1221573

# WASTE SITE RECLASSIFICATION FORM

**Operable Unit:** 100-NR-1 **Control No.:** 2013-030

**Waste Site Code(s)/Subsite Code(s):** 124-N-2; 124-N-2 Septic Tank; 100-N Sanitary Sewer System No. 2 Waste Site

**Reclassification Category:** Interim ☒ Final ☐

**Reclassification Status:** Closed Out ☒ No Action ☐ Rejected ☐
RCRA Postclosure ☐ Consolidated ☐ None ☐

**Approvals Needed:** DOE ☒ Ecology ☒ EPA ☐

**Description of current waste site condition:**

The 124-N-2; 124-N-2 Septic Tank; 100-N Sanitary Sewer System No. 2 waste site was located southeast of the former 182-N Building. The site is identified in the *Interim Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington (100-N Area ROD) (EPA 1999), with removal and disposal as the selected remedy. This waste site consisted of a septic tank and seepage pit that received sanitary sewage from the 182-N Building. The 182-N Building housed over 30 pumps, diesel generators, 5 diesel engines, compressors, receivers, and electrical switchgear. Several diesel oil tanks were located in and around the building to support the diesel generator and diesel engines. One 2,082-L (550-gal) above-grade diesel oil storage tank was located just outside the east wall of the 182-N Building.

The 124-N-2 septic tank was pumped and isolated after the 124-N-10 Septic Treatment Facility was placed in service in February 1987. In June 2009, the 124-N-2 septic tank was removed, disposed, and the site was backfilled with the seepage pit remaining in place. Remedial action at the 124-N-2 waste site to remove the seepage pit and soil underlying the former septic tank was performed in September through December 2012 and in January and April 2013. A total of approximately 1,796 bank cubic meters (2,349 bank cubic yards) of contaminated soil and debris were removed from the 124-N-2 excavation and direct loaded for disposal at the Environmental Restoration Disposal Facility. The excavation extended to an approximate depth of 5.1 m (17 ft) below ground surface. Verification sampling was performed on May 14, 2013, to determine if the waste site meets the remedial action objectives and remedial action goals (RAGs) established by the *Remedial Design Report/Remedial Action Work Plan for the 100-N Area* (100-N Area RDR/RAWP), DOE/RL-2005-93, Rev. 0, U.S. Department of Energy, Richland, Washington (DOE-RL 2006) and the 100-N Area ROD (EPA 1999). The selected remedy involved (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at the ERDF, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification as Interim Closed Out.

**Basis for reclassification:**

The verification sampling results were evaluated in comparison to the RAGs. In accordance with this evaluation, the verification sampling results support a reclassification of the 124-N-2 waste site to Interim Closed Out. The current site conditions achieve the RAGs established by the 100-N Area RDR/RAWP (DOE-RL 2006b) and the 100-N Area ROD (EPA 1999). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. The entire 124-N-2 excavation is located within the deep zone soils (i.e., greater than 4.6 m [15 ft] depth). Therefore, no direct exposure pathway to humans or ecological receptors will exist after backfill of the excavation. However, contamination above shallow zone direct exposure soil cleanup levels was observed in deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are required. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 124-N-2; 124-N-2 Septic Tank; 100-N Sanitary Sewer System No.2 Waste Site* (attached).

Attached to: 1221572

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# WASTE SITE RECLASSIFICATION FORM

**Operable Unit:** 100-NR-1 **Control No.:** 2013-030

**Waste Site Code(s)/Subsite Code(s):** 124-N-2; 124-N-2 Septic Tank; 100-N Sanitary Sewer System No. 2 Waste Site

**Regulator comments:**

**Waste Site Controls:**

Engineered Controls: ☐ Yes ☒ No Institutional Controls: ☒ Yes ☐ No O&M Requirements: ☐ Yes ☒ No

If any of the Waste Site Controls are checked Yes, specify control requirements including reference to the Record of Decision, TSD Closure Letter, or other relevant documents:

Institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are required because contamination above shallow zone direct exposure soil cleanup levels was observed in deep zone soils. This requirement is per the remedial alternatives cited on page 37 to meet the remedial action objectives of the 100-N Area ROD (EPA 1999).

| | | |
|---|---|---|
| J. P. Neath | J P Neath | 8/15/13 |
| DOE Federal Project Director (printed) | Signature | Date |
| N. Menard | Nina M Menard | 8/21/13 |
| Ecology Project Manager (printed) | Signature | Date |
| N/A | | |
| EPA Project Manager (printed) | Signature | Date |

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# REMAINING SITES VERIFICATION PACKAGE FOR THE 124-N-2; 124-N-2 SEPTIC TANK; 100-N SANITARY SEWER SYSTEM NO. 2 WASTE SITE

**Attachment to Waste Site Reclassification Form 2013-030**

**August 2013**

# REMAINING SITES VERIFICATION PACKAGE FOR THE 124-N-2; 124-N-2 SEPTIC TANK; 100-N SANITARY SEWER SYSTEM NO. 2 WASTE SITE

## EXECUTIVE SUMMARY

The 124-N-2, 100-N Sanitary Sewer System No.2 waste site was located southeast of the former 182-N Building in the 100-NR-1 Operable Unit. The 124-N-2 waste site consisted of a septic tank and a seepage pit that received sanitary sewage from the 182-N Building. The 124-N-2 septic tank was pumped and isolated after the 124-N-10 Septic Treatment Facility was placed in service in February 1987. The 124-N-2 septic tank was removed and disposed of in June 2009, and the site was backfilled with the 124-N-2 seepage pit remaining in place. The 124-N-2 waste site operated from 1963 to 1987 and received an estimated 757 L/day (200 gal/day) of sanitary sewage from the 182-N Building.

Remedial action at the 124-N-2 waste site was performed in September and December 2012, and January, March, and April 2013. A total of approximately 1,796 bank cubic meters (BCM) (2,349 bank cubic yards [BCY]) of contaminated soil and debris were removed from the 124-N-2 excavation and direct loaded for disposal at the Environmental Restoration Disposal Facility (ERDF). Excavation continued until all debris and contamination associated with the 124-N-2 waste site had been removed. No radiologically contaminated material was discovered during remediation activities.

Original verification sampling was conducted on September 10, 2012. Verification sampling results indicated that several sampling locations failed direct exposure remedial action goals (RAGs) for polycyclic aromatic hydrocarbons (PAH) and total petroleum hydrocarbons (TPH). Following additional remediation, resampling of the failing sampling locations was performed in January and February 2013. Resampling results indicated that PAH and TPH were still present at concentrations exceeding RAGs. The excavation of the 124-N-2 waste site resumed on March 28, 2013, and included the removal of all adjacent pipelines and excavation of the entire footprint of the 124-N-2 waste site. The final depth of the 124-N-2 excavation is 4.9 to 5.1 m (16 to 17 ft) below ground surface, with some locations extending deeper. Final verification sampling was performed on May 14, 2013, per Rev. 2 of the 124-N-2 Verification Work Instruction (WCH 2013b).

A summary of the cleanup evaluation for the soil results against the applicable criteria is presented in Table ES-1. The results of the verification sampling are used to make reclassification decisions for the 124-N-2 waste site in accordance with the TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2011).

A reclassification of Interim Closed Out for the 124-N-2 waste site is supported based on the verification sampling results. The current site conditions achieve the remedial action objectives and the corresponding RAGs established in the *Remedial Design Report/Remedial Action Work Plan for the 100-N Area* (DOE-RL 2006b) and the *Interim Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington* (100-N Area ROD) (EPA 1999).

## Table ES-1. Summary of Remedial Action Goals for the 124-N-2 Waste Site.

| Regulatory Requirement | Remedial Action Goals | Results | Remedial Action Objectives Attained? |
|---|---|---|---|
| Direct Exposure – Radionuclides | Attain dose rate of <15 mrem/yr above background over 1,000 years. | Radionuclides were not COPCs for the 124-N-2 waste site. Also, there is no direct exposure pathway for this site because it is located below 4.6 m (15 ft) depth. | NA |
| Direct Exposure – Nonradionuclides | Attain individual COPC RAGs. | Benzo(a)pyrene was detected above the direct exposure cleanup level (0.137 mg/kg) in the deep zone soil. However, there is no direct exposure pathway for this site because it is located below 4.6 m (15 ft) depth. | NA |
| Risk Requirements – Nonradionuclides | Attain a hazard quotient of <1 for all individual noncarcinogens. | There is no direct exposure pathway for this site because it is located below 4.6 m (15 ft) depth. | NA |
| | Attain a cumulative hazard quotient of <1 for noncarcinogens. | | |
| | Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens. | | |
| | Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens. | | |
| Groundwater/River Protection – Radionuclides | Attain single-COPC groundwater and river protection RAGs. | Radionuclides were not COPCs for the 124-N-2 waste site. | NA |
| | Attain national primary drinking water standards [a]: 4 mrem/yr (beta/gamma) dose rate to target receptor/organs. | | |
| | Meet drinking water standards for alpha emitters: the most stringent of 15 pCi/L MCL or 1/25th of the derived concentration guides from DOE Order 5400.5 [b]. | | |
| | Meet total uranium standard of 30 µg/L (21.2 pCi/L) [c]. | | |
| Groundwater/River Protection – Nonradionuclides | Attain individual nonradionuclide groundwater and river cleanup requirements. | Residual concentrations of aroclor-1254, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene exceeded the soil RAGs for the protection of groundwater and/or the Columbia River. However, it is predicted that these constituents will not migrate to groundwater (and thus the Columbia River) at concentrations exceeding groundwater or river protection criteria within 1,000 years. Therefore, residual concentrations achieve the remedial action objectives for groundwater and river protection [d]. | Yes |

[a] "National Primary Drinking Water Regulations" (40 *Code of Federal Regulations* 141).

[b] *Radiation Protection of the Public and Environment* (DOE Order 5400.5).

[c] Based on the isotopic distribution of uranium in the 100 Area, the 30 µg/L MCL corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater* (BHI 2001).

[d] Based on the RESidual Radioactivity (RESRAD) modeling discussed in Appendix C of the 100-N Area RDR/RAWP (DOE-RL 2006b), residual concentrations of aroclor-1254, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene and indeno(1,2,3-cd)pyrene are not predicted to migrate more than 1.0 m (3.3 ft) vertically in 1,000 years (based on the lowest distribution coefficient of the contaminants [aroclor-1254] of 75.6 mL/g). The vadose zone underlying the excavation is approximately 16 m (52.5 ft) thick. Therefore, residual concentrations of these contaminants are predicted to be protective of groundwater and the Columbia River.

COPC = contaminant of potential concern
DOE = U.S. Department of Energy
MCL = maximum contaminant level
PCB = polychlorinated biphenyl
RAG = remedial action goal
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100-N Area*
RESRAD = RESidual RADioactivity (dose model)

The verification sample results show that residual contaminant concentrations are protective of groundwater and the Columbia River. The entire 124-N-2 excavation is located within the deep vadose zone (i.e., greater than 4.6 [15 ft] depth). Therefore, no direct exposure pathway to humans or ecological receptors will exist after back fill of the excavation and evaluation of attainment of RAGs for the site is limited to demonstrating that residual contamination is protective of groundwater and the Columbia River. However, contamination above shallow zone direct exposure soil cleanup levels was observed in deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are required.

Soil cleanup levels were established in the 100-N Area ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the 100-N Area ROD (EPA 1999), a comparison against ecological risk screening levels is made for sites with contamination located above 4.6 m (15 ft). However, because the entire 124-N-2 excavation is located below a depth of 4.6 m (15 ft), there is no risk to ecological receptors and no evaluation of ecological risk is required.

# REMAINING SITES VERIFICATION PACKAGE FOR THE 124-N-2; 124-N-2 SEPTIC TANK; 100-N SANITARY SEWER SYSTEM NO. 2 WASTE SITE

## STATEMENT OF PROTECTIVENESS

The 124-N-2 waste site verification sampling data demonstrate that this site meets the objectives established in the *Remedial Design Report/Remedial Action Work Plan for the 100-N Area* (100-N Area RDR/RAWP) (DOE-RL 2006b) and the *Interim Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington* (100-N Area ROD) (EPA 1999). The entire 124-N-2 waste site excavation is located within the deep zone (i.e., greater than 4.6 m [15 ft] depth). Therefore, no direct exposure pathway to humans or ecological receptors will exist after backfill of the excavation and evaluation of attainment of remedial action goals (RAGs) for the site is limited to demonstrating that residual contamination is protective of groundwater and the Columbia River. The results of the verification sampling show that residual contaminant concentrations are protective or groundwater and the Columbia River. However, because contamination above shallow zone direct exposure soil cleanup levels was observed in deep zone soils, institution controls to prevent uncontrolled drilling or excavation into the deep zone are required.

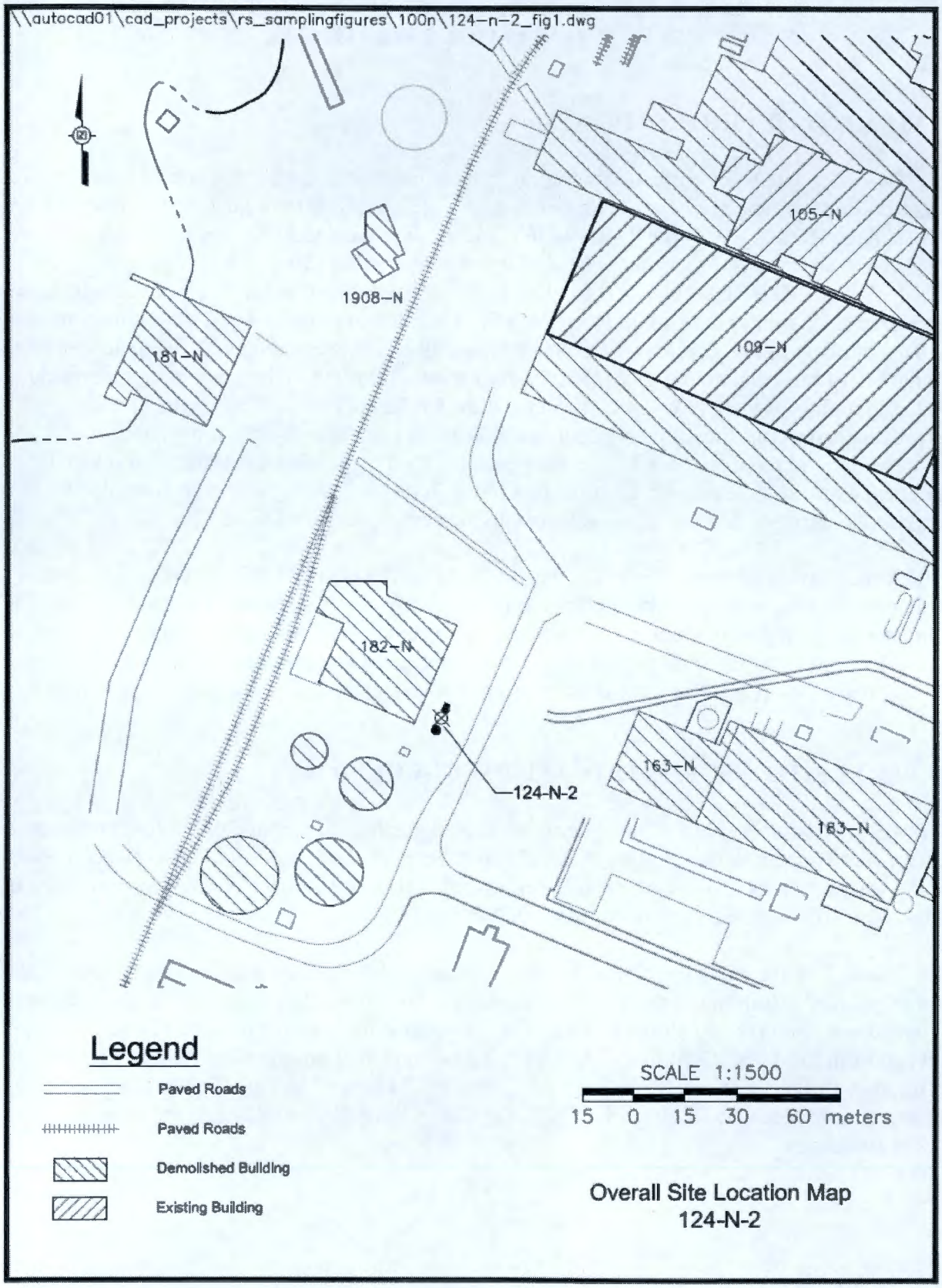
Soil cleanup levels were established in the 100-N Area ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the 100-N Area ROD (EPA 1999), a comparison against ecological risk screening levels is made for sites with contamination located above 4.6 m (15 ft). Because the entire 124-N-2 excavation is located below a depth of 4.6 m (15 ft), there is no risk to ecological receptors and no evaluation of ecological risk is required.

