Fax: 206-632-6017
Email: brl@brooksrand.com

WORK ORDER
0828032

Customer: Kleinfelder
Contact: David King
Project ID: KLE-BE0801

TAT: 20
Receipt Date: 07/09/08 09:00
Log-in Date: 07/10/08 10:55

Sample Custodian: Jason Barrett
BRL Project Manager: Citron Choice

Courier: UPS

Shipping Container #1

3.3

Custody Seals: Present

Airbill: 1Z8491690110033712
Shipping Container: Default Cooler
Shipping Container Temp: 3.3 °C
Shipping Container Coolant: Ice

BRL Sample ID	Client ID / Site ID	Collection Date/Time	Matrix	Analyte
0828032-01	NAS 1817G	06/25/08	Biota	

Comments: 5 containers for composite

	Container	Size	Preservation	pH			
0828032-01A	Jar HDPE	8oz	None		**Method:**	EPA Method 160.3	%TS
	Jar HDPE	8oz	None		**Method:**	EPA Method 1631, Appendix	Hg
	Jar HDPE	8oz	None		**Method:**	BRL SOP No. BR-0106	HomogO

0828032-02	NAS 1818G	06/25/08	Biota	

Comments: 5 containers for composite

	Container	Size	Preservation	pH			
0828032-02A	Jar HDPE	8oz	None		**Method:**	EPA Method 160.3	%TS
	Jar HDPE	8oz	None		**Method:**	EPA Method 1631, Appendix	Hg
	Jar HDPE	8oz	None		**Method:**	BRL SOP No. BR-0106	HomogO

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Seattle WA 98107
www.brooksrand.com

BROOKS RAND LABS
MEANINGFUL METALS DATA

Phone: 206-632-6206
Fax: 206-632-6017
Email: brl@brooksrand.com

BRL Sample ID	Client ID / Site ID	Collection Date/Time	Matrix	Analyte
0828032-03	NAS 1729G	06/25/08 10:00	Biota	

Comments: 5 containers for composite

	Container	Size	Preservation	pH			
0828032-03A	Jar HDPE	8oz	None		**Method:**	EPA Method 160.3	%TS
	Jar HDPE	8oz	None		**Method:**	EPA Method 1631, Appendix	Hg
	Jar HDPE	8oz	None		**Method:**	BRL SOP No. BR-0106	HomogO

Sample Custodian — Date 7/10/08

Reviewed By — Date 7/11/08

BROOKS RAND LABS
MEANINGFUL METALS DATA
3958 6th Avenue NW
Seattle, WA 98107
Phone: 206-632-6206
Fax: 206-632-6017
samples@brooksrand.com
www.brooksrand.com

Chain of Custody Record

White: LAB COPY
Yellow: CUSTOMER COPY

Client: SQUIER KLEINFELDER
Contact: DAVID KING
Client project ID: KLE-BE
PO #:

Address:
Phone #:

COC receipt confirmation? (Y) / N
If so, by: (email) / fax (circle one)
Email: girissarri@nwaquatic.com
Fax #:

Requested TAT in business days:
☐ 20 (standard)
☐ 15
☐ 10
☐ 5
☐ Other ____
Surcharges apply for expedited turn around times.

	Sample ID	Collection: Date	Collection: Time	Miscellaneous: Sampler (initials)	Miscellaneous: Matrix type	Miscellaneous: # of containers	Miscellaneous: Field filtered? (Y/N)	Field Preservation: Unpreserved / ice only	Field Preservation: HCl / HNO_3 (circle one)	Field Preservation: Other (specify)	Analyses required: Total Hg, EPA 1631	Analyses required: Methyl Hg, EPA 1630	Analyses required: ICP-MS Metals (specify)	Analyses required: As / Se species (specify)	Analyses required: % Solids	Analyses required: Filtration	Analyses required: Other (specify)	Analyses required: Other (specify)	Comments
1	NAS 18176	4/25/08	–	GJI	L	5	N/A	Y											L = LUMBRICULUS VARIEGATUS TISSUE
2	NAS 18186	4/25/08	–	GJI	L	5	N/A	Y											
3	NAS 17296	5/25/08	1000	GJI	L	5	N/A	Y											
4																			
5																			
6																			
7																			
8																			
9																			
10																			

Relinquished by: Gerald Girissarri	Date: 7-8-08	Time: 1500	Relinquished by:	Date:	Time:
Received by:	Date:	Time:	Received at BRL by:	Date: 7/9/08	Time: 900
Shipping carrier:	# of coolers:		BRL work order ID: 0828032	BRL project ID: KLE-BE0801	

BRL WO# 0828032

Report

of

Test No. 762-9

Bioaccumulation of *Lumbriculus variegatus* in a 28-day Exposure to Test Sediments in Support of the Supplemental Mercury Re-Evaluation for the Northwestern Lake Sediment Characterization Condit Dam Removal Project (FERC No.2342), White Salmon, WA, Kleinfelder Project No. 58336/4.

Submitted to

Squier | Kleinfelder
15050 SW Koll Parkway
Suite L
Beaverton, OR 97006-6028

Submitted by

Northwestern Aquatic Sciences
3814 Yaquina Bay Road
P.O. Box 1437
Newport, OR 97365

July 31, 2008

TOXICITY TEST REPORT

TEST IDENTIFICATION

Test No.: 762-9

Title: *Lumbriculus variegatus* 28-day bioaccumulation exposure to a reference sediment in support of the Supplemental Mercury Re-Evaluation for the Northwestern Lake Sediment Characterization Condit Dam Removal Project (FERC No.2342), White Salmon, WA, Kleinfelder Project No. 58336/ 4.

Protocol No.: NAS-XXX-LV5 January 6, 2000 (Revision 4, 11-9-05). Based on EPA Method 100.3 (Methods for measuring the toxicity and bioaccumulation of sediment-associated contaminants with freshwater invertebrates, EPA/600/R-99/064), the "Inland Testing Manual" (EPA-B-98-004), and ASTM E 1688-97a.

STUDY MANAGEMENT

Study Sponsor: Squier | Kleinfelder, 15050 SW Koll Parkway, Suite L, Beaverton, OR 97006

Sponsor's Study Monitor: Mr. Peter Stroud

Testing Laboratory: Northwestern Aquatic Sciences, P.O. Box 1437, Newport, OR 97365

Test Location: Newport laboratory

Laboratory's Study Personnel: G.J. Irissarri, B.S., Proj. Man./Study Dir.; L.K. Nemeth, B.A., M.B.A., QA Officer; R.S. Caldwell, PhD., Sr. Toxicologist; G.A. Buhler, B.S., Aq. Toxicologist; S.J. Gage, B.A., Sr. Tech.; L.P. Sandoval, B.S., Tech.

Study Schedule:

Test Beginning: 5-28-08, 0940

Test Ending: 6-25-08, 1820

Disposition of Study Records: All specimens, raw data, reports and other study records are stored according to Good Laboratory Practice regulations at Northwestern Aquatic Sciences, 3814 Yaquina Bay Rd., Newport, OR 97365.

Good Laboratory Practices: The test was conducted following the principles of Good Laboratory Practices (GLP) as defined in the EPA/TSCA Good Laboratory Practice regulations revised August 17, 1989 (40 CFR Part 792).

Statement of Quality Assurance: The test data were reviewed by the Quality Assurance Unit to assure that the study was performed in accordance with the protocol and standard operating procedures. This report is an accurate reflection of the raw data.

TEST MATERIAL

Test Sediments: Freshwater test sediments collected as part the Supplemental Mercury Re-Evaluation for the Northwestern Lake Sediment Characterization Condit Dam Removal Project (FERC No.2342), White Salmon, Washington, Kleinfelder Project No. 58336 / 4. Details are as follows:

NAS Sample No.	1728G
Description	ILFAS-052108
Collection Date	5/21/08
Receipt Date	5/22/08

Control Sediment: The negative control sediment (NAS#1727G) was collected on 5-21-08 from an area approximately one mile east of the Hwy. 101 bridge at Beaver Creek, approx. 8 miles south of Newport, OR. The control sediment was press sieved through a 1.0 mm screen.

Storage: All test and control sediments were stored at 4°C in the dark until used.

TEST WATER

Source: Dechlorinated municipal tap water.

Dates of Preparation: 5-23-08 to 6-20-08

Water Quality: Averaged: pH 7.1 ± 0.1; conductivity 165 ± 4 µmhos/cm; hardness 38 ± 10 mg/L as $CaCO_3$; alkalinity 38 ± 4 mg/L as $CaCO_3$. Total chlorine was <0.02 mg/L in all batches.

Pretreatment: Dechlorinated and aerated ≥24 hr.

TEST ORGANISMS

4-Day Toxicity Screening Test P762-8:

Species: *Lumbriculus variegatus.*
Age: Adults
Source: Aquatic Foods, Inc., Fresno, CA. Received 5-22-08.
Acclimation: Worms were placed in small aquaria with test dilution water and aerated. Animals were not fed during holding. Water quality conditions for the four days prior to testing averaged: temperature, 21.9 ± 0.8°C; dissolved oxygen, 7.8 ± 0.3 mg/L; pH, 7.1 ± 0.2; conductivity 244 ± 17 umhos/cm; hardness, 43 ± 0 mg/L as CaCO3 and alkalinity, 53 ± 5 mg/L as CaCO3. Photoperiod: 16:8, L:D.

Bioaccumulation Test P762-9:

Species: *Lumbriculus variegatus.*
Age: Adults
Source: Aquatic Foods, Inc., Fresno, CA. Received 5-22-08.
Acclimation: Worms were placed in small aquaria with test dilution water and aerated. Animals were not fed during holding. Water quality conditions for the week prior to testing averaged: temperature, 22.1 ± 0.8°C; dissolved oxygen, 7.7 ± 0.3 mg/L; pH, 7.1 ± 0.1; conductivity 252 ± 18 umhos/cm; hardness, 43 ± 0 mg/L as CaCO3 and alkalinity, 57 ± 8 mg/L as CaCO3. Photoperiod: 16:8, L:D.

TEST PROCEDURES AND CONDITIONS

Test Design and Summary of Test Procedures: Prior to starting the bioaccumulation test, a 4-day toxicity screening test was conducted to assess survivability and possible avoidance of the worms in the test sediments. The bioaccumulation test required *L. variegatus* to be exposed for 28 days to test and reference/control sediments. 1.7 gallons of each sediment were placed in the bottom of 5-gallon aquaria and filled with 3.0 gallons of dechlorinated municipal tap water one day prior to the date that the worm exposure was to begin. Test chambers were placed in a temperature-controlled room. On the day of test initiation, approximately 15 grams of worms (wet weight) were placed into each test chamber. A zero-time sample was collected and sent to the analytical laboratory, Brooks Rand, on 7-8-08 for analysis. Three times weekly, the overlying water was siphoned out and replaced. Five replicate aquaria were employed for each sediment treatment. The exposure temperatures were 23 ± 1°C. During the exposure period, test chambers were examined for sediment avoidance behavior. After 28 days, worms were removed from the test sediments, cleaned of sediment and debris and returned to clean water-filled beakers without sediment to depurate for 6-8 hours. Worms were then removed from the depuration chambers, rinsed with Milli-Q® deionized water, lightly blotted, weighed and put into clean jars and frozen. Animals were shipped to the analytical laboratory (Brooks Rand) on 7-8-07 for chemical analysis.