## GENERAL SITE INFORMATION AND BACKGROUND

The 105-N Reactor, the last of the nine water-cooled graphite-moderated plutonium production reactors constructed at the Hanford Site, is located between the 100-K and 100-D Reactor areas on the southern bank of the Columbia River. Construction began in 1959 and was completed in 1964. The 105-N Reactor operated from 1964 to 1987.

The 124-N-2 waste site, part of the 100-NR-1 Operable Unit, located adjacent to the southeast corner of 182-N Building of the 100-N Area (Figure 1), consisted of a septic tank and seepage pit (Appendix A, Figures A-1 through A-3). The septic tank and seepage pit received sanitary sewage from the 182-N Building. The seepage pit provided approximately 18.4 $m^2$ (200 $ft^2$) of infiltration surface area and 8,700 L (2,300 gal) of fluid storage. During the period of operation, the septic tank received an estimated 757 L/day (200 gal/day) of sanitary sewage from the 182-N Building.

**Figure 1. The 124-N-2 Waste Site Location Map.**



The 124-N-2 septic system was in service from 1963 to 1987, at which point the sanitary sewage was rerouted to the 124-N-10 septic system. In 1985, a study was performed to evaluate the condition of the 124-N-2 sewer system (UNI 1985). The study reported that the effluent in the seepage pit was just few inches away from the inlet pipe. The average fluid level was about 1.4 m (4.75 ft) deep. The sewage effluent in the seepage pit appeared cloudy and black, with oily film covering the surface. A 50-cm (20-in.)-thick layer of heavy sludge was discovered on top of a 11.4-cm (4.5 in.) layer of black mud in the seepage pit. The walls, about 7.6 to 13 cm (3 to 5 in.) above the fluid surface, had a cake-like buildup covering the masonry block. It was concluded that this sewer system was approaching complete failure due to poor maintenance and hydraulic overloading. The danger of total failure was imminent, and therefore in February 1987 the 124-N-2 septic tank was pumped and isolated after the 124-N-10 Septic Treatment Facility was placed in service. The *100-N Area Technical Baseline Report* refers to the 124-N-2 waste site as an inactive, nonhazardous, and nonradioactive liquid waste site (WHC 1994).

According to the Post-Demolition Summary Report for the 100-N sanitary Sewer System No. 2 Tank, the 124-N-2 septic tank was removed and disposed of in June 2009 (WCH 2009). The septic tank site was backfilled, but the 124-N-2 seepage pit remained in place.

The 182-N Building housed the pumps that supplied raw water, demineralized water, and sanitary water to the various buildings in the 100-N Area. The 182-N High Lift Pump House was a single-story building with a full basement level. The main floor included the equipment area, motor control room, shop, office, and switchgear area. There was also a partial upper level that included a locker room, restroom, and lunch room. The basement level extended 7.5 m (24.5 ft) below grade and was used for pumping equipment. Equipment on the main floor level of the building included approximately 19 pumps, a diesel generator, air compressors and receivers, and electrical switchgear. The basement also included five diesel engines to support the diesel pumps. Several diesel oil tanks were located in and around the building to support the diesel generator and diesel engines. The main diesel oil supply was provided from three below-grade tanks (1715-NA) near the north side of the building. A 2,082-L (550-gal) above-grade waste oil tank was located near the 1715-NA tanks. Two 2,082-L (550-gal) above-grade diesel oil storage tanks were added in the early 1970s. One was located near the southwest corner of the building, while the other was just outside the east wall.

## REMEDIAL ACTION SUMMARY

The 124-N-2 waste site was remediated between April 12, 2012, and April 18, 2012, along with the remediation of the 182-N Building by the Deactivation, Decontamination, Decommissioning, and Demolition (D4) Project (WCH 2009). Materials from the 124-N-2 waste site could not be physically separated from the 182-N Building materials; therefore, an accurate total volume excavated from the 124-N-2 waste site is unknown. A volume of approximately 240 BCM (314 BCY) of material is estimated to have been excavated from the 124-N-2 waste site by the D4 Project. Materials removed from the excavation included the demolished seepage pit, concrete, soil, and rocks. The septic tank excavation extended approximately 1.7 m (5.6 ft) below the original ground surface. Materials were temporarily staged within the 124-N-2 excavation, prior to removal and disposal at the Environmental Restoration

Disposal Facility (ERDF). There were no staging pile areas (SPAs) or overburden piles associated with the 124-N-2 waste site excavation.

The 124-N-2 Verification Work Instruction, Revision 0, was prepared and approved prior to the completion of 124-N-2 waste site remediation (WCH 2012a). The sampling design was prepared using the excavation design boundary of the 124-N-2 waste site. Following remediation, a boundary walk-around of the excavation was performed to compare the excavation boundary to the 124-N-2 waste site sampling design. It was determined that the layback of the excavation was less then predicted by design; therefore, the boundaries for the actual excavation did not align with the design boundaries used for the sampling design. The 124-N-2 waste site sampling design was revised (Rev. 1) to include the walk-around boundary of the existing excavation (WCH 2012b).

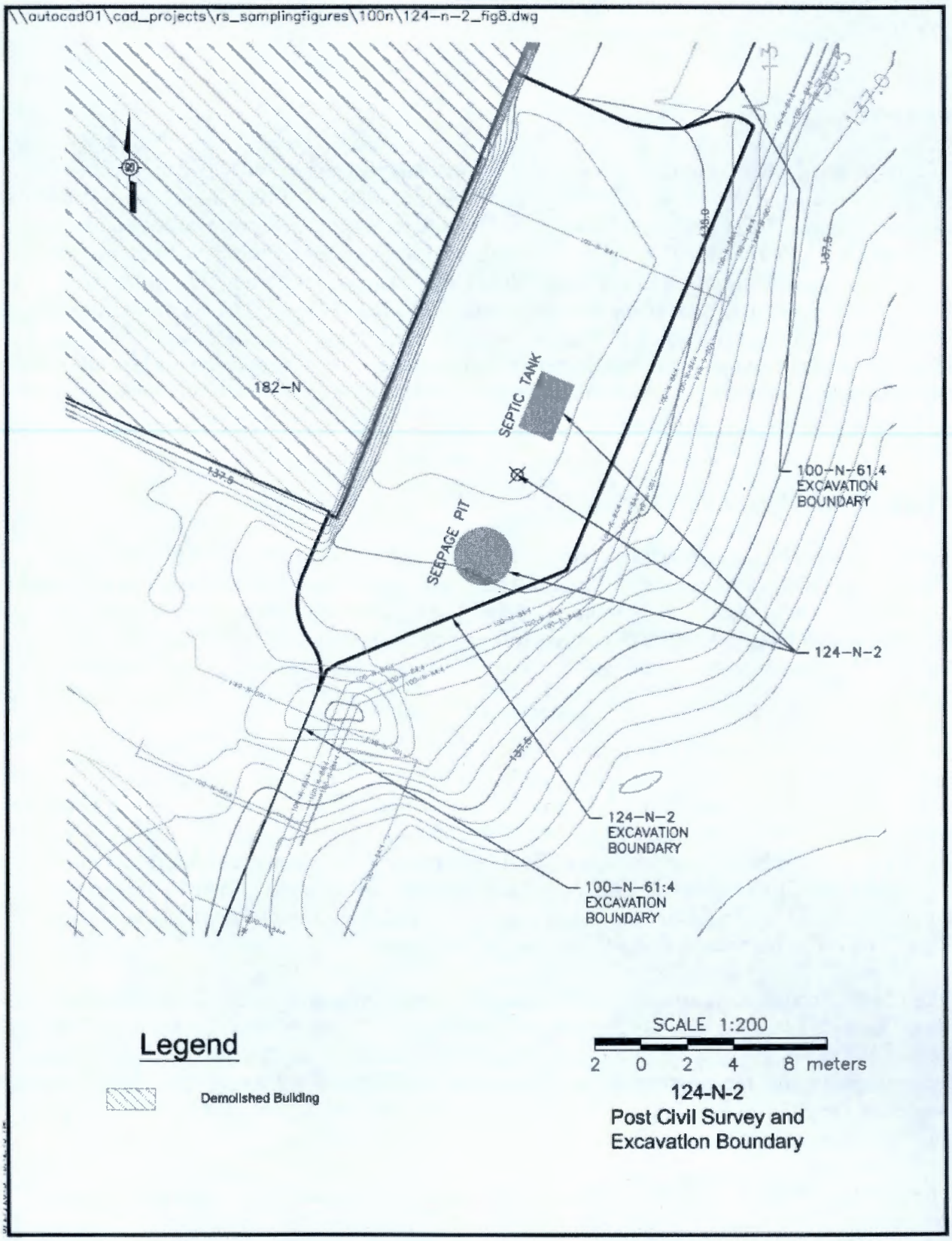
Verification sampling was performed on September 10, 2012, per the approved verification work instruction (Rev. 1) (WCH 2012b). One decision unit was identified for the 124-N-2 waste site and included the excavation area only. Twelve statistical samples plus quality assurance/quality control (QA/QC) samples were collected from the decision unit. Nine out of 12 sample locations EXC-2, EXC-3, EXC-4, EXC-5, EXC-6, EXC-7, EXC-8, EXC-9, and EXC-11, failed one or more direct exposure RAGs. All nine locations failed for polycyclic aromatic hydrocarbons (PAH). Additionally, EXC-3 failed for total petroleum hydrocarbons (TPH). Figures A-4 through A-6 in Appendix A show the 124-N-2 excavation after the initial sampling was performed.

Additional remediation of the 124-N-2 waste site was performed by the Field Remediation (FR) Project between January 21 and 30, 2013. Approximately 371 BCM (485 BCY) of material was excavated from the 124-N-2 waste site for direct disposal at the ERDF. The failing sampling locations were resampled on February 5, 2013, per the approved 124-N-2 Plume Chase Agreement (DOE-RL 2012). The resample results indicated that PAH and TPH contamination was present at the 124-N-2 waste site above direct exposure RAGs.

On March 28, 2013, remediation at the 124-N-2 waste site resumed to further excavate the entire footprint of the 124-N-2 waste site (Figures A-7, A-8 and A-9 in Appendix A). The excavation was expanded to the east to remove the adjacent 100-N-84:4 pipelines, to allow the 124-N-2 excavation to proceed to a greater depth. The 124-N-2 excavation was completed on April 25, 2013, and final depth of the excavation is approximately 4.9 to 5.1 m (16 to 17 ft below ground surface), with some locations extending deeper. Approximately 1,185 BCM (1,550 BCY) of additional material was removed from the 124-N-2 excavation. All excavated materials and pipelines were removed for direct disposal at the ERDF.

For the purposes of the 124-N-2 waste site closure, it was determined that only the footprint of the 124-N-2 waste site would be included in the revised (Rev. 2) verification sampling design (WCH 2013b). The 100-N-84:4, 100-N Area Steam and Condensate pipelines east of the 124-N-2 waste site will be addressed separately and were excluded from the 124-N-2 waste site verification sampling design. In addition, the 100-N-61:4 pipeline excavations border the 124-N-2 waste site on the south and north ends; therefore, the 124-N-2 site excavation footprint will extend to the south and north boundary of the 100-N-61:4 excavation, as shown in Figure 2.

**Figure 2. 124-N-2 Post-Excavation Boundary.**



The 100-N-84:5, 100-N Area Sanitary Pipeline segments were partially removed within the 124-N-2 excavation area during the remediation effort and will be addressed with the 124-N-2 waste site verification sampling.

## VERIFICATION SAMPLING ACTIVITIES

The initial verification sampling of the 124-N-2 waste site was conducted between September 10, 2012, and May 14, 2012. The samples prescribed in Rev. 2 of the verification work instruction (WCH 2013b), which are used for site reclassification, were collected on May 14, 2013 (WCH 2013b). Samples were collected to support a determination that residual contaminant concentrations at this site meet the cleanup criteria specified in the 100-N Area RDR/RAWP (DOE-RL 2006b) and the 100-N Area ROD (EPA 1999). The verification sample results are provided in Appendix B. The following subsections provide discussion of the information used to develop the verification sampling design. A more detailed discussion of the verification sample design can be found in the *Work Instruction for Verification Sampling of the 124-N-2, 124-N-2 Septic Tank; 100-N Sanitary Sewer System No. 2 Waste Site,* Rev. 2 (WCH 2013b).

### Contaminants of Potential Concern

The only contaminants of potential concern (COPCs) for the 124-N-2 waste site listed in the 100-N ROD (EPA 1999) are TPH. The 124-N-2 Verification White Paper (WCH 2011b) added inductively coupled plasma (ICP) metals, mercury, hexavalent chromium, nitrate, pesticides, polychlorinated biphenyls (PCBs), semivolatile organic compounds (SVOCs), and PAH to the list of COPCs based on the historical knowledge of contaminants typically present in septic systems.

According to the in-process data presented in the 124-N-2 Ex-situ Bioremediation Evaluation (WCH 2011a), SVOCs were excluded from the list of COPCs. Benzo(a)anthracene and benzo(a)pyrene were detected in the in-process SVOC samples; however, these contaminants are also PAH, and were therefore analyzed using EPA Method 8310 for PAH. Bis(2-ethylhexyl)phalate was reported in the in-process field soil sample and in the laboratory method blank. Bis(2-ethylhexyl)phalate is a major component in plastics manufacture, is commonly found on the surfaces of plastic equipment, and is a common laboratory contaminant. Therefore, it was not included as a COPC for this waste site.

The 124-N-2 verification sampling was performed on September 10, 2012, per the approved *Work Instruction for Verification Sampling of the 124-N-2; 124-N-2 Septic Tank; 100-N Sanitary Sewer System No. 2 Waste Site*, Rev. 1 (WCH 2012b). The TPH and PAH verification results led to the additional remediation of the entire footprint of the 124-N-2 waste site. The 124-N-2 waste site verification sampling results from this sampling event are included for informational purposes in Appendix B.

The initial verification work instruction included gamma energy analysis (GEA) to evaluate for americium-241, cesium-137, cobalt-60, europium-152, europium-154, and europium-155 radionuclides in the initial 124-N-2 waste site verification sampling (WCH 2012b).

However, the verification sampling results indicated that radionuclides were either undetected or detected well below background levels. In addition, a radiological field survey was performed on June 17, 2009, at the 124-N-2 waste site. Radiological activity was not detected above background levels. Therefore, radionuclides were excluded from the COPC list for the 124-N-2 waste site.

Pesticide analysis was also performed in the initial round of 124-N-2 waste site verification sampling. However, analytical sampling results indicated that pesticides were undetected in all samples. Therefore, pesticides were eliminated as 124-N-2 waste site COPCs.

Hexavalent chromium was detected in 2 of the 12 samples in the initial 124-N-2 waste site verification sampling results. However, the detected results were less than one-sixth of the most restrictive hexavalent chromium RAG, and there is no indication that hexavalent chromium contamination was present at the 124-N-2 waste site. Therefore, hexavalent chromium was excluded from the list of COPCs.

Based on the initial verification sampling data results discussed above, the revised list of 124-N-2 waste site COPCs is as follows: ICP metals, mercury, nitrate, PCBs, TPH, and PAH. A summary of all the contaminants analyzed per the final revision (Rev. 2) of the verification work instruction (WCH 2013b) and their analytical methods is provided in Table 1. Verification samples were analyzed using EPA-approved analytical methods (DOE-RL 2006b).

**Table 1. 124-N-2 Laboratory Analytical Methods and Contaminants of Potential Concern.**

| Analysis | Analytical Method | Contaminant of Potential Concern |
|---|---|---|
| ICP metals [a] | EPA Method 6010 | Metals |
| Mercury | EPA Method 7471 | Mercury |
| Nitrate/nitrite | EPA Method 353.2 | Nitrate |
| PCB | EPA Method 8082 | Polychlorinated biphenyls |
| PAH | EPA Method 8310 | Polycyclic aromatic hydrocarbons |
| TPH | EPA Method NWTPH-Dx | Total petroleum hydrocarbons |

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

EPA = U.S. Environmental Protection Agency
ICP = inductively coupled plasma
NWTPH-Dx = Northwest total petroleum hydrocarbons – diesel range organics
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
TPH = total petroleum hydrocarbons

## Verification Sample Design

One decision unit was identified for the 124-N-2 waste site excavation footprint. A total of 12 statistical verification soil samples were collected from the excavation area. All sampling was performed in accordance with ENV-1, *Environmental Monitoring & Management*, to fulfill the requirements of the *100-N Area Remedial Action Sampling and Analysis Plan* (DOE-RL 2006a). Verification sampling is documented in the field sampling logbook (WCH 2013a).

The verification samples are listed in Table 2, and sample locations are shown in Figure 3.

**Table 2. 124-N-2 Sample Summary.**

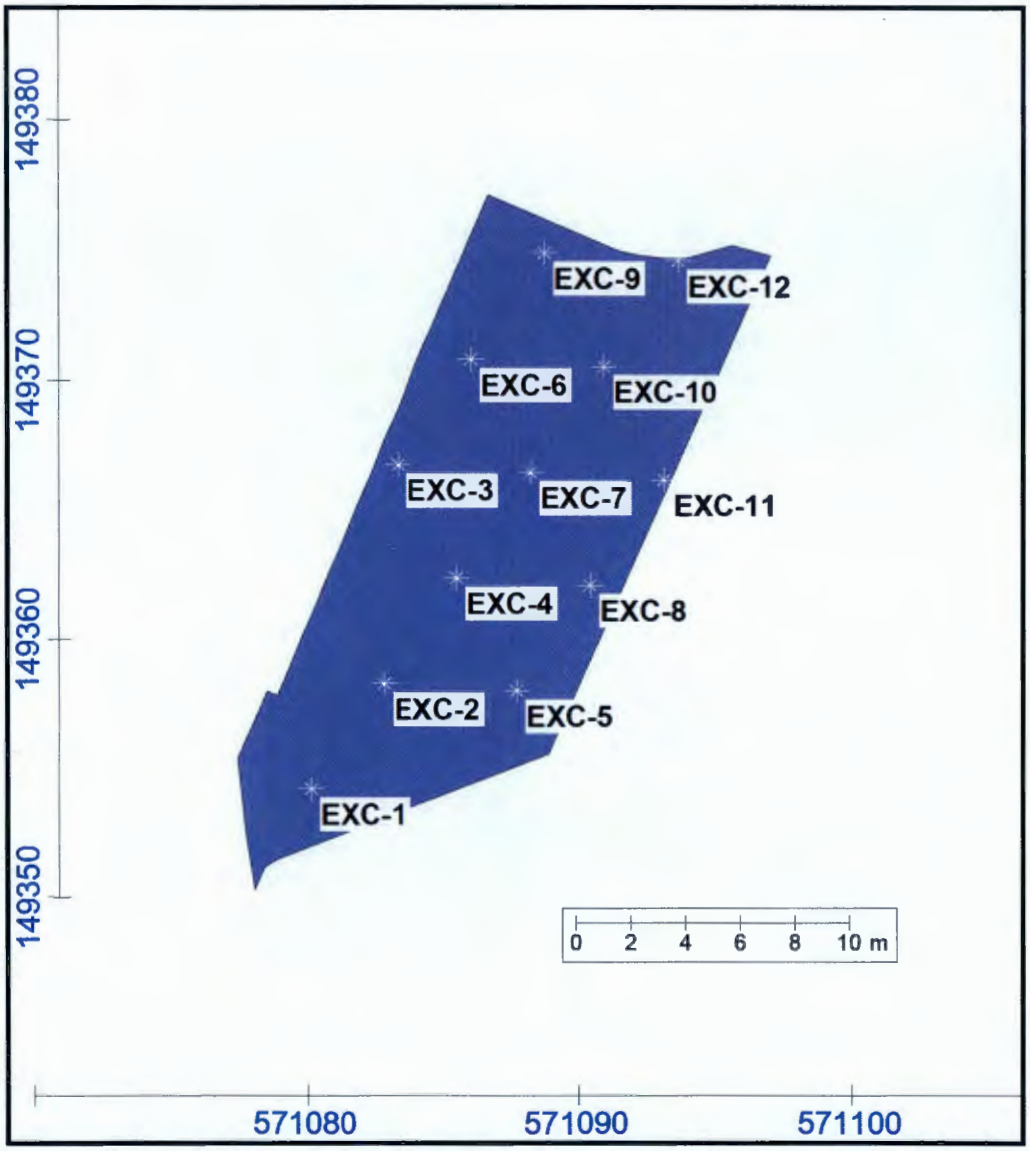
| Sample Location | HEIS Sample Number | Washington State Plane Coordinates | | Sample Analysis |
|---|---|---|---|---|
| | | Northing | Easting | |
| EXC-1 | J1RMH8 | 149354.2 | 571080.2 | ICP metals [a], mercury, $NO_2/NO_3$, PCBs, PAH, TPH |
| EXC-2 | J1RMH9 | 149358.3 | 571082.8 | |
| EXC-3 | J1RMJ0 | 149366.7 | 571083.4 | |
| EXC-4 | J1RMJ1 | 149362.4 | 571085.5 | |
| EXC-5 | J1RMJ2 | 149358.0 | 571087.7 | |
| EXC-6 | J1RMJ3 | 149370.8 | 571086.0 | |
| EXC-7 | J1RMJ4 | 149366.4 | 571088.2 | |
| EXC-8 | J1RMJ5 | 149362.1 | 571090.4 | |
| EXC-9 | J1RMJ6 | 149374.9 | 571088.7 | |
| EXC-10 | J1RMJ7 | 149370.5 | 571090.9 | |
| EXC-11 | J1RMJ8 | 149366.1 | 571093.1 | |
| EXC-12 | J1RMJ9 | 149374.6 | 571093.6 | |
| Duplicate of J1RMJ4 [b] | J1RMK0 | 149366.4 | 571088.2 | |
| Split of J1RMJ4 [b] | J1RMK2 | 149366.4 | 571088.2 | |
| Equipment blank | J1RMK1 | NA | NA | ICP metals [a], mercury, PAH |

[a] The expanded list of ICP metals included antimony, arsenic, barium, beryllium, boron, cadmium, chromium(total), cobalt, copper, lead, manganese, magnesium, molybdenum, nickel, silver, selenium, vanadium, and zinc in the analytical results package.

[b] One duplicate and one split sample were collected at a location selected at the project analytical lead's discretion.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
TPH = total petroleum hydrocarbons

**Figure 3. Verification Sample Locations for the 124-N-2 Waste Site.**




## Verification Sample Results

Evaluation of the verification data from the 124-N-2 waste site was performed by direct comparison of the statistical or maximum sample results for each COPC against cleanup criteria. The primary statistical calculation to evaluate compliance with cleanup standards is the 95% upper confidence limit (UCL) on the arithmetic mean of the data. The 95% UCL on the true population mean for residual concentrations of COPCs was calculated for each decision unit as specified by the 100-N Area RDR/RAWP (DOE-RL 2006b), with calculations provided in Appendix B. When a nonradionuclide COPC was detected in fewer than 50% of the verification samples collected for the area, the maximum detected value was used for comparison to RAGs. If no detections for a given COPC were reported in the data set, then no statistical evaluation or calculations were performed for that COPC.

Comparisons of the results for each COPC from the 124-N-2 excavation area statistical verification samples against site RAGs are summarized in Table 3. Since the entire 124-N-2 excavation is located within the deep vadose zone (i.e., greater than 4.6 m [15 ft] depth), no direct exposure pathway to humans or ecological receptors will exist after backfill of the excavation. Therefore, evaluation of attainment of RAGs for the site as shown in Table 3 is limited to demonstrating that residual contamination is protective of groundwater and the Columbia River. Contaminants that were not detected by laboratory analysis are excluded from this table. Calculated cleanup levels for calcium, magnesium, potassium, silicon, and sodium are not presented in the 100-N Area RDR/RAWP (DOE-RL 2006b). Parameters to calculate cleanup levels for these constituents are not presented in the Cleanup Levels and Risk Calculations (CLARC) Database (Ecology 2011) under WAC 173-340-740(3) or other reference databases. The EPA's *Risk Assessment Guidance for Superfund* (EPA 1989) recommends that aluminum and iron not be considered in site risk evaluations. Therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not considered site COPCs and are also not included in these tables. The laboratory-reported data results for all constituents are stored in the Environmental Restoration (ENRE) project-specific database prior to provision to the Hanford Environmental Information System (HEIS) and are presented as an attachment to the 95% UCL calculation in Appendix B.

**Table 3. Comparison of Statistical Values to Action Levels for the 124-N-2 Waste Site Excavation. (2 Pages)**

| COPC | Statistical or Maximum Result [b] (mg/kg) | Remedial Action Goals (mg/kg) [a] | | Does the Result Exceed RAGs? | Do the Results Pass RESRAD Modeling? |
|---|---|---|---|---|---|
| | | Soil Cleanup Level for Groundwater Protection | Soil Cleanup Level for River Protection | | |
| Arsenic | 2.3 (<BG) | 20 [c] | 20 [c] | No | -- |
| Barium | 60.2 (<BG) | 200 | 400 | No | -- |
| Beryllium | 0.37 (<BG) | 1.51 [c] | 1.51 [c] | No | -- |
| Boron [d] | 1.1 | 320 | NA | No | -- |
| Cadmium [e] | 0.22 (<BG) | 0.81 [c] | 0.81 [c] | No | -- |
| Chromium | 10.7 (<BG) | 18.5 [c] | 18.5 [c] | No | -- |
| Cobalt | 7.5 (<BG) | 15.7 [c] | NA | No | -- |
| Copper | 16.0 (<BG) | 59.2 | 22.0 [c] | No | -- |
| Lead | 9.0 (<BG) | 10.2 [c] | 10.2 [c] | No | -- |
| Manganese | 325 (<BG) | 512 [c] | NA | No | -- |
| Mercury | 0.0079 (<BG) | 0.33 [c] | 0.33 [c] | No | -- |
| Molybdenum [d] | 0.23 (<BG) | 8 | NA | No | -- |
| Nickel | 12.0 (<BG) | 19.1 [c] | 27.4 | No | -- |
| Vanadium | 51.6 (<BG) | 85.1 [c] | NA | No | -- |
| Zinc | 45.8 (<BG) | 480 | 67.8 [c] | No | -- |
| Chloride | 8.5 (<BG) | 25,000 | NA | No | -- |
| Fluoride | 1.1 (<BG) | 96 | 400 | No | -- |
| Nitrogen in nitrate | 1.1 (<BG) | 1,000 | 2,000 | No | -- |
| Nitrogen in nitrite and nitrate | 1.4 (<BG) | 100 | 200 | No | -- |
| Sulfate | 53.3 (<BG) | 25,000 | NA | No | -- |

## Table 3. Comparison of Statistical Values to Action Levels for the 124-N-2 Waste Site Excavation. (2 Pages)

| COPC | Statistical or Maximum Result [b] (mg/kg) | Remedial Action Goals (mg/kg) [a] | | Does the Result Exceed RAGs? | Do the Results Pass RESRAD Modeling? |
|---|---|---|---|---|---|
| | | Soil Cleanup Level for Groundwater Protection | Soil Cleanup Level for River Protection | | |
| Aroclor-1254 | 0.035 | 0.017 [f] | 0.017 [f] | Yes | Yes [g] |
| Acenaphthene | 0.33 | 96 | 129 | No | -- |
| Anthracene | 0.57 | 240 | 1,920 | No | -- |
| Benzo(a)anthracene | 1.2 | 0.015 [f] | 0.015 [f] | Yes | Yes [g] |
| Benzo(a)pyrene | 0.73 | 0.015 [f] | 0.015 [f] | Yes | Yes [g] |
| Benzo(b)fluoranthene | 0.79 | 0.015 [f] | 0.015 [f] | Yes | Yes [g] |
| Benzo(ghi) fluoranthene [h] | 0.36 | 48 | 192 | No | -- |
| Benzo(k)fluoranthene | 0.32 | 0.12 [f] | 0.015 [f] | Yes | Yes [g] |
| Chrysene | 1.3 | 1.2 | 0.10 [f] | Yes | Yes [g] |
| Dibenz(a,h)anthracene | 0.085 | 0.03 [f] | 0.03 [f] | Yes | Yes [g] |
| Fluoranthene | 2.5 | 64 | 18.0 | No | -- |
| Fluorene | 0.27 | 64 | 260 | No | -- |
| Indeno(1,2,3-cd)pyrene | 0.35 | 0.33 [f] | 0.33 [f] | Yes | Yes [g] |
| Phenanthrene [h] | 1.4 | 240 | 1,920 | No | -- |
| Pyrene | 2.5 | 48 | 192 | No | -- |
| TPH - diesel | 43 | 200 | 200 | No | -- |
| TPH - diesel range | 60 | 200 | 200 | No | -- |

[a] RAGs obtained from the 100-N Area RDR/RAWP (DOE-RL 2006b) or the 100 Area RDR/RAWP (DOE-RL 2009).

[b] Maximum or 95% UCL, depending on data censorship, as described in the *124-N-2 Waste Site Cleanup Verification 95% UCL Calculation* (Appendix B).

[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers, as discussed in Section 2.1.2.1 of the 100-N Area RDR/RAWP (DOE-RL 2006b).

[d] No Hanford Site-specific or Washington State background value available.

[e] Hanford Site-specific background value is not available. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[f] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996). The cited RDLs are based on EPA-approved analytical methods that may not be available for rapid-turnaround analyses.

[g] Based on the RESidual Radioactivity (RESRAD) modeling discussed in Appendix C of the 100-N Area RDR/RAWP (DOE-RL 2006b) residual concentrations of aroclor-1254, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene are not predicted to migrate more than 1.0 m (3.3 ft) vertically in 1,000 years (based on the lowest distribution coefficient of the contaminants [aroclor-1254] of 75.6 mL/g). The vadose zone underlying the excavation is approximately 16 m (52.5 ft) thick. Therefore, residual concentrations of these contaminants are predicted to be protective of groundwater and the Columbia River.

[h] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals:
benzo(ghi)perylene; surrogate: pyrene
phenanthrene; surrogate: anthracene.

-- = not applicable
BG = background
COPC = contaminant of potential concern
EPA = U.S. Environmental Protection Agency
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = Remedial Design Report/Remedial Action Work Plan
RESRAD = RESidual RADioactivity (dose model)
TPH = total petroleum hydrocarbons
UCL = upper confidence limit
WAC = *Washington Administrative Code*

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## CLEANUP VERIFICATION DATA EVALUATION

This section demonstrates that remedial action at the 124-N-2 waste site has achieved the applicable RAGs developed to support unrestricted land use of the shallow-zone soil (i.e., surface to 4.6 m [15 ft] deep) at the 100-N Area as documented in the 100-N Area RDR/RAWP (DOE-RL 2006b).

### Direct Comparison to RAGs

Table 3 compares the statistical verification sampling results to the applicable soil RAGs for protection of groundwater and the Columbia River. Although benzo(a)pyrene was detected above direct exposure cleanup limit (0.137 mg/kg), the entire 124-N-2 excavation is located within the deep vadose zone (i.e., greater than 4.6 m [15 ft] depth). Therefore, no direct exposure pathway to humans or ecological receptors will exist after backfill of the excavation and evaluation of attainment of RAGs for the site is limited to demonstrating that residual contamination is protective of groundwater and the Columbia River.

All COPCs were quantified below groundwater and/or river protection soil RAGs with the exception of aroclor-1254, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. However, RESidual RADioactivity (RESRAD) modeling discussed in Appendix C of the 100-N Area RDR/RAWP (DOE-RL 2006b) indicates that residual concentrations of contaminants are not predicted to migrate more than 1.0 m (3.3 ft) vertically within 1,000 years (based on the lowest distribution coefficient ($K_d$) of the contaminants exceeding RAGs, aroclor-1254, with a $K_d$ value of 75.6 mL/g). Therefore, the residual concentration of aroclor-1254, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene are predicted to be protective of groundwater and the Columbia River.