4-Day Toxicity Screening Test P762-8 Conditions:

Test Chambers: 300 ml high-form glass beakers
Test Volumes: 100 ml sediment layer; 175 ml test water
Replicates/Treatment: 4
Organisms/Treatment: 40
Water Volume Changes: 2 water volumes per day
Aeration: None.
Feeding: Animals were fed 1.5 ml of TetraFin suspension (1.5 ml contains 6 mg dry solids) per beaker daily.
Effects Criteria: Survival after 4 days. Death is defined as no visible movement or response to tactile stimulation. Missing organisms were considered to be dead.
Water Quality and Other Test Conditions: The temperature, dissolved oxygen, conductivity, pH, hardness, and alkalinity were measured in the overlying water of one replicate test container per treatment on days 0 and 4 of the test. Temperature and dissolved oxygen were measured daily in the overlying water of one replicate test container per treatment. Hardness and alkalinity were measured with titrimetric methods. The photoperiod was 16:8, L:D.

Bioaccumulation Test P762-9 Conditions:

Test Chambers: 5 gallon glass aquaria.
Test Volumes: 1.7 gal sediment and approximately 3.0 gal of overlying freshwater
Replicates/Treatment: 5
Organisms/Treatment: approximately 75 grams wet weight (15 grams per tank)
Water Volume Changes: 75% of overlying water replaced three times weekly.
Aeration: Provided using 1 ml glass pipet placed 3-5 cm above the sediment surface
Feeding: None
Effects Criteria: The primary purpose of the bioaccumulation study was to measure the concentrations of selected sediment contaminants in the tissues of the worms after 28 days of exposure, rather than to observe organism physiological or behavioral responses as in ordinary toxicology tests. NAS performed the laboratory sediment exposure only. After a 6-8-hr depuration period, the surviving worms were frozen and shipped under chain-of-custody to the analytical laboratory (Brooks Rand).
Water Quality and Other Test Conditions: The temperature, dissolved oxygen, pH, conductivity, hardness, alkalinity, and ammonia-N were measured in one replicate of each sediment on Days 0, 7, 14, 21, 28. Temperature and dissolved oxygen were measured in one replicate daily during the 28-day exposure. The values of individual water quality measurements are to be found in the raw data (Appendix II).

DATA ANALYSIS METHODS

Means and standard deviations for water quality parameters and wet tissue weights were calculated using Microsoft Excel 2000.

PROTOCOL DEVIATIONS

None

TEST RESULTS

Results of the preliminary 4-day sediment toxicity screening test are presented in Table 1. None of the sediments tested resulted in a survival of less than 100%, indicating that all sediments were acceptable for bioaccumulation testing. Means and standard deviations for water quality measurements collected for the duration of the bioaccumulation study are given in Table 2. Animal biomass prior to and after the 28-day exposure period and tissue sample numbers are given in Table 3. All zero-time and post sediment exposure *Lumbriculus* biomass samples were sent to Brooks Rand on 7-8-08 for analysis.

STUDY APPROVAL

Gerald Crissari 8-1-08
Project Manager/Study Director Date

Julie R. Fiore 8-5-08
Quality Assurance Unit Date

Linda K. Hemeth 7/30/08
Assistant Laboratory Director Date

APPENDIX I

PROTOCOL

TEST PROTOCOL

FRESHWATER OLIGOCHAETE, *LUMBRICULUS VARIEGATUS*, 28-DAY SEDIMENT BIOACCUMULATION

1. INTRODUCTION

1.1 Purpose of Study: Laboratory sediment bioaccumulation tests provide an estimate of contaminant uptake by benthic infauna. The purpose of this study is to expose oligochaetes (*Lumbriculus variegatus*) to freshwater sediments for 28 days so that they may bioaccumulate sediment-associated contaminants. After the bioaccumulation period, worms are frozen for subsequent tissue analysis.

1.2 Referenced Method: This protocol is based on EPA Method 100.3 (EPA/600/R-99/064), the "Inland Testing Manual" (EPA-B-98-004) and ASTM E1688-97a.

1.3 Summary of Method: A summary of test conditions for the 28-day oligochaete bioaccumulation test is provided at the end of this protocol.

Because *L. variegatus* is quite sensitive to some contaminants, a 96-hour toxicity screening test is performed to insure that the samples are not overly toxic prior to setting up the bioacummulation test. The screening test is conducted in 300 ml test chambers containing 100 ml of sediment and 175 ml of overlying water. The test is conducted at 23°C, 16:8 photoperiod, with twice daily renewal of overlying water. The screening test is inititated with ten adult oligochaetes per replicate and a minimum of four replicates per treatment. Animals are not fed during the test. If there is significant mortality or animals are exhibiting avoidance behavior, then bioaccumulation testing with *L. variegatus* may not be possible or appropriate. If the screening test indicates that the test sediments are not toxic and animals are not avoiding the sediment, then the bioaccumulation test is started.

The 28-day bioaccumulation test with *Lumbriculus variegatus* is conducted at 23°C with a 16L:8D photoperiod at an illuminance of about 50-100 ft-c. Test chambers are typically 19 L (5 gal) or larger aquaria containing a minimum of 1 to 13 L of sediment and 6-20 L or more of overlying water. The test is stocked at densities of 10-40 g wet biomass per replicate test chamber depending upon chemistry requirements as long as the minimum ratio of sediment TOC to organism dry weight of 50:1 is not violated. Larger test systems may be employed if greater tissue volumes are required. Overlying water is replaced at regular intervals, normally three times per week, but can be up to twice daily as dictated by study needs. There are one to five replicates per treatment, with three normally used. Test organisms are not fed during the test. Gentle aeration will be employed if dissolved oxygen concentration falls below 2.5 mg/L. Overlying water may be culture water, well water, surface water, site water, reconstituted water, dechlorinated municipal water, or other water as per study design. The test endpoint is bioaccumulation.

2. STUDY MANAGEMENT

2.1 Sponsor's Name and Address:

_____
_____
_____
_____

2.2 Sponsor's Study Monitor:

_____

2.3 Name of Testing Laboratory:
Northwestern Aquatic Sciences
3814 Yaquina Bay Road, P.O. Box 1437
Newport, OR 97365.

2.4 Test Location: _____

2.5 Laboratory's Personnel to be Assigned to the Study:
Study Director: _____
Quality Assurance Unit: _____
Aquatic Toxicologist: _____
Aquatic Toxicologist: _____

2.6 Proposed Testing Schedule: The time between sediment collection and use in testing should be kept to a minimum; therefore, bioaccumulation testing is started as soon after sample receipt as logistically possible. For many applications a maximum holding time of 8 weeks is employed.

2.7 Good Laboratory Practices: The test is conducted following the principles of Good Laboratory Practices (GLP) as defined in the EPA/TSCA Good Laboratory Practice regulations revised August 17, 1989 (40 CFR Part 792).

3. TEST MATERIAL

The test materials are freshwater sediments. It is recommended that the control, reference, and test sediments be placed in clean, air-tight containers. Sediments for metals bioaccumulation should be stored in the absence of air to minimize the oxidation of reduced forms. Nitrogen can be used to fill the headspace in the containers. Glass containers are recommended for sediments polluted with either metals or organics, although high-density polyethylene and PTFE containers are also acceptable. Large organisms and extraneous materials, such as bivalves or twigs, should be removed from the sediments before storing. At the laboratory the samples are stored at 4°C in the dark. The time between sediment collection and use in testing should be kept to a minimum. A maximum holding time of eight weeks is recommended. A negative control sediment is collected from a clean site or the animal collection site, and should contain no or very low concentrations of the contaminant(s) of concern. In addition, a reference sediment may be employed as a comparison station when evaluating dredged materials

4. TEST WATER

Test water (overlying water) at NAS is normally either moderately hard synthetic water or dechlorinated municipal water. Moderately hard synthetic water is prepared from dechlorinated and deionized municipal water or Milli-Q reagent grade water and reagent grade chemicals. Test water may also be well water, surface water, site water, or other water, depending on the study needs.

5. TEST ORGANISMS

5.1 Species: oligochaete, *Lumbriculus variegatus*.

5.2. Source: Commercial suppliers or laboratory cultures

5.3 Age: Variable

5.4 Acclimation and Pretest Observation: After receipt, worms should be held in the laboratory for at least 24 hours prior to test initiation in order to assess their health and acclimate them to test conditions. Mortality during the holding period should not be excessive.

6. DESCRIPTION OF TEST SYSTEM

6.1 Test Chambers and Environmental Control: Test chambers generally used in the toxicity test are 19 L (5 gal) or larger aquaria. Test chambers are maintained at constant temperature by partial immersion in a temperature-controlled water bath or by placement in a temperature-controlled room. Gentle aeration may be employed to insure that dissolved oxygen concentration does not fall below 2.5 mg/L. The test is conducted under an illuminance of 50-100 ft-c with a 16L:8D photoperiod.

6.2 Cleaning: All laboratory glassware, including test chambers, is cleaned as described in EPA/600/4-90/027F. New glassware and test systems are soaked 15 minutes in tap water and scrubbed with detergent (or cleaned in automatic dishwasher); rinsed twice with tap water; carefully rinsed once with fresh, dilute (10%, V:V) hydrochloric or nitric acid to remove scale, metals, and bases; rinsed twice with deionized water; rinsed once with acetone to remove organic compounds (using a fume hood or canopy); and rinsed three times with deionized water. Test systems and chambers are rinsed again with dilution water just before use.

7. EXPERIMENTAL DESIGN AND TEST PROCEDURES

7.1 Experimental Design: The test involves exposure of worms to test, control, and optionally, reference sediments. The sediments are placed on the bottom of the test containers and are overlain with test water. The test exposure is for 28 days. Static replacement of overlying water may be performed three times a week (EPA 823-B-98-004) or up to twice daily at approximately 12 hour intervals (EPA/600/R-99/064). Each treatment consists of one to five replicate test containers, each containing enough organisms to provide approximately the target wet weight. The animals are added to each replicate at about 1.33 times the target stocking weight (the additional 33% accounts for the excess weight from water in the nonblotted oligochaetes). Test chamber positions are completely randomized. Test organisms are randomly distributed to the test chambers. Animals are placed on the sediment surface and allowed to bury.

7.2 Setup of Test Containers: Sediments are homogenized and placed in test chambers on the day before addition of test organisms. After addition of the sediment, test water is gently added to each test container in a manner to prevent resuspension. The overlying water is as mentioned above The test begins when worms are introduced to the test chambers. Initial water quality measurements are taken prior to the addition of test organisms.

7.3 Test Conditions: Gentle aeration may be employed to insure that dissolved oxygen concentration does not fall below 2.5 mg/L. The test temperature employed is 23 ± 1°C. A 16:8, L:D photoperiod is used. Illumination is supplied by daylight fluorescent lamps at 50-100 ft-c. The overlying water is replaced three times per week, or more frequently if required.

7.4 Beginning the Test: The test is begun by adding the organisms to the equilibrated test containers as previously described. A one to five replicate zero-time sample of test animals is preserved (frozen) for analysis of initial concentrations of chemicals of concern.

7.5 Feeding: None.

7.6 Test Duration, Type and Frequency of Observations, and Methods: The duration of the bioaccumulation test is 28 days. The type and frequency of observations to be made are summarized as follows:

TYPE OF OBSERVATION	TIMES OF OBSERVATION
BIOLOGICAL DATA	
Observations on behavior	Daily
PHYSICAL AND CHEMICAL DATA	
Hardness, alkalinity, conductivity, pH and total ammonia	Beginning and end of test in overlying water. One replicate per treatment. (Optionally on days 0, 3, 7, 14, 21, 28).
Dissolved oxygen, temperature	Daily in overlying water. One replicate per treatment

Dissolved oxygen is measured using a polarographic oxygen probe calibrated according to the manufacturer's recommendations. The pH is measured using a pH probe and a properly calibrated meter with scale divisions of 0.1 pH units. Temperature is measured with a calibrated mercury thermometer or telethermometer. Conductivity is measured with a conductivity meter. Hardness and alkalinity are measured using titrometric methods. Ammonia-nitrogen is measured using the salicylate colorimetric method (Clin. Chim. Acta 14:403, 1996).

7.7 Test Termination and Depuration: At test termination, animals are removed from the sediment by gently sieving test chamber contents through a fine-mesh sieve sufficiently small to retain the oligochaetes (e.g., 500 µm mesh). Immobile organisms should be considered dead. Live oligochaetes from an individual replicate should be transferred to a 1-L beaker containing overlying water without sediment for 6 to 8 hours (or up to 24 hours if needed, depending on the chemicals of concern) to depurate, or eliminate gut contents. Aeration may be required if dissolved oxygen falls below 2.5 mg/L. Each sample is then weighed, placed in a clean container, and frozen for later tissue residue analysis. If an estimate of dry weight is needed, a subsample should be dried to a constant weight at about 60 to 90°C, then brought to room temperature in a dessicator and weighed to the nearest 0.01 mg. Ash-free weight may be desirable in some instances.

7.8 Criteria of Test Acceptance: The test results are acceptable if the test organisms burrow into the sediments, and if there is an adequate mass of test organisms at test completion for detection of target analytes; the test should be considered invalid if overt sediment avoidance is observed.

8. DATA ANALYSIS

The endpoint of the test is bioaccumulation. Surviving worms are depurated for 6 to 8 hours and then frozen for subsequent tissue analysis. Data analysis consists of calculating means and standard deviations for water quality parameters and for tissue chemical concentrations, if chemical data are provided to NAS. Statistical comparisons of treatment groups may be done using standard hypothesis test procedures (i.e. test for normality and homogeneity followed by parametric or non-parmetric comparison tests as appropriate).

9. REPORTING

The final report of the test results must include all of the following standard information at a minimum (except that tabulation and analysis of tissue chemical concentrations is optional depending on client requirements): name and identification of the test; the investigator and laboratory; date and time of test beginning and end; information on the test material; information on the source and quality of the overlying/test water; detailed information about the test organisms including acclimation conditions; a description of the experimental design and test chambers and other test conditions including water quality; definition of the effect criteria and other observations; responses, if any, in the control treatment, tabulation and statistical analysis of measured responses and a summary table of endpoints; a description of the statistical methods used; any unusual information about the test or deviations from procedures; results of the initial screening toxicity test.

10. STUDY DESIGN ALTERATION

Amendments made to the protocol must be approved by the sponsor and study director and should include a description of the change, the reason for the change, the date the change took effect and the dated signatures of the study director and sponsor. Any deviations in the protocol must be described and recorded in the study raw data.

11. REFERENCED AND/OR CONSULTED GUIDELINES

ASTM. 1997. Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates. ASTM Standard Method No. E 1688 – 97a. Am. Soc. Test. Mat., Philadelphia, PA.

Portland Harbor Sediment Management Plan. June 25, 1999. Oregon Department of Environmental Qualtiy.

U.S. EPA. 2000. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates. Second Edition. EPA/600/R-99/064.

U.S. EPA. 1998. Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual: Inland Testing Manual. EPA 823-B-98-004.

Weber, C.I. (Ed.) 1993. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms (Fourth Edition). EPA/600/4-90/027F.

12. APPROVALS

_____ for _____
Name Date

_____ for Northwestern Aquatic Sciences
Name Date

SUMMARY OF TEST CONDITIONS

LUMBRICULUS VARIEGATUS, 28-DAY SEDIMENT BIOACCUMULATION

1. Test type:	Static Renewal
2. Test duration:	28 days
3. Temperature:	23 ± 1° C
4. Light quality:	Ambient Laboratory
5. Light itensity:	50-100 ft-c
6. Photoperiod:	16L:8D
7. Test chamber size:	5-10 gal aquaria normally
8. Sediment volume:	normally 1-13 L depending on aquaria size
9. Overlying water volume:	6 to 20L depending on aquaria size
10. Renewal of overlying water:	3x/wk ; or optionaly up to twice daily; approx. 12-hr intervals
11. Age of test organisms:	variable
12. Loading of organisms in chamber:	10-40 g/replicate (or more). Ratio of sediment TOC to organism dry weight ≥ 50:1
13. Replicates per sediment:	1 - 5
14. Test chamber cleaning:	None
15. Feeding:	None
16. Aeration:	Gentle, as needed to keep DO above 2.5 mg/L
17. Overlying water:	Moderatley hard synthetic water, dechlorinated municipal water, culture water, well water, surface water, site water, or other water
18. Study treatments:	Site sediment(s), a reference sediment (optional), and a control sediment.
19. Overlying water quality:	Hardness, alkalinity, conductivity, pH, and ammonia at the beginning and end of a test. Temperature and dissolved oxygen daily.
20. Endpoint:	Bioaccumulation
21. Sample holding requirements:	up to 8 weeks
22. Sample volume required:	5 – 10 L up to 20 gal. or more depending on study design.
23. Test acceptability:	1. Test organisms must burrow into the test sediments (numbers of worms in 4-day screening test should not be signficantly reduced in test sediment relative to control sediment). 2. Adequate mass of test organisms at test completion for detection of target analytes.

APPENDIX II

RAW DATA

TEST DESCRIPTION, MONITORING, AND RESULTS BENCHSHEETS

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-LV5

LUMBRICULUS VARIEGATUS 28-DAY SOLID PHASE BIOACCUMULATION TEST

Test No. 762-9 Client Kleinfelder Investigator REVIEWED PAGES 1-21 -GJI

STUDY MANAGEMENT

Client: Squier | Kleinfelder, 15050 SW Koll Parkway, Suite L, Beaverton, OR 97006

Client's Study Monitor: Mr. David King

Testing Laboratory: Northwestern Aquatic Sciences

Test Location: Newport Laboratory

Laboratory's Study Personnel:

Proj. Man./Study Dir.: G.J. Irissarri GJI

QA Officer: L.K. Nemeth

1. Susan Gage SG
2. Lidia P. Sandoval LPS
3. S A Burtell SB
4. R. S. Caldwell RSC
5.
6.

Study Schedule:

Test Beginning: 5-28-08 0940 Test Ending: 6-25-08 1820

TEST MATERIAL

General description (see sample logbook/chain-of-custody for details):

NAS Sample No.:	1727G	1728G			
Description:	Control	ILFAS-052108			
Collection Date:	5/21/08	5/21/08			
Receipt Date:	5/21/08	5/22/08			
:					
NAS Sample No.:					
Description:					
Collection Date:					
Receipt Date:					
:					
NAS Sample No.:					
Description:					
Collection Date:					
Receipt Date:					
:					
NAS Sample No.:					
Description:					
Collection Date:					
Receipt Date:					
:					
NAS Sample No.:					
Description:					
Collection Date:					
Receipt Date:					
:					
NAS Sample No.:					
Description:					
Collection Date:					
Receipt Date:					

Error codes: 1) correction of handwriting error
2) written in wrong location; entry deleted
3) wrong date deleted, replaced with corrrect date
4) error found in measurement; measurement repeated

Test No. 762-9 Client Kleinfelder Investigator

SEDIMENT DESCRIPTIONS -- SUPPLEMENTAL NOTES

Sample No.	Description
1727G	FINE BLACK MUD
1728G	FINE DARK GRAY/GREEN MUD w/ PLANT DEBRIS

Test No. 762-9 Client Kleinfelder Investigator _____

Test conducted in (circle one): room 1 room 2 (trailer) water bath other: _____

Randomization chart: 2ND SHELF

DOOR	1	2	3	4	5	6	7	8	9	10

Randomization chart:

Randomization chart:

Randomization chart:

Test No. 762-9 Client Kleinfelder Investigator

TEST WATER

Source: Dechlorinated Newport, OR tap water

Dates of Collection: 5-23-08, 5-30-08, 6-8-08, 6-13-08, 6-20-08

pH 7.1, 7.1, 7.0, 7.1, 7.0 $\bar{X}$ = 7.1 ± 0.1

Cond (umhos/cm2) 160, 165, 170, 165, 165 $\bar{X}$ = 165 ± 4

Hardness (mg/L) 34, 43, 51, 34, 26 $\bar{X}$ = 38 ± 10

Alkalinity (mg/L) 30, 40, 40, 40, 40 $\bar{X}$ = 38 ± 4

Chlorine (mg/L) <0.02 FOR ALL BATCHES

Treatments: Aerated ≥ 24 hrs

TEST ORGANISMS

Species: *Lumbriculus variegatus* Date received: 5-22-08

Source: Aquatic Foods, Inc., Fresno, CA

Acclimation Data:

Date	Temp. (deg.C)	DO (mg/L)	pH	Cond (umhos/cm²)	Feeding amount	Feeding description	Water changes	Comments	
5-23-08	20.7	8.1	6.8	220	NONE		YES	H=43	A=50
5-24-08	22.2	7.8	7.1	245			YES	H=43	A=60
5-25-08	22.3	7.9	7.1	250			YES	H=43	A=50
5-26-08	22.4	7.4	7.2	260			YES	H=43	A=50
5-27-08	22.0	7.6	7.0	265			YES	H=43	A=60
5-28-08	23.1	7.6	7.1	270			YES	H=43	A=70
Mean	22.1	7.7	7.1	252				43	57
S.D.	0.8	0.3	0.1	18				0	8
(N)	6	6	6	6				6	6

Photoperiod during acclimation: 16:8, L:D

TEST PROCEDURES AND CONDITIONS

Test chambers: 5 gal glass aquaria

Test volumes: 1.7 gal of test sediment; 3.0 gal of dilution water

Replicates/treatment: Organisms/treatment: approximately 15 grams wet tissue per replicate

Test water changes: Three times per week

Aeration: as needed to keep D.O. above 2.5 mg/L Aquaria placement: Total randomization

Feeding: None Photoperiod: 16:8, L:D

Test temperature (deg.C): 23 ± 1

Control Sediment:

Source: From an area approximately one mile east of the Hwy. 101 bridge at Beaver Creek, approx. 8 miles south of Newport, OR.

Date collected: 5/21/08

Storage: 4°C in the dark in closed containers. NAS# 1727G

MISCELLANEOUS NOTES

Light Intensity:

Date:	Location	Foot candles	Comments	Initials
6-19-08	TANK # 7	25.5		GJ
6-19-08	TANK # 3	19.6		GJ

*To convert ft-candles to lux divide by 0.0929

NORTHWESTERN AQUATIC SCIENCES
LUMBRICULUS VARIEGATUS 28-DAY SOLID PHASE BIOACCUMULATION TEST

PROTOCOL NO. NAS-XXX-LV5

Test No 762-9 Client Kleinfelder Investigator

DAILY RECORD SHEET

Day 0 (5/28/08) GJ

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond.* (umhos/cm)	pH*	Hardness* (mg/L)	Alkalinity* (mg/L)	NH3* (ppm)	Comments
1	23.1	8.0	155	6.7	34	40		
5	23.3	8.2	245	6.8	34	40		Water changed in all aquaria.
								Time: 0900
								Initials:

*Water quality measurements to be taken.

Day 1 (5/29/08) GJ

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	22.1	7.0						
5	22.2	6.7						

*Water quality measurements to be taken.

Day 2 (5/30/08) GJ

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	22.3	6.8						
5	22.3	6.2						Water changed in all aquaria.
								Time: 1055
								Initials: GJ

*Water quality measurements to be taken.

Day 3 (5/31/08)

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	22.9	6.5						
5	22.7	6.5						

*Water quality measurements to be taken.