### Three-Part Test for Nonradionuclides

When using a statistical sampling approach, a RAG requirement for nonradionuclides is the WAC 173-340-740(7)(e) three-part test. The WAC 173-340 three-part test consists of the following criteria: (1) the cleanup verification 95% UCL value must be less than the cleanup level, (2) no single detection can exceed two times the cleanup criteria, and (3) the percentage of samples exceeding the cleanup criteria must be less than 10% of the data set. The application of the three-part test for the 124-N-2 remediation footprint is included in the 95% UCL statistical calculations (Appendix B). The results of this evaluation indicate aroclor-1254, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene data sets have sample results that exceeded the cleanup limit by greater than two times in comparison against the soil RAGs for groundwater and river protection in the excavation decision unit. In addition, greater than 10% of the sample results for lead in the excavation area exceed the cleanup levels. However, based on the RESRAD modeling discussed in Appendix C of the 100-N Area RDR/RAWP (DOE-RL 2006b), residual concentrations of contaminants are not predicted to migrate more than 1.8 m (6 ft) vertically within 1,000 years (based on the lowest $K_d$ of the contaminants exceeding one or more

parts of the WAC 173-340 three-part test, lead, with a $K_d$ value of 30 mL/g). The vadose zone underlying the 124-N-2 excavation is approximately 16 m (52.5 ft) thick. Therefore, the residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.

**Nonradionuclide Direct Contact Hazard Quotient and Carcinogenic Risk RAGs Attained**

Nonradionuclide risk requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than $1 \times 10^{-6}$, and a cumulative carcinogenic risk of less than $1 \times 10^{-5}$. For the 124-N-2 waste site, these risk values were not calculated since the site consists of soil located below a depth of 4.6 m (15 ft) and there is no direct exposure pathway.

**Nonradionuclide Groundwater Hazard Quotient and Carcinogenic Risk RAGs Attained**

A hazard quotient calculation for protection of groundwater was not performed for 124-N-2 waste site because only one constituent qualified for the evaluation of the hazard quotient and carcinogenic (excess cancer) risk values for groundwater protection for nonradionuclides. The requirements include an individual and cumulative hazard quotient of less than 1.0, an individual excess carcinogenic risk of less than $1 \times 10^{-6}$, and a cumulative excess carcinogenic risk of less than $1 \times 10^{-5}$. Risk values were calculated for constituents that were detected at concentrations above Hanford Site or Washington State background values or for which there is no background value. In addition, the $K_d$s for these contaminants must be less than that necessary to show no migration to groundwater in 1,000 years based on RESRAD modeling discussed in Appendix C of the 100-N Area RDR/RAWP (DOE-RL 2006b). Based on this model and a vadose zone of approximately 16 m (52.5 ft) in thickness, a $K_d$ of 4.6 or greater is required to show no predicted migration to groundwater in 1,000 years. Boron was the only analyte included for evaluation because it has a $K_d$ lower than 4.6. The individual and cumulative hazard quotient for the 124-N-2 waste site is $3.4 \times 10^{-3}$, which is less than 1.0. The 124-N-2 waste site does not have any carcinogenic constituents subject to the groundwater cancer risk calculation; therefore, the criterion for excess cancer risk is met. Nonradionuclide risk requirements related to groundwater are met.

## DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the verification sampling approach (WCH 2013b), the field logbooks (WCH 2013a), and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications. The DQA for the 124-N-2 waste site established that the data are of the right type, quality, and quantity to support site verification decisions within specified error tolerances. All analytical data were found to be acceptable for decision-making purposes. The cleanup verification sample analytical data are stored in the ENRE project-specific database for data evaluation prior to their archival in HEIS and are summarized in Appendix B. The detailed DQA is presented in Appendix C.

## SUMMARY FOR INTERIM CLOSURE

The 124-N-2 waste site has been evaluated in accordance with the 100-N Area ROD (EPA 1999) and the 100-N Area RDR/RAWP (DOE-RL 2006b). The entire 124-N-2 excavation is located within the deep vadose zone. Therefore, no direct exposure pathway to humans or ecological receptors will exist after backfill of the excavation and evaluation of attainment of RAGs for the site is limited to demonstrating that residual contamination is protective of groundwater and the Columbia River. The results of verification sampling show that residual contaminant concentrations are protective of groundwater and the Columbia River.

In accordance with this evaluation, the verification sampling results support a reclassification of the 124-N-2 waste site to Interim Closed Out. Site contamination is present in the deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are required.

## REFERENCES

40 CFR 141, "National Primary Drinking Water Regulations," *Code of Federal Regulations*, as amended.

BHI, 2001, Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater, 0100X-CA-V0038, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, as amended, U.S. Department of Energy, Washington, D.C.

DOE-RL, 2006a, *100-N Area Sampling and Analysis Plan for CERCLA Waste Sites,* DOE/RL-2005-92, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2006b, *Remedial Design Report/Remedial Action Work Plan for the 100-N Area,* DOE/RL-2005-93, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2009, *Remedial Design Report/Remedial Action Work Plan for the 100 Area,* DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2011, *Tri-Party Agreement Handbook Management Procedures,* RL-TPA-90-0001, Rev. 2, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)," U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2012, "124-N-2 Additional Remediation and Resampling Writeup," CCN 168452, Email Message to W. Elliott, Department of Ecology, and J. E. Jakubek, Washington Closure Hanford, from J.C. Chance, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, 1994, *Natural Background Soil Metals Concentrations in Washington State*, Publication No. 94-115, Washington State Department of Ecology, Olympia, Washington.

Ecology, 1996, "Model Toxics Control Act – Cleanup," *Washington Administrative Code* (WAC) 173-340, Washington State Department of Ecology, Olympia, Washington.

Ecology, 2011, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.

ENV-1, *Environmental Monitoring & Management*, Washington Closure Hanford, Richland, Washington.

EPA, 1989, *Risk Assessment Guidance for Superfund: Volume 1, Human Health Evaluation Manual, Part A; Interim Final*, EPA/540/1-89/002, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1999, *Interim Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

UNI, 1985, *Preliminary Engineering Study Report 100-N Sewer System Project H-677*, UNI-2951, Rev. 0, Kaiser Engineers Hanford Company, Richland, Washington.

WAC 173-340, 2007, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, as amended.

WCH, 2009, "Post-Demolition Summary Report for the 100-N Sanitary Sewer System No. 2 Tank (1607-N2, 124-N-2)," CCN 145646, Interoffice Memorandum, M. T. Stankovich to M. E. Allen, Washington Closure Hanford, Richland, Washington, July 14.

WCH, 2011a, "124-N-2 Ex-situ Bioremediation Evaluation," CCN 160160, Email from T. L. Faust to WCH Document Control, Washington Closure Hanford, Richland, Washington, July 27.

WCH, 2011b, "124-N-2 Verification Sampling White Paper," CCN 162203, Email from T. L. Faust to R. Varljen, Washington Closure Hanford, Richland, Washington, October 31.

WCH, 2012a, *Work Instruction for Verification Sampling of the 124-N-2; 124-N-2 Septic Tank; 100-N Sanitary Sewer System No. 2 Waste Site,* 0100N-WI-G0039, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2012b, *Work Instruction for Verification Sampling of the 124-N-2; 124-N-2 Septic Tank; 100-N Sanitary Sewer System No. 2 Waste Site,* 0100N-WI-G0039, Rev. 1, Washington Closure Hanford, Richland, Washington.

WCH, 2013a, *100-N Field Remediation Sampling*, Logbook EL-1652-09, pp. 46-47, Washington Closure Hanford, Richland, Washington.

WCH, 2013b, *Work Instruction for Verification Sampling of the 124-N-2; 124-N-2 Septic Tank; 100-N Sanitary Sewer System No. 2 Waste Site,* 0100N-WI-G0039, Rev. 2, Washington Closure Hanford, Richland, Washington.

WHC, 1994, *100-N Area Technical Baseline Report,* WHC-SD-EN-TI-251, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

# APPENDIX A

# PHOTOGRAPHS

**Figure A-1. Septic System Under Construction View to the North (September 25, 1962).**

**Figure A-2. Seepage Pit Under Construction (September 25, 1962).**

**Figure A-3. Constructed Seepage Pit (September 25, 1962).**

**Figure A-4. 124-N-2 Excavation View to the North (September 18, 2012).**

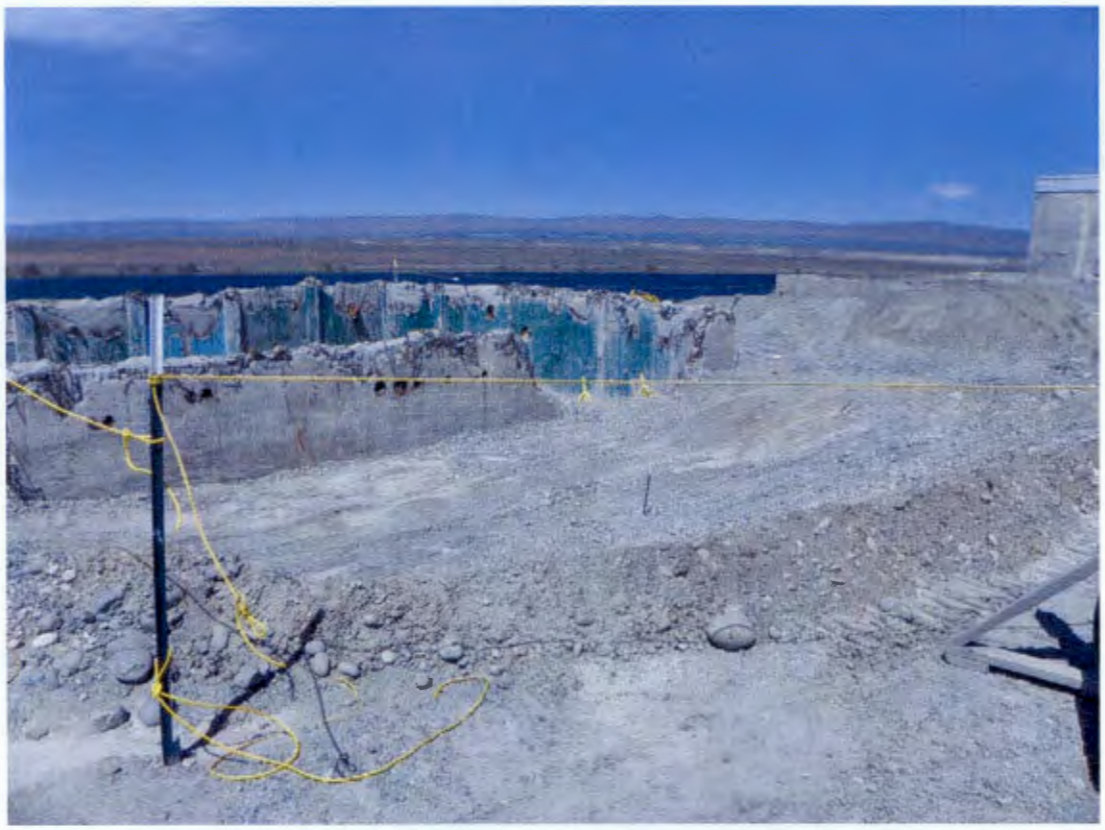
**Figure A-5. 124-N-2 Excavation View to the West (September 18, 2012).**

**Figure A-6. 124-N-2 Excavation View to the North Towards the 182-N Building (September 18, 2012).**

**Figure A-7. Aerial Photograph of the 124-N-2 Waste Site Location (January 2013).**

**Figure A-8. Aerial Photograph of the 124-N-2 Excavation (April 2013).**

**Figure A-9. Photograph of the 124-N-2 Excavation – Looking West (April 2013).**



# APPENDIX B

# CALCULATIONS

# APPENDIX B

## CALCULATION BRIEFS

The calculations in this appendix are kept in the active Washington Closure Hanford project files and are available upon request. When the project is completed, the file will be stored in a U.S. Department of Energy, Richland Operations Office, repository. This calculation has been prepared in accordance with ENG-1, *Engineering Services*, ENG-1-4.5, "Project Calculations," Washington Closure Hanford, Richland, Washington. The following calculations are provided in this appendix.

*124-N-2 Waste Site Cleanup Verification, 95% UCL Calculation,* 0100N-CA-V0189, Rev. 0, Washington Closure Hanford, Richland, Washington.

*124-N-2 Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater,* 0100N-CA-V0196, Rev. 0, Washington Closure Hanford, Richland, Washington.

**DISCLAIMER FOR CALCULATIONS**

The calculations that are provided in this appendix have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

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# CALCULATION COVER SHEET

Project Title: 100-N Field Remediation **Job No. 14655**

Area: 100-N

Discipline: Environmental *Calculation No: 0100N-CA-V0189

Subject: 124-N-2 Waste Site Cleanup Verification 95% UCL Calculation

Computer Program: Excel Program No: Excel 2003

The attached calculations have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

| Rev. | Sheet Numbers | Originator | Checker | Reviewer | Approval | Date |
|---|---|---|---|---|---|---|
| 0 | Cover = 1<br>Sheets = 17<br>Attm. 1 = 17<br>Total = 35 | N. K. Schiffern<br>N K Schiffern | I. B. Berezovskiy<br>I B Berezovskiy | J. D. Sloglie<br>J D Sloglie | D. F. Obenauer<br>D. F. Obenauer | 8/21/13 |
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## SUMMARY OF REVISION

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WCH-DE-018 (05/08/2007) *Obtain Calc. No. from Document Control and Form from Intranet

***Washington Closure Hanford*** **CALCULATION SHEET**

| | | | | | |
|---|---|---|---|---|---|
| **Originator** N. K. Schiffern | **Date** 06/12/13 | **Calc. No.** 0100N-CA-V0189 | **Rev. No.** 0 |
| **Project** 100-N Field Remediation | **Job No.** 14655 | **Checked** I. B. Berezovskiy | **Date** 06/12/13 |
| **Subject** 124-N-2 Waste Site Cleanup Verification 95% UCL Calculations | | | **Sheet No.** 1 of 17 |

**Summary**

**Purpose:**
Calculate the 95% upper confidence limit (UCL) values to evaluate compliance with cleanup standards for the subject site. Also, perform the *Washington Administrative Code* (WAC) 173-340-740(7)(e) Model Toxics Control Act (MTCA) 3-part test for nonradionuclide analytes and calculate the relative percent difference (RPD) for primary-duplicate sample pairs for each contaminant of concern (COC) and contaminant of potential concern (COPC), as necessary.

**Table of Contents:**
Sheets 1 to 5 - Calculation Sheet Summary
Sheet 6 to 11 - Calculation Sheet Verification Data - Excavation
Sheet 12 to 15 - Ecology Software (MTCAStat) Results
Sheet 16 to 17 - Calculation Sheet Duplicate/Split Analysis
Attachment 1 - 124-N-2, Verification Sampling Results (17 sheets)

**Given/References:**
1) Sample Results (Attachment 1).
2) DOE-RL, 2006a, 100-N Area Sampling and Analysis Plan for CERCLA Waste Sites, DOE/RL-2005-92, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
3) DOE-RL, 2006b, Remedial Design Report/Remedial Action Work Plan for the 100-N Area, DOE/RL-2005-93, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
4) Ecology, 1992, Statistical Guidance for Ecology Site Managers, Publication #92-54, Washington Department of Ecology, Olympia, Washington.
5) Ecology, 1993, Statistical Guidance for Ecology Site Managers, Supplement S-6, Analyzing Site or Background Data with Below-detection Limit or Below-PQL Values (Censored Data Sets), Publication #92-54, Washington Department of Ecology, Olympia, Washington.
6) Ecology, 2012, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.
7) EPA, 1989, Risk Assessment Guidance for Superfund: Volume 1, Human Health Evaluation Manual, Part A; Interim Final, EPA/540/1-89/002, U.S. Environmental Protection Agency, Washington, D. C.
8) WAC 173-340, 1996, "Model Toxic Control Act - Cleanup," Washington Administrative Code.

**Solution:**
Calculation methodology is described in Ecology Pub. #92-54 (Ecology 1992, 1993), below, and in the RDR/RAWP (DOE-RL 2006b). Use data from attached worksheets to perform the 95% UCL calculation for each analyte, the WAC 173-340-740(7)(e) 3-part test for nonradionuclides, and the RPD calculations for each COC/COPC. The hazard quotient and carcinogenic risk calculations are located in a separate calculation brief as an appendix to the Remaining Sites Verification Package (RSVP).