NORTHWESTERN AQUATIC SCIENCES
PROTOCOL NO. NAS-XXX-LV5
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Test No 762-9 Client Kleinfelder Investigator

DAILY RECORD SHEET

Day 4 (6/1/05) [illegible]

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	23.1	6.5						
5	22.9	5.2						

*Water quality measurements to be taken.

Day 5 (6/2/08) [illegible]

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	22.5	6.4						
5	22.4	5.0						Water changed in all aquaria.
								Time: 1100
								Initials: [illegible]

*Water quality measurements to be taken.

Day 6 (6/3/08) [illegible]

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	22.9	6.4						
5	22.7	5.0						

*Water quality measurements to be taken.

Day 7 (6/4/08) [illegible]

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond.* (umhos/cm)	pH*	Hardness* (mg/L)	Alkalinity* (mg/L)	NH3* (ppm)	Comments
1	23.0	6.4	185	6.1	17	30		
5	22.9	6.5	315	6.6	26	50		Water changed in all aquaria.
								Time: 1130
								Initials: [illegible]

*Water quality measurements to be taken.

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-LV5

LUMBRICULUS VARIEGATUS 28-DAY SOLID PHASE BIOACCUMULATION TEST

Test No 762-9 Client Kleinfelder Investigator

DAILY RECORD SHEET

Day 8 (6/5/08) 6.51

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	22.9	6.4						
5	22.8	6.5						

*Water quality measurements to be taken.

Day 9 (6/6/08) [illegible]

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	22.7	6.4						
5	22.7	6.6						Water changed in all aquaria.
								Time: 1000
								Initials: [illegible]

*Water quality measurements to be taken.

Day 10 (6/7/08) [illegible]

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	23.4	6.3						
5	23.3	6.3						

*Water quality measurements to be taken.

Day 11 (6/8/08) [illegible]

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	23.0	6.21						
5	23.1	6.1						

*Water quality measurements to be taken.

NORTHWESTERN AQUATIC SCIENCES
LUMBRICULUS VARIEGATUS 28-DAY SOLID PHASE BIOACCUMULATION TEST

PROTOCOL NO. NAS-XXX-LV5

Test No 762-9 Client Kleinfelder Investigator

DAILY RECORD SHEET

Day 12 (6/9 108 AS

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	22.9	6.6						
5	22.8	6.3						Water changed in all aquaria.
								Time: 1430
								Initials: AS

*Water quality measurements to be taken.

Day 13 (6 / 10 /08) GJ

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	22.5	6.4						
5	22.4	6.2						

*Water quality measurements to be taken.

Day 14 (6 /11 /08) LPS

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond.* (umhos/cm)	pH*	Hardness* (mg/L)	Alkalinity* (mg/L)	NH3* (ppm)	Comments
1	23.3	6.2	205	5.5	26	30		
5	22.9	5.9	290	6-2	17	30		Water changed in all aquaria.
								Time: 1045
								Initials: LPS

*Water quality measurements to be taken.

Day 15 (6/12 108 AS

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	23.3	6.6						
5	23.1	6.4						

*Water quality measurements to be taken.

Test No 762-9 Client Kleinfelder Investigator

DAILY RECORD SHEET

Day 16 (6/13/08) LRS

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	22.9	6.2						
5	22.9	6.0						Water changed in all aquaria.
								Time: 0930
								Initials: LRS

*Water quality measurements to be taken.

Day 17 (6/14/08) LRS

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	22.4	6.3						
5	22.4	6.1						

*Water quality measurements to be taken.

Day 18 (6/15/08) LRS

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	22.0	6.4						
5	22.1	6.2						

*Water quality measurements to be taken.

Day 19 (6/16/08) LRS/LB

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	22.0	6.8						
5	22.1	6.6						Water changed in all aquaria.
								Time: 1545
								Initials: [illegible]

*Water quality measurements to be taken.

Test No 762-9 Client Kleinfelder Investigator

DAILY RECORD SHEET

Day 20 (6/17/08) [illegible]

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	22.4	6.4	~~20~~ 200					
5	22.1	6.6						

*Water quality measurements to be taken.

Day 21 (6/18/08) [illegible]

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond.* (umhos/cm)	pH*	Hardness* (mg/L)	Alkalinity* (mg/L)	NH3* (ppm)	Comments
1	22.8	6.5	200	5.5	26	20		
5	22.3	6.2	~~250~~ 250	6.0	26	20		Water changed in all aquaria.
								Time: 1115
								Initials: [illegible]

*Water quality measurements to be taken.

Day 22 (6/19/08) LPS

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	22.8	6.4						
5	22.4	6.3						

*Water quality measurements to be taken.

Day 23 (6/20/08) LPS

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	22.7	7.0						
5	22.4	6.6						Water changed in all aquaria.
								Time: 0945
								Initials: LPS

*Water quality measurements to be taken.

NORTHWESTERN AQUATIC SCIENCES
LUMBRICULUS VARIEGATUS 28-DAY SOLID PHASE BIOACCUMULATION TEST

PROTOCOL NO. NAS-XXX-LV5

Test No 762-9 Client Kleinfelder Investigator

DAILY RECORD SHEET

Day 24 (6/21/08) 6SL

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	22.7	7.0						
5	22.4	6.8						

*Water quality measurements to be taken.

Day 25 (6/22/08)

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond.* (umhos/cm)	pH*	Hardness* (mg/L)	Alkalinity* (mg/L)	NH3* (ppm)	Comments
1	22.8	7.3						
5	22.3	6.8						

*Water quality measurements to be taken.

Day 26 (6/23/08)

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	22.1	7.1						
5	22.1	6.6						Water changed in all aquaria. Time: 1210 Initials:

*Water quality measurements to be taken.

Day 27 (6/24/08)

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
1	22.7	6.8						
5	22.8	6.5						Water changed in all aquaria. Time: Initials:

*Water quality measurements to be taken.

Test No 762-9 Client Kleinfelder Investigator

DAILY RECORD SHEET

Day 28 (6 / 25 / 08) GJ

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond.* (umhos/cm)	pH*	Hardness* (mg/L)	Alkalinity* (mg/L)	NH3* (ppm)	Comments
1	23.0	7.2	176 GJ	4.8	17	20		
5	23.1	7.0	205	5.8	26	20		

*Water quality measurements to be taken.

Day (/ /)

Beaker No.	Temp. (deg.C)	DO (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments

*Water quality measurements to be taken.

Day (/ /)

Beaker No.	Temp. (deg.C)	DO (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments

*Water quality measurements to be taken.

Day (/ /)

Beaker No.	Temp. (deg.C)	DO (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments

*Water quality measurements to be taken.

Test No. 762-9 Client Kleinfelder Investigator

INITIAL AND POST EXPOSURE WET WEIGHT

Tank	Initial Wet Wt* (g)	Date	Initials	Post Exposure Wet Wt (g)	Date	Initials	Comments
1	20.37	5-28-08	GJI	~~18.4~~ 10.1	6-25-08	GJI	
2	20.31			10.0			
3	20.16			10.6			
4	20.09			16.3			
5	20.11			21.5			
6	20.06			9.4			
7	20.14			18.7			
8	20.18			17.7			
9	20.04			13.1			
10	20.07			18.4			
0-time repl 1	20.50						1729G
0-time repl 2	20.41						
0-time repl 3	20.61						
0-time repl 4	20.40						
0-time repl 5	20.30						

*Animals added at 1.33 X the target stocking weight (13 g per aquaria) to account for excess weight from the water in the nonblotted *Lumbriculus* at the start of the test. EPA/600/R-99/064

Test No. 762-9 Client KLEIN FELDER Investigator

SUPPLEMENTAL NOTES

6-25-08	OBSERVED LARGE NUMBERS OF TUBIFEX WORMS IN SEDIMENT 1FAS-052108 (NAS# 1728G) DURING EXTRACTION OF LUMBRICULUS.
	-GJI

TEST DATA ANALYSIS RECORDS

Freshwater Sediment Test
Lumbriculus Bioaccumulation Test

Lumbriculus Randomization and Tissue Results

INDEX	TANK	NAS SMPL	CLIENT DESCRIP	REPL		INITIAL WET* WEIGHT (g)	TOTAL INITIAL WET WEIGHT	POST EXPOSURE WET WEIGHT (g)	POST EXPOSURE TOTAL WET WEIGHT	TISSUE SAMPLE NUMBER
			0-time	1		20.5				1729G
			0-time	2		20.41				1729G
			0-time	3		20.61				1729G
			0-time	4		20.4				1729G
			0-time	5		20.3	102.2			1729G
1	10	1727G	Control	1		20.07		18.4		1817G
2	8	1727G	Control	2		20.18		17.7		1817G
3	7	1727G	Control	3		20.14		18.7		1817G
4	4	1727G	Control	4		20.09		16.3		1817G
5	5	1727G	Control	5	wq replicate	20.11	100.6	21.5	92.6	1817G
6	9	1728G	ILFAS-052108	1		20.04		13.1		1818G
7	3	1728G	ILFAS-052108	2		20.16		10.6		1818G
8	6	1728G	ILFAS-052108	3		20.06		9.4		1818G
9	2	1728G	ILFAS-052108	4		20.31		10.0		1818G
10	1	1728G	ILFAS-052108	5	wq replicate	20.37	100.9	10.1	53.2	1818G

*Animals added at 1.33 times the target stocking weight (15 grams per aquaria) to account for excess weight from the water in the nonblotted Lumbriculus at the start of the test. EPA/600/R-99/064

Data Entry Verified against Laboratory Bench Sheets 7-29-08 JRF

Test Number: 762-9

Freshwater Sediment Test
Lumbriculus Bioaccumulation Test

Water Quality Data

	NAS	CLIENT			Overlying water						
BKR	SMPL	DESCRIP	REPL	DAY	TEMP	DO	COND	pH	NH3	HARD	ALK
1	1728G	ILFAS-052108	5	0	23.4	8.0	155	6.7	1.3	34	40
5	1727G	Control	5	0	23.3	8.2	245	6.8	0.2	34	40
1	1728G	ILFAS-052108	5	1	22.1	7.0					
5	1727G	Control	5	1	22.2	6.7					
1	1728G	ILFAS-052108	5	2	22.3	6.8					
5	1727G	Control	5	2	22.3	6.2					
1	1728G	ILFAS-052108	5	3	22.9	6.5					
5	1727G	Control	5	3	22.7	5.5					
1	1728G	ILFAS-052108	5	4	23.1	6.5					
5	1727G	Control	5	4	22.9	5.2					
1	1728G	ILFAS-052108	5	5	22.5	6.4					
5	1727G	Control	5	5	22.4	5.0					
1	1728G	ILFAS-052108	5	6	22.9	6.4					
5	1727G	Control	5	6	22.7	5.0					
1	1728G	ILFAS-052108	5	7	23.0	6.4	185	6.1	3.9	17	30
5	1727G	Control	5	7	22.9	6.5	315	6.6	2.7	26	50
1	1728G	ILFAS-052108	5	8	22.9	6.4					
5	1727G	Control	5	8	22.8	6.5					
1	1728G	ILFAS-052108	5	9	22.7	6.4					
5	1727G	Control	5	9	22.7	6.6					
1	1728G	ILFAS-052108	5	10	23.4	6.3					
5	1727G	Control	5	10	23.3	6.3					
1	1728G	ILFAS-052108	5	11	23.0	6.2					
5	1727G	Control	5	11	23.1	6.1					
1	1728G	ILFAS-052108	5	12	22.9	6.6					
5	1727G	Control	5	12	22.8	6.3					
1	1728G	ILFAS-052108	5	13	22.5	6.4					
5	1727G	Control	5	13	22.4	6.2					
1	1728G	ILFAS-052108	5	14	23.3	6.2	205	5.5	4.0	26	30
5	1727G	Control	5	14	22.9	5.9	290	6.2	1.6	17	30
1	1728G	ILFAS-052108	5	15	23.3	6.6					
5	1727G	Control	5	15	23.1	6.4					
1	1728G	ILFAS-052108	5	16	22.9	6.2					
5	1727G	Control	5	16	22.9	6.0					
1	1728G	ILFAS-052108	5	17	22.4	6.3					
5	1727G	Control	5	17	22.4	6.1					
1	1728G	ILFAS-052108	5	18	22.0	6.4					
5	1727G	Control	5	18	22.1	6.2					
1	1728G	ILFAS-052108	5	19	22.0	6.8					
5	1727G	Control	5	19	22.1	6.6					
1	1728G	ILFAS-052108	5	20	22.4	6.4					
5	1727G	Control	5	20	22.1	6.6					
1	1728G	ILFAS-052108	5	21	22.8	6.5	200	5.5	2.5	26	20
5	1727G	Control	5	21	22.3	6.2	250	6.0	0.2	26	20
1	1728G	ILFAS-052108	5	22	22.8	6.4					
5	1727G	Control	5	22	22.4	6.3					
1	1728G	ILFAS-052108	5	23	22.7	7.0					
5	1727G	Control	5	23	22.4	6.6					