**Calculation Description:**
The subject calculations were performed on statistical data from soil verification samples (Attachment 1) from the 124-N-2 waste site. The data were entered into an EXCEL 2003 spreadsheet and calculations performed by using the built-in spreadsheet functions and/or creating formulae within the cells. The statistical evaluation of data for use in accordance with the RDR/RAWP (DOE-RL 2006b) is documented by this calculation. Duplicate RPD results are used in evaluation of data quality within the RSVP for this site.

**Methodology:**
The 124-N-2 waste site underwent verification sampling at one decision unit: excavation area. Twelve statistical samples (EXC-1 to 12) were collected with the first sample design. Also included in the excavation area were one duplicate and one split sample. Due to multiple direct exposure exceedances for polycyclic aromatic hydrocarbons (PAHs) and total petroleum hydrocarbons (TPH), additional remediation of the entire footprint of the 124-N-2 waste site was performed. New sample design was generated for the excavation area, to replace the original design. Therefore, entire data from the first statistical sampling campaign, EXC-1 to 12, are provided for informational purposes only. Further information is explained in the RSVP for this site.

Analytical results for all sampling locations are summarized in the tables provided on sheets 4 and 5. Further information of the sample data quality is presented in the data quality assessment section of the associated RSVP.

**Washington Closure Hanford** **CALCULATION SHEET**

| | | | | | |
|---|---|---|---|---|---|
| **Originator** N. K. Schiffern | **Date** 06/11/13 | **Calc. No.** 0100N-CA-V0189 | **Rev. No.** 0 |
| **Project** 100-N Field Remediation | **Job No.** 14655 | **Checked** I. B. Berezovskiy | **Date** 06/11/13 |
| **Subject** 124-N-2 Waste Site Cleanup Verification 95% UCL Calculations | | | **Sheet No.** 2 of 17 |

**Summary (continued)**

**Methodology, continued:**

For nonradioactive analytes with ≤ 50% of the data below detection limits, the statistical value calculated to evaluate the effectiveness of cleanup is the 95% UCL. For nonradioactive analytes with >50% of the data below detection limits, as determined by direct inspection of the sample results (Attachment 1), the maximum detected value for the data set (which includes primary and duplicate samples) is used instead of the 95% UCL, and no further calculations are performed for those data sets. For convenience, these maximum detected values are included in the summary tables that follow. The 95% UCL was not calculated for data sets with no reported detections. Calculated cleanup levels are not available in (Ecology 2012) under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance for Superfund* (EPA 1989) recommends that aluminum and iron not be considered in site risk evaluations. Therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not considered site COCs/COPCs and are also not included in these calculations.

All nonradionuclide data reported as being undetected are set to ½ the detection limit value for calculation of the statistics (Ecology 1993). For the statistical evaluation of duplicate sample pairs, the samples are averaged before being included in the data set, after adjustments for censored data as described above. For radionuclide data, calculation of the statistics is done using the reported value. In cases where the laboratory does not report a value below the minimum detectable activity (MDA), half of the MDA is used in the calculation. For the statistical evaluation of duplicate sample pairs, the samples are averaged before being included in the data set, after adjustments for censored data as described above.

For nonradionuclides, the WAC 173-340 statistical guidance suggests that a test for distributional form be performed on the data and the 95% UCL calculated on the appropriate distribution using Ecology software. For nonradionuclide small data sets (n < 10), the calculations are performed assuming nonparametric distribution, so no tests for distribution are performed. For nonradionuclide data sets of ten or greater, as for the subject site, distributional testing is done using Ecology's MTCAStat software (Ecology 1993). Due to differences in addressing censored data between the RDR/RAWP (DOE-RL 2006b) and MTCAStat coding and due to a limitation in the MTCAStat coding (no direct capability to address variable quantitation limits within a data set), substitutions for censored data are performed before software input and the resulting data set treated as uncensored.

The WAC 173-340-740(7)(e) 3-part test is performed for nonradionuclide analytes only and determines if:
1) the 95% UCL exceeds the most stringent cleanup limit for each COPC/COC,
2) greater than 10% of the raw data exceed the most stringent cleanup limit for each COPC/COC,
3) the maximum value of the raw data set exceeds two times the most stringent cleanup limit for each COPC/COC.

The RPD is calculated when both the primary value and the duplicate value for a given analyte are above detection limits and are greater than 5 times the target detection limit (TDL). The TDLs are pre-determined values for analytical methods and constituents with cleanup levels as listed in Table 2-1 of the SAP (DOE-RL 2006a). Table 2-1 includes nominal TDLs for identified methods based organic analyses. The nominal TDLs are also used in support of the RPD calculation for the methods based analytes. TDLs not included in Table 2-1 are based on the laboratory and/or methods used. Where direct evaluation of the attached sample data showed that a given analyte was not detected in the primary and/or duplicate sample, further evaluation of the RPD value was not performed. The RPD calculations use the following formula:

$$RPD = [\,|M-S|/((M+S)/2)]*100$$

where, M = Main Sample Value S = Split (or duplicate) Sample Value

For quality assurance/quality control (QA/QC) duplicate RPD calculations, a value less than 30% indicates the data compare favorably. If the RPD is greater than 30%, further investigation regarding the usability of the data is performed. To assist in the identification of anomalous sample pairs, when an analyte is detected in the primary or duplicate/split sample, but was quantified at less than 5 times the TDL in one or both samples, an additional parameter is evaluated. In this case, if the difference between the primary and duplicate/split result exceeds a control limit of 2 times the TDL, further assessment regarding the usability of the data is performed. Additional discussion as necessary is provided in the data quality assessment section of the applicable RSVP.

***Washington Closure Hanford*** **CALCULATION SHEET**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Originator** | N. K. Schiffern | **Date** | 06/11/13 | **Calc. No.** | 0100N-CA-V0189 | **Rev. No.** | 0 |
| **Project** | 100-N Field Remediation | **Job No.** | 14655 | **Checked** | I. B. Berezovskiy | **Date** | 06/11/13 |
| **Subject** | 124-N-2 Waste Site Cleanup Verification 95% UCL Calculations | | | | | **Sheet No.** | 3 of 17 |

**Summary (continued)**

**QUALIFIER LIST**

B = estimate
D = dilution
J = estimate
M = sample duplicate precision not met.
N = recovery is outside control limits
P = aroclor flag, greater than 25% difference for detected concentrations between the two GC columns.
U = undetected
X (metals) = serial dilution in the analytical batch indicates that physical and chemical interferences are present.
X (organics) = More than 40% difference between columns, lower result reported.

**ACRONYM LIST**

-- = not applicable
DE = direct exposure
EXC = excavation
EXT = extended
GW = groundwater
MTCA = *Model Toxics Control Act*
NA = not applicable
PAH = polycyclic aromatic hudrocarbons
PCB = polychlorinated biphenyls
PEST = pesticide
PQL = practical quantitation limit
Q = qualifier
QA/QC = quality assurance/quality control
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
RPD = relative percent difference
RSVP = remaining sites verification package
SAP = sampling and analysis plan
TDL = target detection limit
TPH = total petroleum hydrocarbons
UCL = upper confidence limit
WAC = Washington Administrative Code

***Washington Closure Hanford*** **CALCULATION SHEET**

**Originator** N. K. Schiffern **Date** 06/12/13 **Calc. No.** 0100N-CA-V0189 **Rev. No.** 0
**Project** 100-N Field Remediation **Job No.** 14655 **Checked** I. B. Berezovskiy **Date** 06/12/13
**Subject** 124-N-2 Waste Site Cleanup Verification 95% UCL Calculations **Sheet No.** 4 of 17

**Summary (continued)**

**Results:**
The results presented in the tables that follow include the summary of the results of the 95% UCL calculations for the excavation, the WAC 173-340-740(7)(e) 3-part test evaluation, and the RPD calculations, and are for use in risk analysis and the RSVP for this site.

**Results Summary - Excavation Samples [a]**

| Analyte | EXC | | Units |
|---|---|---|---|
| | 95% UCL Result | Maximum Result | |
| Arsenic | 2.3 | -- | mg/kg |
| Barium | 60.2 | -- | mg/kg |
| Beryllium | 0.37 | -- | mg/kg |
| Boron | -- | 1.1 | mg/kg |
| Cadmium | 0.22 | -- | mg/kg |
| Chromium | 10.7 | -- | mg/kg |
| Cobalt | 7.5 | -- | mg/kg |
| Copper | 16.0 | -- | mg/kg |
| Lead | 9.0 | -- | mg/kg |
| Manganese | 325 | -- | mg/kg |
| Mercury | -- | 0.0079 | mg/kg |
| Molybdenum | 0.23 | -- | mg/kg |
| Nickel | 12.0 | -- | mg/kg |
| Vanadium | 51.6 | -- | mg/kg |
| Zinc | 45.8 | -- | mg/kg |
| Chloride | 8.5 | -- | mg/kg |
| Fluoride | -- | 1.1 | mg/kg |
| Nitrogen in Nitrate | 1.1 | -- | mg/kg |
| Nitrogen in Nitrite and Nitrate | 1.4 | -- | mg/kg |
| Sulfate | 53.3 | -- | mg/kg |
| TPH - diesel | 43 | -- | mg/kg |
| TPH - diesel EXT | 60 | -- | mg/kg |
| Acenaphthene | 0.33 | -- | mg/kg |
| Anthracene | 0.57 | -- | mg/kg |
| Benzo(a)anthracene | 1.2 | -- | mg/kg |
| Benzo(a)pyrene | 0.73 | -- | mg/kg |
| Benzo(b)fluoranthene | 0.79 | -- | mg/kg |
| Benzo(ghi)perylene | 0.36 | -- | mg/kg |
| Benzo(k)fluoranthene | 0.32 | -- | mg/kg |
| Chrysene | 1.3 | -- | mg/kg |
| Dibenz(a,h)anthracene | 0.085 | -- | mg/kg |
| Fluoranthene | 2.5 | -- | mg/kg |
| Fluorene | 0.27 | -- | mg/kg |
| Indeno(1,2,3-cd)pyrene | 0.35 | -- | mg/kg |
| Phenenthrene | 1.4 | -- | mg/kg |
| Pyrene | 2.5 | -- | mg/kg |
| Aroclor-1254 | 0.035 | -- | mg/kg |

| **3-Part Test Evaluation:** | **EXC** | |
|---|---|---|
| 95% UCL or maximum > Cleanup Limit? | YES | NO |
| > 10% above Cleanup Limit? | YES | NO |
| Any sample > 2x Cleanup Limit? | YES | NO |

[a] The 95% UCL result or maximum value, depending on data censorship, as described in the methodology section.

***Washington Closure Hanford*** **CALCULATION SHEET**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Originator** | N. K. Schiffern | **Date** | 06/11/13 | **Calc. No.** | 0100N-CA-V0189 | **Rev. No.** | 0 |
| **Project** | 100-N Field Remediation | **Job No.** | 14655 | **Checked** | I. B. Berezovskiy | **Date** | 06/11/13 |
| **Subject** | 124-N-2 Waste Site Cleanup Verification 95% UCL Calculations | | | | | **Sheet No.** | 5 of 17 |

**Summary (continued)**

**Results:**
The results presented in the tables that follow include the summary of the results of the 95% UCL calculations for the excavation, the WAC 173-340-740(7)(e) 3-part test evaluation, and the RPD calculations, and are for use in risk analysis and the RSVP for this site.

**Relative Percent Difference Results and QA/QC Analysis[a]**

| Analyte | Duplicate Analysis | Split Analysis |
|---|---|---|
| Aluminum | ***55.4%*** | 34.9% |
| Barium | ***62.3%*** | ***42.2%*** |
| Calcium | ***66.4%*** | ***75.5%*** |
| Copper | ***44.6%*** | 29.9% |
| Iron | ***33.5%*** | 18.3% |
| Magnesium | ***48.2%*** | 34.5% |
| Manganese | ***41.2%*** | 29.1% |
| Silicon | ***37.6%*** | ***32.5%*** |
| Vanadium | 10.8% | 6.8% |
| Zinc | 29.6% | ***40.6%*** |
| Sulfate | -- | 32.5% |
| TPH - Diesel | ***75.9%*** | -- |
| TPH - Diesel EXT | ***72.4%*** | -- |
| Acenaphthene | ***81.8%*** | ***154.0%*** |
| Anthracene | ***108.4%*** | ***66.7%*** |
| Benzo(a)anthracene | ***45.2%*** | ***69.7%*** |
| Benzo(a)pyrene | 26.8% | ***43.5%*** |
| Benzo(b)fluoranthene | ***40.7%*** | ***57.5%*** |
| Benzo(ghi)perylene | ***66.7%*** | ***71.2%*** |
| Benzo(k)fluoranthene | ***34.8%*** | ***53.3%*** |
| Chrysene | ***47.2%*** | ***56.6%*** |
| Fluoranthene | ***62.5%*** | ***58.8%*** |
| Fluorene | ***77.8%*** | 16.7% |
| Indeno(1,2,3-cd)pyrene | ***66.7%*** | 30.8% |
| Phenanthrene | ***94.1%*** | ***70.0%*** |
| Pyrene | ***66.7%*** | ***47.2%*** |

[a]RPD listed where result produced, based on criteria. If RPD not required, no value is listed. The significance of the reported RPD values, including values greater than 30% for duplicate analysis and 35 % for split analysis, is addressed in the data quality assessment section of the RSVP.

**CALCULATION SHEET**

***Washington Closure Hanford***

**Originator** N. K. Schiffern **Date** 06/11/13 **Calc. No.** 0100N-CA-V0189 **Rev. No.** 0

**Project** 100-N Field Remediation **Job No.** 14655 **Checked** I. B. Berezovskiy **Date** 06/11/13

**Subject** 124-N-2 Waste Site Cleanup Verification 95% UCL Calculations **Sheet No.** 6 of 17

**124-N-2 Statistical Calculations**

**Verification Data -Excavation (EXC)**

| Sample Area | Sample Number | Sample Date | Arsenic mg/kg | Arsenic Q | Arsenic PQL | Barium mg/kg | Barium Q | Barium PQL | Beryllium mg/kg | Beryllium Q | Beryllium PQL | Cadmium mg/kg | Cadmium Q | Cadmium PQL | Chromium mg/kg | Chromium Q | Chromium PQL | Cobalt mg/kg | Cobalt Q | Cobalt PQL | Copper mg/kg | Copper Q | Copper PQL | Lead mg/kg | Lead Q | Lead PQL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EXC-7 | J1RMJ4 | 5/14/2013 | 1.0 | | 0.59 | 24.3 | X | 0.068 | 0.28 | | 0.029 | 0.14 | B | 0.037 | 4.1 | X | 0.052 | 4.7 | X | 0.089 | 9.4 | X | 0.19 | 4.6 | | 0.24 |
| Duplicate of J1RMJ4 | J1RMK0 | 5/14/2013 | 1.8 | | 0.58 | 46.3 | X | 0.067 | 0.37 | | 0.029 | 0.18 | | 0.036 | 5.9 | X | 0.051 | 7.4 | X | 0.088 | 14.8 | X | 0.19 | 3.3 | | 0.24 |
| EXC-1 | J1RMH8 | 5/14/2013 | 2.0 | | 0.58 | 56.1 | X | 0.067 | 0.38 | | 0.029 | 0.20 | | 0.036 | 8.1 | X | 0.051 | 7.4 | X | 0.088 | 14.9 | X | 0.19 | 6.9 | | 0.24 |
| EXC-2 | J1RMH9 | 5/14/2013 | 1.9 | | 0.61 | 60.8 | X | 0.070 | 0.36 | | 0.030 | 0.21 | | 0.038 | 9.2 | X | 0.053 | 7.1 | X | 0.092 | 14.7 | X | 0.20 | 5.1 | | 0.25 |
| EXC-3 | J1RMJ0 | 5/14/2013 | 3.3 | | 0.64 | 44.4 | X | 0.073 | 0.31 | | 0.032 | 0.17 | B | 0.040 | 12.6 | X | 0.056 | 5.9 | X | 0.10 | 14.0 | X | 0.21 | 4.8 | | 0.26 |
| EXC-4 | J1RMJ1 | 5/14/2013 | 1.9 | | 0.58 | 50.1 | X | 0.067 | 0.30 | | 0.029 | 0.18 | | 0.036 | 9.6 | X | 0.051 | 5.7 | X | 0.088 | 13.8 | X | 0.19 | 6.8 | | 0.24 |
| EXC-5 | J1RMJ2 | 5/14/2013 | 1.4 | | 0.64 | 46.8 | X | 0.074 | 0.37 | | 0.032 | 0.18 | B | 0.040 | 4.6 | X | 0.057 | 8.3 | X | 0.10 | 15.2 | X | 0.21 | 3.2 | | 0.26 |
| EXC-6 | J1RMJ3 | 5/14/2013 | 2.1 | | 0.64 | 54.1 | X | 0.074 | 0.33 | | 0.032 | 0.19 | | 0.040 | 11.1 | X | 0.056 | 6.2 | X | 0.10 | 14.8 | X | 0.21 | 4.9 | | 0.26 |
| EXC-8 | J1RMJ5 | 5/14/2013 | 2.1 | | 0.62 | 51.3 | X | 0.071 | 0.40 | | 0.031 | 0.24 | | 0.038 | 7.0 | X | 0.054 | 7.9 | X | 0.093 | 17.2 | X | 0.20 | 12.8 | | 0.25 |
| EXC-9 | J1RMJ6 | 5/14/2013 | 1.9 | | 0.67 | 46.2 | X | 0.077 | 0.31 | | 0.033 | 0.18 | B | 0.041 | 10.7 | X | 0.059 | 5.7 | X | 0.10 | 13.7 | X | 0.22 | 3.4 | | 0.27 |
| EXC-10 | J1RMJ7 | 5/14/2013 | 2.1 | | 0.63 | 49.3 | X | 0.072 | 0.39 | | 0.031 | 0.24 | | 0.039 | 6.9 | X | 0.055 | 8.0 | X | 0.10 | 18.4 | X | 0.21 | 5.9 | | 0.26 |
| EXC-11 | J1RMJ8 | 5/14/2013 | 2.1 | | 0.62 | 92.2 | X | 0.071 | 0.39 | | 0.031 | 0.24 | | 0.039 | 6.8 | X | 0.055 | 8.3 | X | 0.094 | 16.7 | X | 0.20 | 19.2 | | 0.25 |
| EXC-12 | J1RMJ9 | 5/14/2013 | 2.9 | | 0.62 | 57.3 | X | 0.072 | 0.31 | | 0.031 | 0.24 | | 0.039 | 12.6 | X | 0.055 | 5.1 | X | 0.10 | 10.5 | X | 0.21 | 5.1 | | 0.26 |

**Statistical Computation Input Data**

| Sample Area | Sample Number | Sample Date | Arsenic mg/kg | Barium mg/kg | Beryllium mg/kg | Cadmium mg/kg | Chromium mg/kg | Cobalt mg/kg | Copper mg/kg | Lead mg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| EXC-7 | J1RMJ4/J1RMK0 | 5/14/2013 | 1.4 | 35.3 | 0.33 | 0.16 | 5.0 | 6.1 | 12.1 | 4.0 |
| EXC-1 | J1RMH8 | 5/14/2013 | 2.0 | 56.1 | 0.38 | 0.20 | 8.1 | 7.4 | 14.9 | 6.9 |
| EXC-2 | J1RMH9 | 5/14/2013 | 1.9 | 60.8 | 0.36 | 0.21 | 9.2 | 7.1 | 14.7 | 5.1 |
| EXC-3 | J1RMJ0 | 5/14/2013 | 3.3 | 44.4 | 0.31 | 0.17 | 12.6 | 5.9 | 14.0 | 4.8 |
| EXC-4 | J1RMJ1 | 5/14/2013 | 1.9 | 50.1 | 0.30 | 0.18 | 9.6 | 5.7 | 13.8 | 6.8 |
| EXC-5 | J1RMJ2 | 5/14/2013 | 1.4 | 46.8 | 0.37 | 0.18 | 4.6 | 8.3 | 15.2 | 3.2 |
| EXC-6 | J1RMJ3 | 5/14/2013 | 2.1 | 54.1 | 0.33 | 0.19 | 11.1 | 6.2 | 14.8 | 4.9 |
| EXC-8 | J1RMJ5 | 5/14/2013 | 2.1 | 51.3 | 0.40 | 0.24 | 7.0 | 7.9 | 17.2 | 12.8 |
| EXC-9 | J1RMJ6 | 5/14/2013 | 1.9 | 46.2 | 0.31 | 0.18 | 10.7 | 5.7 | 13.7 | 3.4 |
| EXC-10 | J1RMJ7 | 5/14/2013 | 2.1 | 49.3 | 0.39 | 0.24 | 6.9 | 8.0 | 18.4 | 5.9 |
| EXC-11 | J1RMJ8 | 5/14/2013 | 2.1 | 92.2 | 0.39 | 0.24 | 6.8 | 8.3 | 16.7 | 19.2 |
| EXC-12 | J1RMJ9 | 5/14/2013 | 2.9 | 57.3 | 0.31 | 0.24 | 12.6 | 5.1 | 10.5 | 5.1 |

**Statistical Computations**

| | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead |
|---|---|---|---|---|---|---|---|---|
| 95% UCL based on | Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic. | Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic. | Large data set (n ≥ 10), use MTCAStat lognormal distribution. | Large data set (n ≥ 10), use MTCAStat lognormal distribution. | Large data set (n ≥ 10), use MTCAStat lognormal distribution. | Large data set (n ≥ 10), use MTCAStat lognormal distribution. | Large data set (n ≥ 10), use MTCAStat lognormal distribution. | Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic. |
| N | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| % < Detection limit | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Mean | 2.1 | 53.7 | 0.35 | 0.20 | 8.7 | 6.8 | 14.7 | 6.8 |
| Standard deviation | 0.54 | 13.9 | 0.037 | 0.030 | 2.7 | 1.2 | 2.2 | 4.6 |
| 95% UCL on mean | 2.3 | 60.2 | 0.37 | 0.22 | 10.7 | 7.5 | 16.0 | 9.0 |
| Maximum value | 3.3 | 92.2 | 0.40 | 0.24 | 12.6 | 8.3 | 18.4 | 19.2 |
| **Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)** | 20 DE, GW & River Protection | 200 GW Protection | 1.51 GW & River Protection | 0.81 GW & River Protection | 18.5 GW & River Protection | 32 GW Protection | 22.0 River Protection | 10.2 GW & River Protection |
| **WAC 173-340 3-PART TEST** | | | | | | | | |
| 95% UCL > Cleanup Limit? | NA | NA | NA | NA | NA | NA | NA | NO |
| > 10% above Cleanup Limit? | NA | NA | NA | NA | NA | NA | NA | YES |
| Any sample > 2X Cleanup Limit? | NA | NA | NA | NA | NA | NA | NA | NO |
| **WAC 173-340 Compliance?** | Because all values are below background (6.5 mg/kg) the WAC 173-340 3-part test is not required. | Because all values are below background (132 mg/kg) the WAC 173-340 3-part test is not required. | Because all values are below background (1.51 mg/kg) the WAC 173-340 3-part test is not required. | Because all values are below background (0.81 mg/kg) the WAC 173-340 3-part test is not required. | Because all values are below background (18.5 mg/kg) the WAC 173-340 3-part test is not required. | Because all values are below background (15.7 mg/kg) the WAC 173-340 3-part test is not required. | Because all values are below background (22.0 mg/kg) the WAC 173-340 3-part test is not required. | A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG. |

Qualifiers are defined on page 3.

**CALCULATION SHEET**

***Washington Closure Hanford***

**Originator** N. K. Schiffern
**Project** 100-N Field Remediation
**Subject** 124-N-2 Waste Site Cleanup Verification 95% UCL Calculations

**Date** 06/11/13
**Job No.** 14655

**Calc. No.** 0100N-CA-V0189
**Checked** I. B. Berezovskiy

**Rev. No.** 0
**Date** 06/11/13
**Sheet No.** 7 of 17

1 **124-N-2 Statistical Calculations**
2 **Verification Data -Excavation (EXC)**

| 3 | Sample | Sample | Sample | Manganese | | | Molybdenum | | | Nickel | | | Vanadium | | | Zinc | | | Chloride | | | Nitrogen in Nitrate | | | Nitrogen in Nitrite and Nitrate | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Area | Number | Date | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL |
| 5 | EXC-7 | J1RMJ4 | 5/14/2013 | 179 | X | 0.089 | 0.25 | B | 0.23 | 5.0 | X | 0.11 | 50.0 | X | 0.084 | 30.8 | X | 0.36 | 11.4 | | 1.9 | 0.75 | BJ | 0.31 | 0.55 | B | 0.30 |
| 6 | Duplicate of J1RMJ4 | J1RMK0 | 5/14/2013 | 272 | X | 0.088 | 0.23 | U | 0.23 | 8.5 | X | 0.11 | 55.7 | X | 0.083 | 41.5 | X | 0.35 | 9.5 | | 1.9 | 1.1 | BJ | 0.31 | 0.29 | U | 0.29 |
| 7 | EXC-1 | J1RMH8 | 5/14/2013 | 299 | X | 0.088 | 0.25 | B | 0.23 | 10.3 | X | 0.11 | 51.2 | X | 0.083 | 40.9 | X | 0.35 | 4.8 | B | 2.0 | 1.1 | BJ | 0.32 | 1.2 | M | 0.30 |
| 8 | EXC-2 | J1RMH9 | 5/14/2013 | 336 | X | 0.092 | 0.29 | B | 0.24 | 11.0 | X | 0.11 | 46.6 | X | 0.086 | 41.8 | X | 0.37 | 5.5 | | 1.9 | 0.95 | BJ | 0.30 | 0.62 | B | 0.29 |
| 9 | EXC-3 | J1RMJ0 | 5/14/2013 | 250 | X | 0.097 | 0.26 | B | 0.25 | 12.7 | X | 0.12 | 33.7 | X | 0.091 | 38.9 | X | 0.38 | 4.5 | B | 2.0 | 1.3 | BJ | 0.32 | 0.35 | B | 0.30 |
| 10 | EXC-4 | J1RMJ1 | 5/14/2013 | 258 | X | 0.088 | 0.24 | B | 0.23 | 10.6 | X | 0.11 | 36.7 | X | 0.082 | 38.8 | X | 0.35 | 10.9 | | 1.9 | 1.6 | BJ | 0.31 | 1.7 | | 0.30 |
| 11 | EXC-5 | J1RMJ2 | 5/14/2013 | 308 | X | 0.098 | 0.25 | U | 0.25 | 7.7 | X | 0.12 | 55.8 | X | 0.092 | 42.3 | X | 0.39 | 6.3 | | 1.9 | 1.2 | BJ | 0.31 | 1.5 | | 0.29 |
| 12 | EXC-6 | J1RMJ3 | 5/14/2013 | 273 | X | 0.097 | 0.25 | U | 0.25 | 13.4 | X | 0.12 | 37.4 | X | 0.091 | 37.8 | X | 0.39 | 4.7 | B | 1.9 | 0.67 | BJ | 0.31 | 0.45 | B | 0.29 |
| 13 | EXC-8 | J1RMJ5 | 5/14/2013 | 304 | X | 0.093 | 0.24 | B | 0.24 | 8.4 | X | 0.11 | 59.8 | X | 0.088 | 52.9 | X | 0.37 | 8.3 | | 1.9 | 0.83 | BJ | 0.30 | 0.87 | | 0.29 |
| 14 | EXC-9 | J1RMJ6 | 5/14/2013 | 248 | X | 0.10 | 0.26 | U | 0.26 | 13.1 | X | 0.12 | 33.3 | X | 0.095 | 34.8 | X | 0.40 | 6.1 | | 2.0 | 0.31 | UJ | 0.31 | 0.30 | U | 0.30 |
| 15 | EXC-10 | J1RMJ7 | 5/14/2013 | 330 | X | 0.095 | 0.25 | U | 0.25 | 9.0 | X | 0.12 | 56.0 | X | 0.090 | 58.2 | X | 0.38 | 8.7 | | 2.0 | 0.32 | UJ | 0.32 | 0.30 | U | 0.30 |
| 16 | EXC-11 | J1RMJ8 | 5/14/2013 | 442 | X | 0.094 | 0.30 | B | 0.24 | 12.1 | X | 0.12 | 60.6 | X | 0.088 | 49.2 | X | 0.37 | 7.7 | | 2.0 | 1.2 | BJ | 0.32 | 0.39 | B | 0.30 |
| 17 | EXC-12 | J1RMJ9 | 5/14/2013 | 227 | X | 0.095 | 0.25 | U | 0.25 | 11.6 | X | 0.12 | 33.4 | X | 0.089 | 35.8 | X | 0.38 | 7.2 | | 2.0 | 0.31 | UJ | 0.31 | 0.30 | U | 0.30 |

18
19 **Statistical Computation Input Data**

| 20 | Sample | Sample | Sample | Manganese | Molybdenum | Nickel | Vanadium | Zinc | Chloride | Nitrogen in Nitrate | Nitrogen in Nitrite and Nitrate |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | Area | Number | Date | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| 22 | EXC-7 | J1RMJ4/J1RMK0 | 5/14/2013 | 226 | 0.18 | 6.8 | 52.9 | 36.2 | 10.5 | 0.93 | 0.35 |
| 23 | EXC-1 | J1RMH8 | 5/14/2013 | 299 | 0.25 | 10.3 | 51.2 | 40.9 | 4.8 | 1.1 | 1.2 |
| 24 | EXC-2 | J1RMH9 | 5/14/2013 | 336 | 0.29 | 11.0 | 46.6 | 41.8 | 5.5 | 0.95 | 0.62 |
| 25 | EXC-3 | J1RMJ0 | 5/14/2013 | 250 | 0.26 | 12.7 | 33.7 | 38.9 | 4.5 | 1.3 | 0.35 |
| 26 | EXC-4 | J1RMJ1 | 5/14/2013 | 258 | 0.24 | 10.6 | 36.7 | 38.8 | 10.9 | 1.6 | 1.7 |
| 27 | EXC-5 | J1RMJ2 | 5/14/2013 | 308 | 0.13 | 7.7 | 55.8 | 42.3 | 6.3 | 1.2 | 1.5 |
| 28 | EXC-6 | J1RMJ3 | 5/14/2013 | 273 | 0.13 | 13.4 | 37.4 | 37.8 | 4.7 | 0.67 | 0.45 |
| 29 | EXC-8 | J1RMJ5 | 5/14/2013 | 304 | 0.24 | 8.4 | 59.8 | 52.9 | 8.3 | 0.83 | 0.87 |
| 30 | EXC-9 | J1RMJ6 | 5/14/2013 | 248 | 0.13 | 13.1 | 33.3 | 34.8 | 6.1 | 0.16 | 0.15 |
| 31 | EXC-10 | J1RMJ7 | 5/14/2013 | 330 | 0.13 | 9.0 | 56.0 | 58.2 | 8.7 | 0.16 | 0.15 |
| 32 | EXC-11 | J1RMJ8 | 5/14/2013 | 442 | 0.30 | 12.1 | 60.6 | 49.2 | 7.7 | 1.2 | 0.39 |
| 33 | EXC-12 | J1RMJ9 | 5/14/2013 | 227 | 0.13 | 11.6 | 33.4 | 35.8 | 7.2 | 0.16 | 0.15 |