Freshwater Sediment Test
Lumbriculus Bioaccumulation Test

1	1728G	ILFAS-052108	5	24	22.7	7.0						
5	1727G	Control	5	24	22.4	6.8						
1	1728G	ILFAS-052108	5	25	22.8	7.3						
5	1727G	Control	5	25	22.3	6.8						
1	1728G	ILFAS-052108	5	26	22.1	7.1						
5	1727G	Control	5	26	22.1	6.6						
1	1728G	ILFAS-052108	5	27	22.7	6.8						
5	1727G	Control	5	27	22.8	6.5						
1	1728G	ILFAS-052108	5	28	23.0	7.2	175	4.8	1.3	17	20	
5	1727G	Control	5	28	23.1	7.0	205	5.8	0.1	26	20	
				Mean	22.7	6.5	223	6.0	1.8	25	30	
				SD	0.4	0.5	51	0.6	1.4	6	11	
				n	58	58	10	10	10	10	10	
				Min	22.0	5.0	155	4.8	0.1	17	20	
				Max	23.4	8.2	315	6.8	4.0	34	50	

AMMONIA EXPOSURE BENCHSHEETS AND ANALYSIS

Total Ammonia-N in Water: Computation Worksheet
Salicylate Method (SOP #5492)

Result

	Sample description	Dilution factor	OD655	NH3-N (mg/L)
	Blank	-----	-----	-----
	1.0 mg/L NH3-N Std.	-----	0.111	1.00
	3.0 mg/L NH3-N Std.	-----	0.350	3.00
	6.0 mg/L NH3-N Std.	-----	0.650	6.00
	10.0 mg/L NH3-N Std.	-----	1.100	10.00
	3.0 mg/L spike	-----	0.325	2.95
	3.0 mg/L spike dupl.	-----	0.340	3.09
	5.0 mg/L 2nd source	-----	0.490	4.45
1.	Day 0 (5/28/08)			
2.	1	1	0.147	1.34
3.	5	1	0.016	0.15
4.				
5.	Day 7 (6/4/08)			
6.	1	1	0.425	3.86
7.	5	1	0.297	2.70
8.				
9.	Day 14 (6/11/08)			
10.	1	1	0.435	3.95
11.	5	1	0.173	1.57
12.				
13.	Day 21 (6/18/08)			
14.	1	1	0.280	2.54
15.	5	1	0.025	0.23
16.				
17.	Day 28 (6/25/08)			
18.	1	1	0.138	1.25
19.	5	1	0.015	0.14
20.				
21.				
22.				
23.				
24.				
25.				
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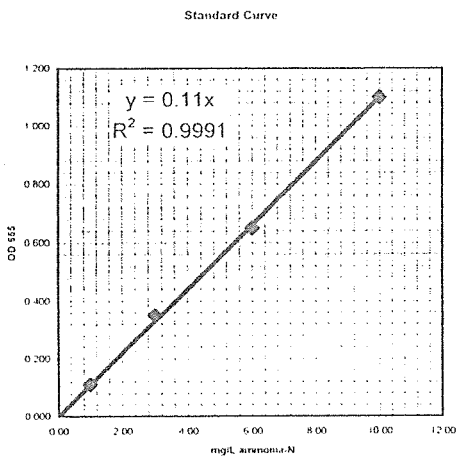
36.				



Reporting limit (mg/L) =	0.1
Recovery (%) =	100.7
Precision (RPD) =	-4.51
2nd source (%) =	89.1
Sample volume (ml):	0.50
Dilution factor	1

Sample Set Description:

Test No.: 762-9
Test Day: 0, 7, 14, 21, 28
Species: *Lumbriculus variegatus*

Proj. No.: P762
Overlying water

Analyst: GJI
Date analysed: 7/24/08

Total Ammonia-N in Water: Computation Worksheet
Salicylate Method (SOP #5492)

Result

Sample description	Dilution factor	OD655	NH_3-N (mg/L)
Blank	-----	-----	-----
1.0 mg/L NH_3-N Std.	-----	0.111	1.00
3.0 mg/L NH_3-N Std.	-----	0.350	3.00
6.0 mg/L NH_3-N Std.	-----	0.650	6.00
10.0 mg/L NH_3-N Std.	-----	1.100	10.00
3.0 mg/L spike	-----	0.325	
3.0 mg/L spike dupl.	-----	0.340	
5.0 mg/L 2nd source	-----	0.490	
1. Day 0 (5/28/08)			
2. 1	1	0.147	
3. 5	1	0.016	
4.			
5. Day 7 (6/4/08)			
6. 1	1	0.425	
7. 5	1	0.297	
8.			
9. Day 14 (6/11/08)			
10. 1	1	0.435	
11. 5	1	0.173	
12.			
13. Day 21 (6/18/08)			
14. 1	1	0.280	
15. 5	1	0.025	
16.			
17. Day 28 (6/25/08)			
18. 1	1	0.138	
19. 5	1	0.015	
20.			
21.			
22.			
23.			
24.			
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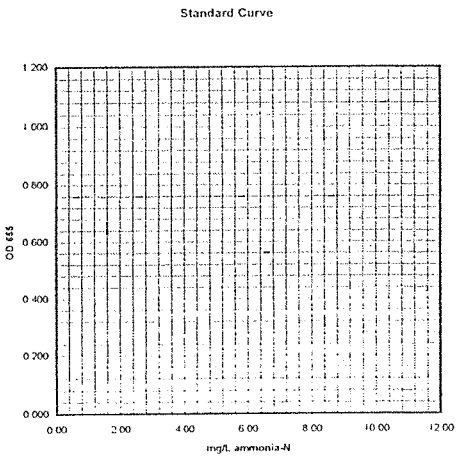
36.			



Reporting limit (mg/L) = 0.1

Recovery (%) = #VALUE!
Precision (RPD) = #VALUE!
2nd source (%) = #VALUE!

Sample volume (ml): 0.50
Dilution factor 1

Sample Set Description:
Test No.: 762-9
Test Day: 0, 7, 14, 21, 28
Species: *Lumbriculus variegatus*

Proj. No.: P762
Overlying water

Analyst: GJI GJI
Date analysed: 7/24/08

CHAIN-OF-CUSTODY RECORDS

CHAIN OF CUSTODY RECORD

Log Number _____

Client name: Kleinfelder

Project or PO#: 94175

Address: 15050 SW Koll Parkway

Phone #: (503) 644-9447

City, State, Zip: Beaverton OR 97006

Report attention: Pete Stroud

Analyses required: Lumbriculus bioaccumulation

Lab sample number	Date sampled	Time sampled	Type* See key below	Sampled by: EJ, CW Sample description	Number of containers	Lumbriculus bioaccumulation								Hazardous sample Special handling required	Remarks
28G	5/21/08	13:00		ILFAS-052108	3										5 gallon buckets

	Signature	Print Name	Company	Date	Time
Relinquished by	[signature]	Eric Jones	Kleinfelder	5/22/08	11:40
Received by					
Relinquished by					
Received by					
Relinquished by					
Received by Laboratory	[signature]	R.S. Caldwell	NAS	5/22/08	11:40

Note:
Samples are discarded 30 days after results are reported unless other arrangements are made.
Hazardous samples will be returned to client or disposed of at client expense.

*KEY: AQ—Aqueous NA—Nonaqueous SL—Sludge GW—Groundwater SO—Soil OT—Other PE—Petroleum

NORTHWESTERN AQUATIC SCIENCES
A Division of NAS Associates, Inc.

BROOKS RAND LABS
MEANINGFUL METALS DATA
3958 6th Avenue NW
Seattle, WA 98107
Phone: 206-632-6206
Fax: 206-632-6017
samples@brooksrand.com
www.brooksrand.com

Chain of Custody Record

White: LAB COPY
Yellow: CUSTOMER COPY

Client: SQUIER KLEINFELDER
Contact: DAVID KING
Client project ID: KLE-BE
PO #:

Address:
Phone #:

COC receipt confirmation? (Y) / N
If so, by: (email) / fax (circle one)
Email: girissarri@nwaquatic.com
Fax #:

Requested TAT in business days:
- ☐ 20 (standard)
- ☐ 15
- ☐ 10
- ☐ 5
- ☐ Other ____

Surcharges apply for expedited turn around times.

	Sample ID	Collection		Miscellaneous				Field Preservation			Analyses required								Comments
		Date	Time	Sampler (initials)	Matrix type	# of containers	Field filtered? (Y/N)	Unpreserved / ice only	HCl / HNO_3 (circle one)	Other (specify)	Total Hg, EPA 1631	Methyl Hg, EPA 1630	ICP-MS Metals (specify)	As / Se species (specify)	% Solids	Filtration	Other (specify)	Other (specify)	
1	NAS 1817G	6/25/08	–	GI	L	5	N/A	Y											L = LUMBRICULUS VARIEGATUS TISSUE
2	NAS 1818G	6/25/08	–	GI	L	5	N/A	Y											
3	NAS 1729G	5/28/08	1000	GI	L	5	N/A	Y											
4																			
5																			
6																			
7																			
8																			
9																			
10																			

Relinquished by: Gerald Girissarri	Date: 7-8-08	Time: 1500	Relinquished by:	Date:	Time:
Received by:	Date:	Time:	Received at BRL by:	Date: 7/9/08	Time: 9:00
Shipping carrier:	# of coolers:		BRL work order ID:	BRL project ID: KLE-BE080	

PAGE 21 OF 21

APPENDIX III

RAW DATA – PRELIMINARY 4-DAY SEDIMENT TOXICITY SCREENING TEST

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-LV5

LUMBRICULUS VARIEGATUS 4-DAY SOLID PHASE SEDIMENT TEST

REVIEWED PAGES 1-10 - GJI

Test No. 762-8 Client Kleinfelder Investigator

STUDY MANAGEMENT

Client: Squier | Kleinfelder, 15050 SW Koll Parkway, Suite L, Beaverton, OR 97006

Client's Study Monitor: Mr. David King

Testing Laboratory: Northwestern Aquatic Sciences

Test Location: Newport Laboratory

Laboratory's Study Personnel:

Proj. Man./Study Dir. G.J. Irissarri GJI

QA Officer L.K. Nemeth

1. Susan Gagel SG 2. Lidia P. Sandoval LPS

3. 4.