34 **Statistical Computations**

| 35 | | Manganese | Molybdenum | Nickel | Vanadium | Zinc | Chloride | Nitrogen in Nitrate | Nitrogen in Nitrite and Nitrate |
|---|---|---|---|---|---|---|---|---|---|
| 36 | 95% UCL based on | Large data set (n ≥ 10), use MTCAStat lognormal distribution. | Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic. | Large data set (n ≥ 10), use MTCAStat lognormal distribution. | Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic. | Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic. | Large data set (n ≥ 10), use MTCAStat lognormal distribution. | Large data set (n ≥ 10), use MTCAStat normal distribution. | Large data set (n ≥ 10), use MTCAStat lognormal distribution. |
| 37 | N | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 38 | % < Detection limit | 0% | 42% | 0% | 0% | 0% | 0% | 25% | 25% |
| 39 | Mean | 292 | 0.20 | 10.6 | 46.4 | 42.3 | 7.1 | 0.85 | 0.66 |
| 40 | Standard deviation | 60.4 | 0.071 | 2.2 | 10.9 | 7.4 | 2.2 | 0.48 | 0.54 |
| 41 | 95% UCL on mean | 325 | 0.23 | 12.0 | 51.6 | 45.8 | 8.5 | 1.1 | 1.4 |
| 42 | Maximum value | 442 | 0.30 | 13.4 | 60.6 | 58.2 | 11.4 | 1.6 | 1.7 |
| 43 | **Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)** | 512 GW Protection | 8 GW Protection | 19.1 GW Protection | 85.1 GW Protection | 67.8 River Protection | 25000 GW Protection | 1000 River Protection | 1000 River Protection |
| 44 | **WAC 173-340 3-PART TEST** | | | | | | | | |
| 45 | 95% UCL > Cleanup Limit? | NA | NO | NA | NA | NA | NO | NA | NA |
| 46 | > 10% above Cleanup Limit? | NA | NO | NA | NA | NA | NO | NA | NA |
| 47 | Any sample > 2X Cleanup Limit? | NA | NO | NA | NA | NA | NO | NA | NA |
| 48 | **WAC 173-340 Compliance?** | Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required. | The data set meets the 3-part test criteria when compared to the most stringent RAG. | Because all values are below background (19.1 mg/kg) the WAC 173-340 3-part test is not required. | Because all values are below background (85.1 mg/kg) the WAC 173-340 3-part test is not required. | Because all values are below background (67.8 mg/kg) the WAC 173-340 3-part test is not required. | The data set meets the 3-part test criteria when compared to the most stringent RAG. | Because all values are below background (11.8 mg/kg) the WAC 173-340 3-part test is not required. | Because all values are below background (11.8 mg/kg) the WAC 173-340 3-part test is not required. |

49 Qualifiers are defined on page 3.

**CALCULATION SHEET**

***Washington Closure Hanford***

**Originator** N. K. Schiffern
**Project** 100-N Field Remediation
**Subject** 124-N-2 Waste Site Cleanup Verification 95% UCL Calculations

**Date** 06/11/13
**Job No.** 14655

**Calc. No.** 0100N-CA-V0189
**Checked** I. B. Berezovskiy

**Rev. No.** 0
**Date** 06/11/13
**Sheet No.** 8 of 17

1 **124-N-2 Statistical Calculations**
2 **Verification Data -Excavation (EXC)**

| 3 | Sample | Sample | Sample | Sulfate | | | TPH - Diesel | | | TPH - Diesel EXT | | | Acenaphthene | | | Anthracene | | | Benzo(a)anthracene | | | Benzo(a)pyrene | | | Benzo(b)fluoranthene | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Area | Number | Date | mg/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL |
| 5 | EXC-7 | J1RMJ4 | 5/14/2013 | 26.3 | | 1.7 | 27000 | | 670 | 37000 | | 990 | 130 | X | 9.4 | 190 | X | 2.9 | 600 | J | 3.0 | 420 | | 6.0 | 470 | X | 3.9 |
| 6 | Duplicate of J1RMJ4 | J1RMK0 | 5/14/2013 | 19.9 | | 1.7 | 60000 | | 670 | 79000 | | 990 | 310 | X | 9.8 | 640 | | 3.0 | 950 | J | 3.1 | 550 | X | 6.3 | 710 | X | 4.1 |
| 7 | EXC-1 | J1RMH8 | 5/14/2013 | 45.1 | | 1.7 | 35000 | | 680 | 50000 | | 1000 | 130 | X | 10 | 210 | | 3.0 | 630 | J | 3.2 | 420 | | 6.4 | 490 | | 4.2 |
| 8 | EXC-2 | J1RMH9 | 5/14/2013 | 35.3 | | 1.7 | 39000 | | 660 | 55000 | | 970 | 530 | X | 9.7 | 1300 | | 2.9 | 2300 | J | 3.1 | 1300 | | 6.2 | 1400 | | 4.1 |
| 9 | EXC-3 | J1RMJ0 | 5/14/2013 | 11.0 | | 1.8 | 38000 | | 690 | 50000 | | 1000 | 250 | X | 10 | 450 | N | 3.1 | 1100 | NJ | 3.2 | 520 | N | 6.4 | 610 | N | 4.2 |
| 10 | EXC-4 | J1RMJ1 | 5/14/2013 | 70.0 | | 1.7 | 44000 | | 680 | 66000 | | 1000 | 220 | X | 10 | 310 | | 3.1 | 980 | J | 3.2 | 620 | | 6.5 | 670 | | 4.3 |
| 11 | EXC-5 | J1RMJ2 | 5/14/2013 | 43.7 | | 1.7 | 13000 | | 670 | 20000 | | 980 | 31 | JX | 9.9 | 27 | X | 3.0 | 130 | J | 3.2 | 65 | | 6.4 | 96 | | 4.2 |
| 12 | EXC-6 | J1RMJ3 | 5/14/2013 | 7.4 | | 1.7 | 5600 | | 690 | 8300 | | 1000 | 9.9 | U | 9.9 | 3.0 | U | 3.0 | 3 | U | 3.2 | 7.0 | J | 6.3 | 6.5 | JX | 4.2 |
| 13 | EXC-8 | J1RMJ5 | 5/14/2013 | 32.0 | | 1.7 | 34000 | | 680 | 48000 | | 1000 | 240 | X | 10 | 320 | | 3.0 | 830 | J | 3.2 | 540 | | 6.4 | 590 | X | 4.2 |
| 14 | EXC-9 | J1RMJ6 | 5/14/2013 | 11.8 | | 1.7 | 12000 | | 680 | 16000 | | 990 | 60 | JX | 9.8 | 94 | | 3.0 | 230 | J | 3.1 | 150 | | 6.3 | 180 | | 4.1 |
| 15 | EXC-10 | J1RMJ7 | 5/14/2013 | 42.2 | | 1.7 | 63000 | | 690 | 91000 | | 1000 | 580 | X | 10 | 820 | | 3.0 | 1500 | J | 3.2 | 1300 | | 6.4 | 1100 | X | 4.2 |
| 16 | EXC-11 | J1RMJ8 | 5/14/2013 | 25.1 | | 1.8 | 51000 | | 680 | 70000 | | 1000 | 390 | X | 9.4 | 540 | | 2.9 | 920 | J | 3.0 | 540 | | 6.0 | 700 | X | 4.0 |
| 17 | EXC-12 | J1RMJ9 | 5/14/2013 | 31.9 | | 1.7 | 30000 | | 680 | 43000 | | 990 | 190 | X | 10 | 250 | | 3.1 | 800 | J | 3.2 | 450 | X | 6.4 | 580 | | 4.2 |

18
19 **Statistical Computation Input Data**

| 20 | Sample | Sample | Sample | Sulfate | TPH - Diesel | TPH - Diesel EXT | Acenaphthene | Anthracene | Benzo(a)anthracene | Benzo(a)pyrene | Benzo(b)fluoranthene |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | Area | Number | Date | mg/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg |
| 22 | EXC-7 | J1RMJ4/J1RMK0 | 5/14/2013 | 23.1 | 43500 | 58000 | 220 | 415 | 775 | 485 | 590 |
| 23 | EXC-1 | J1RMH8 | 5/14/2013 | 45.1 | 35000 | 50000 | 130 | 210 | 630 | 420 | 490 |
| 24 | EXC-2 | J1RMH9 | 5/14/2013 | 35.3 | 39000 | 55000 | 530 | 1300 | 2300 | 1300 | 1400 |
| 25 | EXC-3 | J1RMJ0 | 5/14/2013 | 11.0 | 38000 | 50000 | 250 | 450 | 1100 | 520 | 610 |
| 26 | EXC-4 | J1RMJ1 | 5/14/2013 | 70.0 | 44000 | 66000 | 220 | 310 | 980 | 620 | 670 |
| 27 | EXC-5 | J1RMJ2 | 5/14/2013 | 43.7 | 13000 | 20000 | 31 | 27 | 130 | 65 | 96 |
| 28 | EXC-6 | J1RMJ3 | 5/14/2013 | 7.4 | 5600 | 8300 | 5.0 | 1.5 | 1.6 | 7.0 | 6.5 |
| 29 | EXC-8 | J1RMJ5 | 5/14/2013 | 32.0 | 34000 | 48000 | 240 | 320 | 830 | 540 | 590 |
| 30 | EXC-9 | J1RMJ6 | 5/14/2013 | 11.8 | 12000 | 16000 | 60 | 94 | 230 | 150 | 180 |
| 31 | EXC-10 | J1RMJ7 | 5/14/2013 | 42.2 | 63000 | 91000 | 580 | 820 | 1500 | 1300 | 1100 |
| 32 | EXC-11 | J1RMJ8 | 5/14/2013 | 25.1 | 51000 | 70000 | 390 | 540 | 920 | 540 | 700 |
| 33 | EXC-12 | J1RMJ9 | 5/14/2013 | 31.9 | 30000 | 43000 | 190 | 250 | 800 | 450 | 580 |

34 **Statistical Computations**

| 35 | | Sulfate | TPH - Diesel | TPH - Diesel EXT | Acenaphthene | Anthracene | Benzo(a)anthracene | Benzo(a)pyrene | Benzo(b)fluoranthene |
|---|---|---|---|---|---|---|---|---|---|
| 36 | 95% UCL based on | Large data set (n ≥ 10), use MTCAStat lognormal distribution. | Large data set (n ≥ 10), use MTCAStat normal distribution. | Large data set (n ≥ 10), use MTCAStat normal distribution. | Large data set (n ≥ 10), use MTCAStat normal distribution. | Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic. | Large data set (n ≥ 10), use MTCAStat normal distribution. | Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic. | Large data set (n ≥ 10), use MTCAStat normal distribution. |
| 37 | N | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 38 | % < Detection limit | 0% | 0% | 0% | 8% | 8% | 8% | 0% | 0% |
| 39 | Mean | 31.6 | 34008 | 47942 | 237 | 395 | 850 | 533 | 584 |
| 40 | Standard deviation | 17.7 | 16814 | 23785 | 183 | 366 | 624 | 410 | 393 |
| 41 | 95% UCL on mean | 53.3 | 42726 | 60273 | 332 | 569 | 1173 | 728 | 788 |
| 42 | Maximum value | 70.0 | 63000 | 91000 | 580 | 1300 | 728 | 1300 | 1400 |
| 43 | **Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted** | 25000 GW Protection | 200000 ug/kg GW & River Protection | 200000 ug/kg GW & River Protection | 96000 ug/kg GW Protection | 240000 ug/kg GW Protection | 15 ug/kg GW & River Protection | 15 ug/kg GW & River Protection | 15 ug/kg GW & River Protection |
| 44 | **WAC 173-340 3-PART TEST** | | | | | | | | |
| 45 | 95% UCL > Cleanup Limit? | NA | NO | NO | NO | NO | YES | YES | YES |
| 46 | > 10% above Cleanup Limit? | NA | NO | NO | NO | NO | YES | YES | YES |
| 47 | Any sample > 2X Cleanup Limit? | NA | NO | NO | NO | NO | YES | YES | YES |
| 48 | **WAC 173-340 Compliance?** | Because all values are below background (237 mg/kg) the WAC 173-340 3-part test is not required. | The data set meets the 3-part test criteria when compared to the most stringent RAG. | The data set meets the 3-part test criteria when compared to the most stringent RAG. | The data set meets the 3-part test criteria when compared to the most stringent RAG. | The data set meets the 3-part test criteria when compared to the most stringent RAG. | A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG. | A detailed assessment will be performed. The data set does not meet the 3-part test criteria when compared to the direct exposure RAG. | A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG. |

49 Qualifiers are defined on page 3.

**CALCULATION SHEET**

*Washington Closure Hanford*

**Originator** N. K. Schiffern NS
**Project** 100-N Field Remediation
**Subject** 124-N-2 Waste Site Cleanup Verification 95% UCL Calculations

**Date** 06/11/13
**Job No.** 14655

**Calc. No.** 0100N-CA-V0189
**Checked** I. B. Berezovskiy

**Rev. No.** 0
**Date** 06/11/13
**Sheet No.** 9 of 17

1 **124-N-2 Statistical Calculations**
2 **Verification Data -Excavation (EXC)**

| 3 | Sample | Sample | Sample | Benzo(ghi)perylene | | | Benzo(k)fluoranthene | | | Chrysene | | | Dibenz(a,h)anthracene | | | Fluoranthene | | | Fluorene | | | Indeno(1,2,3-cd)pyrene | | | Phenanthrene | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Area | Number | Date | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL |
| 5 | EXC-7 | J1RMJ4 | 5/14/2013 | 200 | | 6.7 | 190 | | 3.7 | 680 | J | 4.5 | 39 | X | 10 | 1100 | J | 12 | 110 | | 4.9 | 150 | X | 11 | 540 | J | 11 |
| 6 | Duplicate of J1RMJ4 | J1RMK0 | 5/14/2013 | 400 | | 7.1 | 270 | | 3.9 | 1100 | J | 4.8 | 88 | X | 11 | 2100 | J | 13 | 250 | | 5.2 | 300 | | 12 | 1500 | J | 12 |
| 7 | EXC-1 | J1RMH8 | 5/14/2013 | 200 | | 7.2 | 240 | | 3.9 | 700 | J | 4.8 | 11 | U | 11 | 1300 | J | 13 | 100 | | 5.3 | 150 | X | 12 | 440 | J | 12 |
| 8 | EXC-2 | J1RMH9 | 5/14/2013 | 610 | | 7.0 | 540 | | 3.8 | 2200 | J | 4.7 | 130 | X | 11 | 4900 | J | 13 | 500 | | 5.1 | 540 | | 12 | 2900 | J | 12 |
| 9 | EXC-3 | J1RMJ0 | 5/14/2013 | 230 | | 7.2 | 250 | N | 4.0 | 1000 | NJ | 4.9 | 11 | U | 11 | 2200 | NJ | 13 | 200 | X | 5.3 | 190 | X | 12 | 1100 | NJ | 12 |
| 10 | EXC-4 | J1RMJ1 | 5/14/2013 | 330 | | 7.3 | 280 | | 4.0 | 1000 | J | 4.9 | 11 | U | 11 | 1600 | J | 13 | 150 | X | 5.3 | 300 | | 12 | 820 | J | 12 |
| 11 | EXC-5 | J1RMJ2 | 5/14/2013 | 40 | | 7.2 | 26 | | 3.9 | 160 | J | 4.8 | 11 | U | 11 | 210 | J | 13 | 19 | J | 5.2 | 38 | | 12 | 99 | J | 12 |
| 12 | EXC-6 | J1RMJ3 | 5/14/2013 | 7.1 | U | 7.1 | 3.9 | U | 3.9 | 16 | J | 4.8 | 11 | U | 11 | 24 | J | 13 | 5.2 | U | 5.2 | 12 | U | 12 | 12 | UJ | 12 |
| 13 | EXC-8 | J1RMJ5 | 5/14/2013 | 290 | | 7.2 | 260 | | 3.9 | 910 | J | 4.8 | 62 | X | 11 | 2000 | J | 13 | 170 | | 5.3 | 260 | | 12 | 900 | J | 12 |
| 14 | EXC-9 | J1RMJ6 | 5/14/2013 | 90 | | 7.0 | 60 | | 3.8 | 260 | J | 4.7 | 17 | JX | 11 | 410 | J | 13 | 48 | | 5.2 | 98 | | 12 | 200 | J | 12 |
| 15 | EXC-10 | J1RMJ7 | 5/14/2013 | 690 | | 7.2 | 510 | | 3.9 | 1900 | J | 4.8 | 190 | X | 11 | 3200 | J | 13 | 430 | | 5.3 | 510 | X | 12 | 2200 | J | 12 |
| 16 | EXC-11 | J1RMJ8 | 5/14/2013 | 210 | X | 6.8 | 230 | | 3.7 | 1100 | J | 4.6 | 110 | X | 10 | 2100 | J | 12 | 290 | | 5.0 | 490 | | 11 | 1600 | J | 11 |
| 17 | EXC-12 | J1RMJ9 | 5/14/2013 | 170 | X | 7.2 | 220 | | 4.0 | 900 | J | 4.9 | 67 | | 11 | 1500 | J | 13 | 150 | | 5.3 | 290 | | 12 | 620 | J | 12 |