Study Schedule:

Test Beginning: 5-26-08 1030 Test Ending: 5-30-08 1000

TEST MATERIAL

General description (see sample logbook/chain-of-custody for details):

NAS Sample No.:	1727G	1728G			
Description:	Control	ILFAS-052108			
Collection Date:	5/21/08	5/21/08			
Receipt Date:	5/21/08	5/22/08			
:					
NAS Sample No.:					
Description:					
Collection Date:					
Receipt Date:					
:					
NAS Sample No.:					
Description:					
Collection Date:					
Receipt Date:					
:					
NAS Sample No.:					
Description:					
Collection Date:					
Receipt Date:					
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NAS Sample No.:					
Description:					
Collection Date:					
Receipt Date:					
:					
NAS Sample No.:					
Description:					
Collection Date:					
Receipt Date:					
:					

Error codes: 1) correction of handwriting error
2) written in wrong location; entry deleted
3) wrong date deleted, replaced with corrrect date
4) error found in measurement; measurement repeated

Test No. 762-8 Client Kleinfelder Investigator

SEDIMENT DESCRIPTIONS -- SUPPLEMENTAL NOTES

Sample No.	Description
1727G	FINE BLACK MUD
1728G	FINE DARK GRAY/GREEN MUD w/ PLANT DEBRIS

LUMBRICULUS VARIEGATUS 4-DAY SOLID PHASE SEDIMENT TEST

Test No. 762-8 Client Kleinfelder Investigator

TEST WATER

Source: Dechlorinated Newport, OR tap water

Date of Collection: 5-23-08

pH 7.1

Cond (umhos/cm2) 160

Hardness (mg/L) 34

Alkalinity (mg/L) 30

Chlorine (mg/L) <0.02

Treatments: Aerated ≥ 24 hrs

TEST ORGANISMS

Species: *Lumbriculus variegatus* Date received: 5-22-08

Source: Aquatic Foods, Inc., Fresno, CA

Acclimation Data:

Date	Temp. (deg.C)	DO (mg/L)	pH	Cond (umhos/cm2)	Feeding amount	Feeding description	Water changes	Comments	
5-23-08	20.7	8.1	6.8	220	NONE		YES	H= 43	A= 50
5-24-08	22.2	7.8	7.1	245			YES	H= 43	A= 60
5-25-08	22.3	7.9	7.1	250			YES	H= 43	A= 50
5-26-08	22.4	7.4	7.2	260			YES	H= 43	A= 50
Mean	21.9	7.8	7.1	244				43	53
S.D.	0.8	0.3	0.2	17				0.0	5
(N)	4	4	4	4				4	4

Photoperiod during acclimation: 16:8, L:D

TEST PROCEDURES AND CONDITIONS

Test chambers: 300 ml glass beakers

Test volumes: 100 ml of test sediment; 275 ml total volume

Replicates/treatment: (4) 4 Organisms/treatment: (40) 40 (10/REP)

Test water changes: Twice daily

Aeration: only if DO falls below 2.5 mg/L

Beaker placement: Total randomization

Feeding: everyday beginning with day zero

Photoperiod: 16:8, L:D

Test temperature (deg.C): 23

Control Sediment:

Source: From an area approximately one mile east of the Hwy. 101 bridge at Beaver Creek, approx. 8 miles south of Newport, OR.

Date collected: 7/26/07

Sieved through 0.5 -mm screen

Storage: 4°C in the dark in closed containers. NAS# 1118G

MISCELLANEOUS NOTES

Light Intensity:

Date:	Location	Light Intensity (ft-candles*)	Initials

GJ1

*To convert ft-candles to lux divide by 0.0929

Test No. 762-8 Client Kleinfelder Investigator _____

Test conducted in (circle one): room 1 room 2 trailer water bath other:_____

Randomization chart: TOP SHELF

5	10	15							
4	9	14							
3	8	13							
2	7	12							
1	6	11	16						

Randomization chart:

Randomization chart:

Randomization chart:

LUMBRICULUS VARIEGATUS 4-DAY SOLID PHASE SEDIMENT TEST

Test No 762-8 Client Kleinfelder Investigator _____

DAILY RECORD SHEET

Day 0 (5/26/08) GJL

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond.* µmhos/cm)	pH*	Hardness* (mg/L)	Alkalinity* (mg/L)	NH3 (ppm)	Comments
2	23.8	4.8	155	6.3	34	30		Each beaker fed 1.5 ml
8	23.9	7.0	190	6.8	34	30		Tetra Fin suspension
								Initials: GJL
								Water changed in all
								beakers.
								Time: 0630
								Initials: GJL
								Water changed in all
								beakers.
								Time: 1600
								Initials: LPS

*Water quality measurements to be taken.

Day 1 (5/27/08) GJL

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. µmhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
2	23.8	6.4						Each beaker fed 1.5 ml
8	23.7	7.0						Tetra Fin suspension
								Initials: GJL
								Water changed in all
								beakers.
								Time: 0610
								Initials: GJL
								Water changed in all
								beakers.
								Time: 1645
								Initials: [illegible]

*Water quality measurements to be taken.

Test No 762-8 Client Kleinfelder Investigator _____

DAILY RECORD SHEET

Day 2 (5/28/08) GJ

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. µmhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
2	23.8	6.4						Each beaker fed 1.5 ml
8	23.9	6.9						Tetra Fin suspension
								Initials: GJ
								Water changed in all
								beakers.
								Time: 0610
								Initials: GJ
								Water changed in all
								beakers.
								Time: 1645
								Initials: [illegible]

*Water quality measurements to be taken.

Day 3 (5/29/08) GJ

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond. µmhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
2	22.4	6.6						Each beaker fed 1.5 ml
8	22.5	6.4						Tetra Fin suspension
								Initials: GJ
								Water changed in all
								beakers.
								Time: 0610
								Initials: GJ
								Water changed in all
								beakers.
								Time: 1645
								Initials: [illegible]

*Water quality measurements to be taken.

LUMBRICULUS VARIEGATUS 4-DAY SOLID PHASE SEDIMENT TEST

Test No 762-8 Client Kleinfelder Investigator

DAILY RECORD SHEET

Day 4 (5 /30 /08) GJ

Beaker No.	Temp.* (deg.C)	DO* (ppm)	Cond.* µmhos/cm)	pH*	Hardness* (mg/L)	Alkalinity* (mg/L)	NH3 (ppm)	Comments
2	23.1	5.0	165	6.2	34	30		Each beaker fed 1.5 ml
8	23.1	6.2	175	6.6	34	40		Tetra Fin suspension
								Initials: —
								Water changed in all
								beakers.
								Time: 0605
								Initials: GJ
								Water changed in all
								beakers.
								Time:
								Initials:

*Water quality measurements to be taken.

Day (/ /)

Beaker No.	Temp. (deg.C)	DO (ppm)	Cond. µmhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	NH3 (ppm)	Comments
2								Each beaker fed 1.5 ml
8								Tetra Fin suspension
								Initials:
								Water changed in all
								beakers.
								Time:
								Initials:
								Water changed in all
								beakers.
								Time:
								Initials:

*Water quality measurements to be taken.

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-XXX-LV5

LUMBRICULUS VARIEGATUS 4-DAY SOLID PHASE SEDIMENT TEST

Test No. 762-8 Client Kleinfelder Investigator

DAY 4 TEST TERMINATION SHEET

Beaker No.	Number of survivors	Initials
1	10	GJL
2	10	GJL
3	10	GJL
4	10	GJL
5	10	GJL
6	10	GJL
7	10	GJL
8	10	GJL
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
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32		
33		
34		
35		
36		
37		
38		
39		
40		
41		
42		
43		
44		
45		

Beaker No.	Number of survivors	Initials
46		
47		
48		
49		
50		
51		
52		
53		
54		
55		
56		
57		
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60		
61		
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89		
90		

Test Number: 762-8

Freshwater Sediment Test
Lumbriculus variegatus 4-day test

Endpoints Data Entry and Calculations File

BKR=beaker number
INIT=initial number
SURV=number survivors
MORT=number dead=INIT-SURV
PSURV=%survival=100(SURV/INIT)
PMORT=%mortality=100(MORT/INIT)

INDEX	BKR	NAS SMPL	CLIENT DESCRIP	REPL		INIT	SURV	MORT	PSURV	PMORT			SURV	MORT	PSURV	PMORT
1	7	1727G	Control	1		10	10	0	100.0	0.0						
2	5	1727G	Control	2		10	10	0	100.0	0.0		Mean	10.0	0.0	100.0	0.0
3	4	1727G	Control	3		10	10	0	100.0	0.0		SD	0.0	0.0	0.0	0.0
4	8	1727G	Control	4	wq replicate	10	10	0	100.0	0.0		n	4	4	4	4
5	1	1728G	ILFAS-052108	1		10	10	0	100.0	0.0						
6	6	1728G	ILFAS-052108	2		10	10	0	100.0	0.0		Mean	10.0	0.0	100.0	0.0
7	3	1728G	ILFAS-052108	3		10	10	0	100.0	0.0		SD	0.0	0.0	0.0	0.0
8	2	1728G	ILFAS-052108	4	wq replicate	10	10	0	100.0	0.0		n	4	4	4	4

Test Number: 762-8

Freshwater Sediment Test
4-Day Lumbriculus variegatus

Water Quality Data

	NAS	CLIENT			Overlying water					
BKR	SMPL	DESCRIP	REPL	DAY	TEMP	DO	COND	pH	HARD	ALK
2	1728G	ILFAS-052108	4	0	23.8	4.8	155	6.3	34	30
8	1727G	Control	4	0	23.9	7.0	180	6.8	34	30
2	1728G	ILFAS-052108	4	1	23.8	6.4				
8	1727G	Control	4	1	23.7	7.0				
2	1728G	ILFAS-052108	4	2	23.8	6.4				
8	1727G	Control	4	2	23.9	6.9				
2	1728G	ILFAS-052108	4	3	22.4	6.6				
8	1727G	Control	4	3	22.5	6.4				
2	1728G	ILFAS-052108	4	4	23.1	5.0	165	6.2	34	30
8	1727G	Control	4	4	23.1	6.2	175	6.6	34	40
				Mean	23.4	6.3	169	6.5	34	33
				SD	0.6	0.8	11	0.3	0	5
				n	10	10	4	4	4	4
				Min	22.4	4.8	155	6.2	34	30
				Max	23.9	7.0	180	6.8	34	40

Data Entry verified against
Laboratory Bench Sheets
7-28-08 JRF

REFERENCE TOXICANT RESULTS AND ANALYSIS

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS- _____

ACUTE TOXICITY TEST (ALL SPECIES)

REVIEWED PAGES 1-6 -GJI

Test No. 999-2419 Client: QC Test Investigator _____

Test Type (rangefinding/definitive) _____ Test Length (hr) 96

Species *Lumbriculus variegatus*

STUDY MANAGEMENT

Client: QC test

Client's Study Monitor: QC test

Testing Laboratory: Northwestern Aquatic Sciences

Test Location: Newport Laboratory

Laboratory's Study Personnel:

Proj. Man./Study Dir. G.J. IRISSARRI GJI

QA Officer L. K. Nemeth

1. _____ 2. _____

3. _____ 4. _____

Study Schedule:

Test Beginning: 5-26-08 1040 Test Ending: 5-30-08 1050

TEST MATERIAL

Description: Potassium Chloride Crystals - Lot No.: 045768

NAS Sample No.				
Date of Collection:				
Date of Receipt:				
Temperature (deg C):				
Dissolved oxygen (mg/L):				
pH:				
Conductivity (umhos/cm):				
Hardness (mg/L):				
Alkalinity (mg/L):				
Salinity (ppt):				
Total chlorine (mg/L):				
Total ammonia-N (mg/L):				
_____:				

DILUTION WATER

Description: Moderately hard synthetic water

Date of Preparation/Collection: 5-19-08

Water Quality: Cond. (umhos/cm): 355 Salinity (ppt) – pH 7.8

Hardness (mg/L as $CaCO_3$): 94 Alkalinity (mg/L as $CaCO_3$): 70

Treatments: Aerated ≥ 24 hrs

TEST LOCATION

Test conducted in (circle one): room 1 room 2 (trailer) water bath other: _____

Randomization chart:

REP B	0.5	2	0.125	0.25	Ø	1				
REP A	0.25	Ø	1	0.5	2	0.125				

Error codes: 1) Correction of handwriting error
2) Written in wrong location; entry deleted
3) Wrong date deleted; replaced with correct date
4) Error found in measurement; measurement repeated

Revised 12-5-01

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-_____

ACUTE TOXICITY TEST (ALL SPECIES)

Test No. 999-2419 Client QC Test Investigator _____

TEST ORGANISMS

Species: *Lumbriculus variegatus* Age: adult Size: _____

Source: AQUATIC FOODS, INC., FRESNO, CA Date received: 5-22-08

Acclimation Data:

Date	Temp. (deg.C)	DO (mg/L)	pH	Cond. umhos/cm	Hardness (mg/L)	Alkalinity (mg/L)	Feeding Amount	Feeding description	Water changes
5-23-08	20.7	8.1	6.8	220	43	50	NONE		YES
5-24-08	22.2	7.8	7.1	245	43	60			YES
5-25-08	22.3	7.9	7.1	250	43	50			YES
5-26-08	22.4	7.4	7.2	260	43	50			YES
Mean	21.9	7.8	7.1	244	43	53			
S.D.	0.8	0.3	0.2	17	∅	5			
(N)	4	4	4	4	4	4			

Photoperiod during acclimation: 16:8, L:D

TEST PROCEDURES AND CONDITIONS

Test concentrations (50% series recommended): 2, 1, 0.5, 0.25, 0.125, 0 g/L

Test chamber: 250 ml glass beakers Test volume: 100 ml

Replicates/treatment: 2 Organisms/treatment: 20 (10/rep)

Test water changes: None Aeration during test: None

Feeding: None

Duration: 24-hr, 48-hr, 96-hr Test temperature (deg.C): 23 ± 1

Beaker placement: Stratified randomization Photoperiod: 16:8, L:D

MISCELLANEOUS NOTES

Test solution preparation:

Working stock: Dissolve 1.0 g KCl crystals in dilution water and dilute to 100 mL.
Final conc.: 10 g/L.

5-26-08

Test concentration (g/L)	KCl working stock (ml/200ml)	ml of dilution water per 200 ml
2	40	160
1	20	180
0.5	10	190
0.25	5	195
0.125	2.5	197.5
0	0	0

NORTHWESTERN AQUATIC SCIENCES PROTOCOL NO. NAS-_____

ACUTE TOXICITY TEST (ALL SPECIES)

Test No. 999-2419 Client QC Test

DAILY RECORD SHEET

Day 0 (5 /26 /08) GJL

Conc. (g/L)	Temp. (deg.C)	DO (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	Survivors A	Survivors B
1. 2	23.8	8.6	3190	8.1	86	80	10	10
2. 1	23.8	8.6	1870	8.1			10	10
3. 0.5	23.7	8.6	1150	8.0			10	10
4. 0.25	23.8	8.5	760	7.9			10	10
5. 0.125	23.9	8.6	540	7.8			10	10
6. 0	23.7	8.6	340	7.8	86	80	10	10

Day 1 (5 /27 /08) GJL

Conc. (g/L)	Temp. (deg.C)	DO (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	Survivors A	Survivors B
1. 2	23.8	5.8	3210	7.0			6 (4D)	5 (5D)
2. 1	23.8	7.5	1880	7.6			9 (1D)	10
3. 0.5	23.6	7.0	1210	7.5			10	10
4. 0.25	23.8	6.2	765	7.3			10	10
5. 0.125	23.8	5.8	555	7.1			10	10
6. 0	23.7	6.8	345	7.2			10	10

Day 2 (5 /28 /08) GJL

Conc. (g/L)	Temp. (deg.C)	DO (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	Survivors A	Survivors B
1. 2	~~23.9~~	5.2	3280	7.0			Ø (6D)	Ø (6D) 5 GJL ① 7-28-08
2. 1	23.9	6.0	1860	7.1			2 (7D)	2 (8D)
3. 0.5	23.8	6.5	1220	7.3			10	10
4. 0.25	23.9	6.7	765	7.3			10	10
5. 0.125	23.9	6.3	565	7.1			10	10
6. 0	23.8	6.2	325	7.1			10	10

Day 3 (5 /29 /08) GJL

Conc. (g/L)	Temp. (deg.C)	DO (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	Survivors A	Survivors B
1. 2	—	—	—	—			Ø	Ø
2. 1	23.2	6.5	1845	7.1			Ø (2D)	Ø (2D)
3. 0.5	23.1	6.2	1270	6.9			6 (4D)	8 (2D)
4. 0.25	23.2	6.0	775	6.9			10	10
5. 0.125	23.2	5.5	585	6.9			10	10
6. 0	23.1	5.6	345	7.0			10	10

Day 4 (5 /30 /08) GJL

Conc. (g/L)	Temp. (deg.C)	DO (ppm)	Cond. (umhos/cm)	pH	Hardness (mg/L)	Alkalinity (mg/L)	Survivors A	Survivors B
1. 2	—	—	—	—	—	—	Ø	Ø
2. 1	—	—	—	—			Ø	Ø
3. 0.5	23.7	7.2	1310	6.9			4 (2D)	6 (2D)
4. 0.25	23.8	5.4	780	6.7			10	10
5. 0.125	23.7	4.6	600	6.7			10	10
6. 0	23.7	5.9	365	7.0	94	80	10	10
Mean	23.7	6.7		7.3	89 ~~88.7~~ GJL ① 7-23-08	80		
SD	0.3	1.2		0.4	5	Ø		
n	27	27		27	3	3		

Revised 12-5-01

Acute 96-hr Toxicity Test-96 Hr Survival

Start Date:	5/26/2008 10:40	Test ID:	999-2419	Sample ID:	REF-Ref Toxicant
End Date:	5/30/2008 10:50	Lab ID:	ORNAS-Northwestern Aquati	Sample Type:	KCL-Potassium chloride
Sample Date:		Protocol:	EPAA 91-EPA Acute	Test Species:	Lumbriculus variegatus
Comments:					

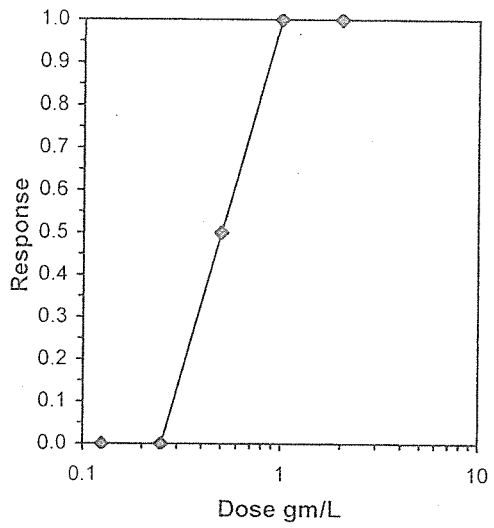
Conc-gm/L	1	2
D-Control	1.0000	1.0000
0.125	1.0000	1.0000
0.25	1.0000	1.0000
0.5	0.4000	0.6000
1	0.0000	0.0000
2	0.0000	0.0000

			Transform: Arcsin Square Root					Number	Total
Conc-gm/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Resp	Number
D-Control	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	2	0	20
0.125	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	2	0	20
0.25	1.0000	1.0000	1.4120	1.4120	1.4120	0.000	2	0	20
0.5	0.5000	0.5000	0.7854	0.6847	0.8861	18.129	2	10	20
1	0.0000	0.0000	0.1588	0.1588	0.1588	0.000	2	20	20
2	0.0000	0.0000	0.1588	0.1588	0.1588	0.000	2	20	20

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Normality of the data set cannot be confirmed				
Equality of variance cannot be confirmed				

Trimmed Spearman-Karber

Trim Level	EC50	95% CL	
0.0%	0.5000	0.4282	0.5838
5.0%	0.5000	0.4209	0.5940
10.0%	0.5000	0.4119	0.6069
20.0%	0.5000	0.3862	0.6474
Auto-0.0%	0.5000	0.4282	0.5838



ToxCalc v5.0.23

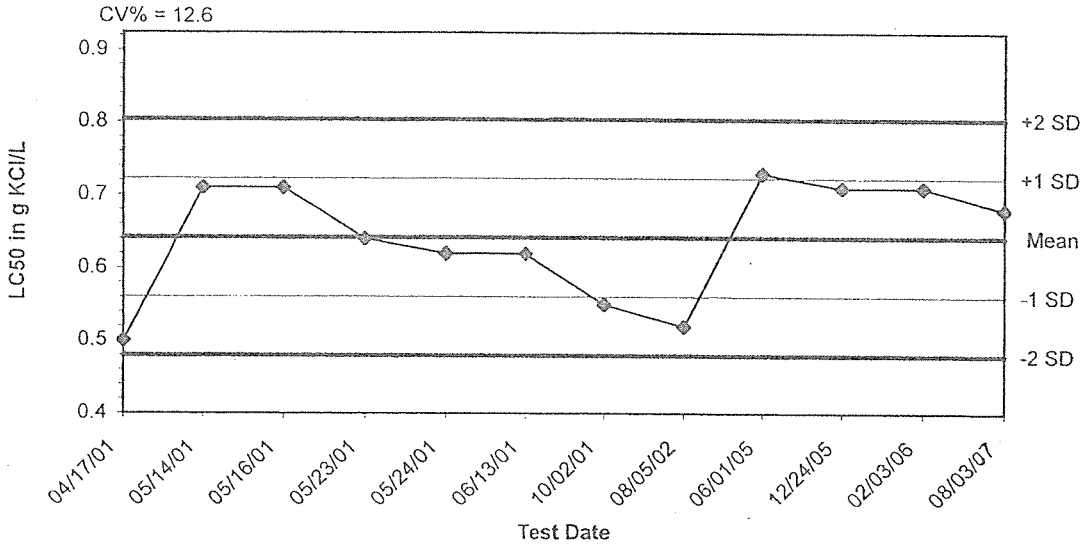
Reviewed by:_____

Test: AT-Acute 96-hr Toxicity Test
Test ID: 999-2419
Species: Lumbriculus variegatus
Protocol: EPAA 91-EPA Acute
Sample ID: REF-Ref Toxicant
Sample Type: KCL-Potassium chloride
Start Date: 5/26/2008 10:40
End Date: 5/30/2008 10:5
Lab ID: ORNAS-Northwestern Aquatic Sciences

Pos	ID	Rep	Group	Start	24 Hr	48 Hr	72 Hr	96 Hr	Notes
	1	1	D-Control	10	10	10	10	10	
	2	2	D-Control	10	10	10	10	10	
	3	1	0.125	10	10	10	10	10	
	4	2	0.125	10	10	10	10	10	
	5	1	0.250	10	10	10	10	10	
	6	2	0.250	10	10	10	10	10	
	7	1	0.500	10	10	10	6	4	
	8	2	0.500	10	10	10	8	6	
	9	1	1.000	10	9	2	0	0	
	10	2	1.000	10	10	2	0	0	
	11	1	2.000	10	6	0	0	0	
	12	2	2.000	10	5	0	0	0	

Comments:

Lumbriculus variegatus acute reference toxicant test - all points



Dates	Values	Mean	-1 SD	-2 SD	+1 SD	+2 SD
04/17/01	0.5000	0.6417	0.5607	0.4797	0.7227	0.8037
05/14/01	0.7100	0.6417	0.5607	0.4797	0.7227	0.8037
05/16/01	0.7100	0.6417	0.5607	0.4797	0.7227	0.8037
05/23/01	0.6400	0.6417	0.5607	0.4797	0.7227	0.8037
05/24/01	0.6200	0.6417	0.5607	0.4797	0.7227	0.8037
06/13/01	0.6200	0.6417	0.5607	0.4797	0.7227	0.8037
10/02/01	0.5500	0.6417	0.5607	0.4797	0.7227	0.8037
08/05/02	0.5200	0.6417	0.5607	0.4797	0.7227	0.8037
06/01/05	0.7300	0.6417	0.5607	0.4797	0.7227	0.8037
12/24/05	0.7100	0.6417	0.5607	0.4797	0.7227	0.8037
02/03/06	0.7100	0.6417	0.5607	0.4797	0.7227	0.8037
08/03/07	0.6800	0.6417	0.5607	0.4797	0.7227	0.8037

MSR
10-12-07

TECHNICAL MEMORANDUM

TO: PacifiCorp Energy

FROM: Kleinfelder

DATE: December 1, 2008

Mercury Demethylation Considerations for Condit Dam Sediments

Many factors influence the speciation, bioavailability, bioaccumulation, and toxicity of mercury in the environment. Due to the number of factors and the complexity of interactions among them, the question regarding the timing of establishment of demethylating bacteria that could reduce methylmercury after the sediments are released into the White Salmon River from Condit dam cannot be easily answered. Without a substantial amount of experimental work and testing (e.g., measuring the rates of mercury methylation and demethylation in project sediments) it is not possible to provide a meaningful estimate of the time required for mercury in sediments impounded behind Condit dam to be demethylated following project removal. The following provides additional background information about the mercury methylation and demethylation processes and discusses how those processes may be impacted by known and expected conditions following project removal.

Inorganic mercury is readily dispersed and transported in the environment (Beyer et al., 1996). Mercury occurs in natural waters in many forms, including elemental mercury, dissolved and particulate ionic forms, and dissolved and particulate methylmercury (Beyer et al., 1996). Methylmercury (organic form) is more toxic and bioaccumulative than the inorganic forms (USDI, 1998). Inorganic mercury is methylated in the environment, primarily by microbes (Beyer et al., 1996). Methylation in aquatic systems can occur in the sediment and water column. Sediment can be a sink and a source of mercury in the environment and is a source of methylmercury to biota and to the water column (USDI, 1998). Mercury levels in water tend to be greatest downstream of wetlands due to the high organic content of the water, and disturbance and re-

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suspension of wetland sediments can mobilize mercury associated with sediments (USDI, 1998).

Nearly all of the mercury found in fish is methylmercury, even though little of the total mercury found in freshwater and sediments exists as methylmercury (Beyer et al., 1996). Inorganic mercury is absorbed less efficiently and excreted more efficiently than methylmercury. Inorganic mercury is not methylated by fish tissue, though it is methylated in the gut. The methylmercury in fish is obtained mostly from the diet and to a smaller extent from the water passing across the gills (Beyer et al., 1996; USDI, 1998). Thus, concentrations of dissolved organic mercury compounds are more useful than total dissolved mercury concentrations for predicting mercury concentrations in fish (USDI, 1998).

Uptake of mercury from water into fish is affected by temperature, pH, and water hardness, as well as mercury speciation (USDI, 1998). A large body of data supports the generalization that mercury concentrations in freshwater fish and other aquatic organisms and fish-eating animals tend to increase as the pH, alkalinity, hardness, conductivity, and neutralizing capacity of the water decrease (see discussion below and Table 1). Methylmercury is created primarily from bioavailable inorganic mercury Hg(II). Both represent only a very small proportion of total mercury in sediment or water. Aquatic organisms preferentially accumulate methylmercury, and this is the main form of Hg found in fish. Inorganic forms of mercury comprise the main repository of mercury in sediments. In oxygenated fresh water, bioavailability of Hg(II) is enhanced in the range of Cl^- levels and pH values at which dissolved inorganic Hg(II) is mostly in the form of the lipophilic species $HgCl_2$. Lipophilic thiol and inorganic sulphide complexes probably account for much of the bioavailability of Hg under reducing conditions. However, bioavailability of Hg is much lower if the dissolved Hg(II) is mostly in the form of ionic complexes or $Hg(OH)_2$. Briefly, inorganic Hg(II) is probably most bioavailable to methylators in acidic fresh water in which it is mainly in the form of $HgCl_2$ or $Hg(SH)_2$, and it should be less bioavailable in weakly acidic or alkaline fresh water in which $Hg(OH)_2$ exceeds $HgCl_2$ or $Hg(SH)S^-$ exceeds $Hg(SH)_2$. In the presence of high pH and low Cl^- levels sufficient to allow $Hg(OH)_2$ to exceed $HgCl_2$, bioavailability of inorganic Hg(II) should be relatively low for two reasons: (a) $Hg(OH)_2$ penetrates membranes less

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easily than $HgCl_2$, and (b) in comparison with $HgCl_2$, $Hg(OH)_2$ is more readily sorbed by suspended matter.

Although smaller fish (due to their relatively faster metabolic rates) tend to accumulate mercury more rapidly than larger fish (USDI, 1998), mercury concentrations in fish tissue generally increase with increasing age or body size (Beyer et al., 1996), and piscivorous (fish-eating) fish and other animals at higher trophic levels (particularly long-lived species) will generally accumulate more methylmercury than animals at lower trophic levels (Beyer et al., 1996).

Elemental mercury and mercuric ions are predominant forms of mercury in the atmosphere and in water, while mercuric sulfide (naturally occurring cinnabar (HgS)) occurs most commonly in soil and in anaerobic sediments (Boening, 2000; D'Itri, 1990). Bacteria in the environment methylate inorganic mercury to produce both monomethyl and dimethylmercury (Clarkson, 1997). Both aerobic and anaerobic bacteria can methylate mercury (D'Itri, 1990). Dimethylmercury is highly volatile and can enter the atmosphere, where it is degraded into monomethyl and inorganic forms (Clarkson, 1997). Environmental levels of methylmercury depend on the balance between bacterial methylation and demethylation (Boening, 2000).

Monomethylmercury enters aquatic food chains to become the predominant source of dietary mercury to humans (Clarkson, 1997). Monomethylmercury is transferred through biological cycles involving aquatic organisms and is probably converted to inorganic forms that can once again enter reduction and methylation pathways (Clarkson, 1997). Monomethylmercury undergoes biomagnification in aquatic food webs, while inorganic mercury Hg(II) does not (Langston and Bebbiano, 1991). Thus, even though inorganic mercury predominates in water and sediments, most of the mercury found in fish occurs as methylmercury (Langston and Bebbiano, 1991). Elevated methylmercury in fish may be found not only in areas polluted with mercury but also in virtually unpolluted ones where conditions favor methylmercury production (Langston and Bebbiano, 1991).

Results of the tests of mercury uptake into nematodes (roundworms) provide some limited information about the potential differences in bioavailability of

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mercury in sediments impounded behind Condit dam and sediments collected at other locations. However, it is unclear at this time whether sediments are the only source of mercury at the locations that were investigated, and the testing that has been conducted did not involve measuring or quantifying the multiple factors that control mercury speciation and bioavailability. The following paragraphs provide some insight into the complexity of mercury behavior in aquatic ecosystems.

The net rate of methylmercury production depends on the abundance of bioavailable inorganic Hg(II) species and the activities of methylating and demethylating microbes. Bioavailability of Hg(II) (and consequently susceptibility to methylation) and activities of methylating and demethylating microbes are controlled by a wide range of environmental variables. Furthermore, the kinetics of methylmercury bioaccumulation depend not only on the supply of methylmercury but also on the characteristics, behavior, activities, stage of development, and food web structure of the organisms involved. (Langston and Bebbiano, 1991)

Many water quality parameters influence production and bioaccumulation of methylmercury, including dissolved oxygen (DO), pH, alkalinity, hardness, buffering capacity, and humic matter (completely decomposed organic matter that is readily soluble in acids or bases). Generally, mercury concentrations in freshwater fish and other aquatic organisms and fish-eating animals tend to increase as the pH, alkalinity, hardness, conductivity, and neutralizing capacity of the water decrease. Physical variables - through their influence on biological activities, redox conditions, and water chemistry - can also strongly influence methylmercury production and bioaccumulation of mercury. Water depth, thermal stratification, water dynamics (turbulent mixing, flushing), and maximum depth are all important. For example, low flow conditions tend to favor methylation (Langston and Bebbiano, 1991). Lake turnover time and mixing are also important, and these are affected by depth and temperature. Mercury transport on particulates is greatest in the smallest size fractions of organic matter. Lakes with longer turnover times allow smaller particles with greater concentrations of mercury more time to settle to the bottom, enriching sediment mercury concentration. The following example illustrates the importance of

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thermal stratification, depth, and productivity, as well as interactions among these three factors. Microbial methylation commonly occurs with greatest intensity at the sediment/water interface, but microbial methylation of mercury can also take place in certain regions of the water column where labile organic matter and local DO depletion may support a level of methylating activity comparable to that observed in surface sediments (Langston and Bebbiano 1991). This phenomenon is sometimes observed in the hypolimnion of a lake just below the thermocline or even in the epilimnion of an extremely eutrophic lake following a phtyoplankton bloom (Langston and Bebbiano 1991).

Optimal conditions for production and bioaccumulation of methylmercury in aquatic ecosystems include: high levels of biodegradable organic substances (e.g., dead algae or plants and other detritus, as would typically be observed in productive lakes), anoxic or oxygen-poor environments with weakly acidic or neutral pH, and absence/low levels of sulphides. These conditions are inter-related (e.g., microorganisms using labile organic matter consume oxygen and generate sulfides). Methylating activity tends to correlate with heterotrophic (an organism that requires organic substrates to get its chemical energy for growth and development) microbial activity, in general. Methylmercury bioaccumulation is favored in acidic fresh water by at least two factors: inorganic Hg(II) is more available to methylators, and biological uptake of methylmercury occurs rapidly. However, it is possible that demethylation will also occur more rapidly under these conditions due to increased availability of mercury to demethylators. Exceptions to these generalizations are common under a wide variety of conditions (Langston and Bebbiano, 1991).

Microbial methylation of mercury is commonly concentrated in surface sediments (i.e., at the sediment/water interface), but in certain regions of the water column, labile (relatively available) organic matter and local DO depletion may support a level of methylating activity comparable to that observed in surface sediments (Langston and Bebbiano, 1991). Consequently, both waterborne and sediment-associated mercury may be important sources to methylating microbes.

Methylation of mercury in sediments occurs most intensely at the sediment/water interface where microbial activity is greatest (Langston and Bebbiano, 1991). If deeper sediments impounded behind Condit dam are released to the river

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downstream, this will presumably expose a greater amount of sediment to microbial activity. The balance of factors favoring methylation versus demethylation will determine the fate of mercury in those sediments. The net effect of all of the modifying factors cannot be estimated reliably without additional testing and measurements.

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