18
19 **Statistical Computation Input Data**

| 20 | Sample | Sample | Sample | Benzo(ghi)perylene | Benzo(k)fluoranthene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-cd)pyrene | Phenanthrene |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | Area | Number | Date | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg | ug/kg |
| 22 | EXC-7 | J1RMJ4/J1RMK0 | 5/14/2013 | 300 | 230 | 890 | 64 | 1600 | 180 | 225 | 1020 |
| 23 | EXC-1 | J1RMH8 | 5/14/2013 | 200 | 240 | 700 | 5.5 | 1300 | 100 | 150 | 440 |
| 24 | EXC-2 | J1RMH9 | 5/14/2013 | 610 | 540 | 2200 | 130 | 4900 | 500 | 540 | 2900 |
| 25 | EXC-3 | J1RMJ0 | 5/14/2013 | 230 | 250 | 1000 | 5.5 | 2200 | 200 | 190 | 1100 |
| 26 | EXC-4 | J1RMJ1 | 5/14/2013 | 330 | 280 | 1000 | 5.5 | 1600 | 150 | 300 | 820 |
| 27 | EXC-5 | J1RMJ2 | 5/14/2013 | 40 | 26 | 160 | 5.5 | 210 | 19 | 38 | 99 |
| 28 | EXC-6 | J1RMJ3 | 5/14/2013 | 3.6 | 2.0 | 16 | 5.5 | 24 | 2.6 | 6.0 | 6.0 |
| 29 | EXC-8 | J1RMJ5 | 5/14/2013 | 290 | 260 | 910 | 62 | 2000 | 170 | 260 | 900 |
| 30 | EXC-9 | J1RMJ6 | 5/14/2013 | 90 | 60 | 260 | 17 | 410 | 48 | 98 | 200 |
| 31 | EXC-10 | J1RMJ7 | 5/14/2013 | 690 | 510 | 1900 | 190 | 3200 | 430 | 510 | 2200 |
| 32 | EXC-11 | J1RMJ8 | 5/14/2013 | 210 | 230 | 1100 | 110 | 2100 | 290 | 490 | 1600 |
| 33 | EXC-12 | J1RMJ9 | 5/14/2013 | 170 | 220 | 900 | 67 | 1500 | 150 | 290 | 620 |

34 **Statistical Computations**

| 35 | | Benzo(ghi)perylene | Benzo(k)fluoranthene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-cd)pyrene | Phenanthrene |
|---|---|---|---|---|---|---|---|---|---|
| 36 | 95% UCL based on | Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic. | Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic. | Large data set (n ≥ 10), use MTCAStat normal distribution. | Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic. | Large data set (n ≥ 10), use MTCAStat normal distribution. | Large data set (n ≥ 10), use MTCAStat normal distribution. | Large data set (n ≥ 10), use MTCAStat normal distribution. | Large data set (n ≥ 10), use MTCAStat normal distribution. |
| 37 | N | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 38 | % < Detection limit | 8% | 8% | 0% | 42% | 0% | 8% | 8% | 8% |
| 39 | Mean | 264 | 237 | 920 | 56 | 1754 | 187 | 258 | 992 |
| 40 | Standard deviation | 207 | 165 | 641 | 61 | 1344 | 154 | 180 | 872 |
| 41 | 95% UCL on mean | 362 | 316 | 1252 | 85 | 2450 | 266 | 351 | 1444 |
| 42 | Maximum value | 690 | 540 | 2200 | 190 | 4900 | 500 | 540 | 2900 |
| 43 | **Most Stringent Cleanup Limit for nonradionuclide and RAG type (ug/kg)** | 48000 GW Protection | 15 River Protection | 100 River Protection | 30 GW & River Protection | 18000 River Protection | 64000 GW Protection | 15 GW & River Protection | 240000 GW Protection |
| 44 | **WAC 173-340 3-PART TEST** | | | | | | | | |
| 45 | 95% UCL > Cleanup Limit? | NO | YES | YES | YES | NO | NO | YES | NO |
| 46 | > 10% above Cleanup Limit? | NO | YES | YES | YES | NO | NO | YES | NO |
| 47 | Any sample > 2X Cleanup Limit? | NO | YES | YES | YES | NO | NO | YES | NO |
| 48 | **WAC 173-340 Compliance?** | The data set meets the 3-part test criteria when compared to the most stringent RAG. | A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG. | A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG. | A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG. | The data set meets the 3-part test criteria when compared to the most stringent RAG. | The data set meets the 3-part test criteria when compared to the most stringent RAG. | A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG. | A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG. |

49 Qualifiers are defined on page 3.

**CALCULATION SHEET**

***Washington Closure Hanford***

**Originator** N. K. Schiffern
**Project** 100-N Field Remediation
**Subject** 124-N-2 Waste Site Cleanup Verification 95% UCL Calculations

**Date** 06/12/13
**Job No.** 14655

**Calc. No.** 0100N-CA-V0189
**Checked** I. B. Berezovskiy

**Rev. No.** 0
**Date** 06/12/13
**Sheet No.** 10 of 17

1 **124-N-2 Statistical Calculations**
2 **Verification Data -Excavation (EXC)**

| 3 | Sample | Sample | Sample | Pyrene | | | Aroclor-1254 | | |
|---|---|---|---|---|---|---|---|---|---|
| 4 | Area | Number | Date | ug/kg | Q | PQL | ug/kg | Q | PQL |
| 5 | EXC-7 | J1RMJ4 | 5/14/2013 | 1100 | J | 11 | 9.2 | J | 2.6 |
| 6 | Duplicate of J1RMJ4 | J1RMK0 | 5/14/2013 | 2200 | J | 12 | 6.9 | J | 2.6 |
| 7 | EXC-1 | J1RMH8 | 5/14/2013 | 1200 | J | 12 | 35 | | 2.6 |
| 8 | EXC-2 | J1RMH9 | 5/14/2013 | 4700 | J | 12 | 30 | J | 2.6 |
| 9 | EXC-3 | J1RMJ0 | 5/14/2013 | 2000 | NJ | 12 | 2.6 | UJ | 2.6 |
| 10 | EXC-4 | J1RMJ1 | 5/14/2013 | 1700 | J | 12 | 20 | P | 2.5 |
| 11 | EXC-5 | J1RMJ2 | 5/14/2013 | 210 | K | 12 | 2.6 | UJ | 2.6 |
| 12 | EXC-6 | J1RMJ3 | 5/14/2013 | 24 | J | 12 | 2.6 | U | 2.6 |
| 13 | EXC-8 | J1RMJ5 | 5/14/2013 | 2000 | J | 12 | 9.4 | JP | 2.6 |
| 14 | EXC-9 | J1RMJ6 | 5/14/2013 | 480 | J | 12 | 2.6 | UJ | 2.6 |
| 15 | EXC-10 | J1RMJ7 | 5/14/2013 | 3500 | J | 12 | 10 | J | 2.6 |
| 16 | EXC-11 | J1RMJ8 | 5/14/2013 | 2200 | J | 11 | 10 | J | 2.5 |
| 17 | EXC-12 | J1RMJ9 | 5/14/2013 | 1700 | J | 12 | 13 | J | 2.6 |

18
19 **Statistical Computation Input Data**

| 20 | Sample | Sample | Sample | Pyrene | | | Aroclor-1254 | | |
|---|---|---|---|---|---|---|---|---|---|
| 21 | Area | Number | Date | ug/kg | | | ug/kg | | |
| 22 | EXC-7 | J1RMJ4/J1RMK0 | 5/14/2013 | 1650 | | | 8.1 | | |
| 23 | EXC-1 | J1RMH8 | 5/14/2013 | 1200 | | | 35 | | |
| 24 | EXC-2 | J1RMH9 | 5/14/2013 | 4700 | | | 30 | | |
| 25 | EXC-3 | J1RMJ0 | 5/14/2013 | 2000 | | | 1.3 | | |
| 26 | EXC-4 | J1RMJ1 | 5/14/2013 | 1700 | | | 20 | | |
| 27 | EXC-5 | J1RMJ2 | 5/14/2013 | 210 | | | 1.3 | | |
| 28 | EXC-6 | J1RMJ3 | 5/14/2013 | 24 | | | 1.3 | | |
| 29 | EXC-8 | J1RMJ5 | 5/14/2013 | 2000 | | | 9.4 | | |
| 30 | EXC-9 | J1RMJ6 | 5/14/2013 | 480 | | | 1.3 | | |
| 31 | EXC-10 | J1RMJ7 | 5/14/2013 | 3500 | | | 10 | | |
| 32 | EXC-11 | J1RMJ8 | 5/14/2013 | 2200 | | | 10 | | |
| 33 | EXC-12 | J1RMJ9 | 5/14/2013 | 1700 | | | 13 | | |

34 **Statistical Computations**

| 35 | | Pyrene | | | Aroclor-1254 | | |
|---|---|---|---|---|---|---|---|
| 36 | 95% UCL based on | Large data set (n ≥ 10), use MTCAStat normal distribution. | | | Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic. | | |
| 37 | N | 12 | | | 12 | | |
| 38 | % < Detection limit | 0% | | | 33% | | |
| 39 | Mean | 1780 | | | 12 | | |
| 40 | Standard deviation | 1327 | | | 11 | | |
| 41 | 95% UCL on mean | 2468 | | | 24 | | |
| 42 | Maximum value | 4700 | | | 35 | | |
| 43 | **Most Stringent Cleanup Limit for nonradionuclide and RAG type (ug/kg)** | 48000 | GW Protection | | 17 | GW Protection | |
| 44 | **WAC 173-340 3-PART TEST** | | | | | | |
| 45 | 95% UCL > Cleanup Limit? | NO | | | YES | | |
| 46 | > 10% above Cleanup Limit? | NO | | | YES | | |
| 47 | Any sample > 2X Cleanup Limit? | NO | | | YES | | |
| 48 | **WAC 173-340 Compliance?** | The data set meets the 3-part test criteria when compared to the most stringent RAG. | | | A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG. | | |

49 Qualifiers are defined on page 3.

**MAXIMUM VALUE 3-PART TEST CALCULATION SHEET**

***Washington Closure Hanford***

**Originator** N. K. Schiffern
**Project** 100-N Field Remediation
**Subject** 124-N-2 Waste Site Cleanup Verification 95% UCL Calculations

**Date** 06/11/13
**Job No.** 14655

**Calc. No.** 0100N-CA-V0189
**Checked** I. B. Berezovskiy

**Rev. No.** 0
**Date** 06/11/13
**Sheet No.** 11 of 17

1 **124-N-2 Maximum Calculations**
2 **Verification Data -Excavation (EXC)**

| 3 | Sample | Sample | Sample | Boron | | | Mercury | | | Fluoride | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Area | Number | Date | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL |
| 5 | EXC-7 | J1RMJ4 | 5/14/2013 | 0.88 | U | 0.88 | 0.0053 | U | 0.0053 | 0.81 | UJ | 0.81 |
| 6 | Duplicate of J1RMJ4 | J1RMK0 | 5/14/2013 | 0.86 | U | 0.86 | 0.0061 | U | 0.0061 | 0.85 | BJ | 0.81 |
| 7 | EXC-1 | J1RMH8 | 5/14/2013 | 0.87 | U | 0.87 | 0.0053 | U | 0.0053 | 0.83 | UNJ | 0.83 |
| 8 | EXC-2 | J1RMH9 | 5/14/2013 | 0.90 | U | 0.90 | 0.0052 | U | 0.0052 | 0.79 | UJ | 0.79 |
| 9 | EXC-3 | J1RMJ0 | 5/14/2013 | 0.95 | U | 0.95 | 0.0051 | U | 0.0051 | 0.83 | UJ | 0.83 |
| 10 | EXC-4 | J1RMJ1 | 5/14/2013 | 0.86 | U | 0.86 | 0.0047 | U | 0.0047 | 0.81 | UJ | 0.81 |
| 11 | EXC-5 | J1RMJ2 | 5/14/2013 | 0.96 | U | 0.96 | 0.0057 | U | 0.0057 | 0.80 | UJ | 0.80 |
| 12 | EXC-6 | J1RMJ3 | 5/14/2013 | 1.1 | B | 0.95 | 0.0048 | U | 0.0048 | 0.80 | UJ | 0.80 |
| 13 | EXC-8 | J1RMJ5 | 5/14/2013 | 0.92 | U | 0.92 | 0.0055 | U | 0.0055 | 0.80 | UJ | 0.80 |
| 14 | EXC-9 | J1RMJ6 | 5/14/2013 | 0.99 | U | 0.99 | 0.0048 | U | 0.0048 | 1.1 | BJ | 0.82 |
| 15 | EXC-10 | J1RMJ7 | 5/14/2013 | 0.93 | U | 0.93 | 0.0079 | B | 0.0063 | 0.84 | BJ | 0.83 |
| 16 | EXC-11 | J1RMJ8 | 5/14/2013 | 0.92 | U | 0.92 | 0.0050 | U | 0.0050 | 0.83 | UJ | 0.83 |
| 17 | EXC-12 | J1RMJ9 | 5/14/2013 | 0.96 | B | 0.93 | 0.0055 | U | 0.0055 | 1.0 | BNJ | 0.82 |

18 **Statistical Computations**

| 19 | | Boron | | | Mercury | | | Fluoride | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 20 | % < Detection limit | 83% | | | 92% | | | 67% | | |
| 21 | Maximum value | 1.1 | | | 0.0079 | | | 1.1 | | |
| 22 | **Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)** | 320 | GW Protection | | 0.33 | GW & River Protection | | 96 | GW Protection | |
| 23 | **3-PART TEST** | | | | | | | | | |
| 24 | Maximum > Cleanup Limit? | NO | | | NO | | | NA | | |
| 25 | > 10% above Cleanup Limit? | NO | | | NO | | | NA | | |
| 26 | Any sample > 2X Cleanup Limit? | NO | | | NO | | | NA | | |
| 27 | **3-Part Test Compliance?** | The data set meets the 3-part test criteria when compared to the most stringent RAG. | | | The data set meets the 3-part test criteria when compared to the most stringent RAG. | | | Because all values are below background (2.81 mg/kg) the WAC 173-340 3-part test is not required. | | |

28 Qualifiers are defined on page 3.
29

**CALCULATION SHEET**

*Washington Closure Hanford*

**Originator** N. K. Schiffern
**Project** 100-N Field Remediation
**Subject** 124-N-2 Waste Site Cleanup Verification 95% UCL Calculations

**Date** 06/11/13
**Job No.** 14655

**Calc. No.** 0100N-CA-V0189
**Checked** I. B. Berezovskiy

**Rev. No.** 0
**Date** 06/11/13
**Sheet No.** 12 of 17

**Ecology Software (MTCAStat) Results, 124-N-2 Excavation (EXC)**

### Arsenic 95% UCL Calculation

| DATA | ID |
|---|---|
| 1.4 | J1RMJ4/J1RMK0 |
| 2.0 | J1RMH8 |
| 1.9 | J1RMH9 |
| 3.3 | J1RMJ0 |
| 1.9 | J1RMJ1 |
| 1.4 | J1RMJ2 |
| 2.1 | J1RMJ3 |
| 2.1 | J1RMJ5 |
| 1.9 | J1RMJ6 |
| 2.1 | J1RMJ7 |
| 2.1 | J1RMJ8 |
| 2.9 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 2.1 |
| Censored | | Lognormal mean | 2.1 |
| Detection limit or PQL | | Std. devn. | 0.54 |
| Method detection limit | | Median | 2.1 |
| TOTAL | 12 | Min. | 1.4 |
| | | Max. | 3.3 |

Lognormal distribution? r-squared is: 0.875
Normal distribution? r-squared is: 0.831
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 2.3

### Barium 95% UCL Calculation

| DATA | ID |
|---|---|
| 35.3 | J1RMJ4/J1RMK0 |
| 56.1 | J1RMH8 |
| 60.8 | J1RMH9 |
| 44.4 | J1RMJ0 |
| 50.1 | J1RMJ1 |
| 46.8 | J1RMJ2 |
| 54.1 | J1RMJ3 |
| 51.3 | J1RMJ5 |
| 46.2 | J1RMJ6 |
| 49.3 | J1RMJ7 |
| 92.2 | J1RMJ8 |
| 57.3 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 53.7 |
| Censored | | Lognormal mean | 53.7 |
| Detection limit or PQL | | Std. devn. | 13.9 |
| Method detection limit | | Median | 50.7 |
| TOTAL | 12 | Min. | 35.3 |
| | | Max. | 92.2 |

Lognormal distribution? r-squared is: 0.870
Normal distribution? r-squared is: 0.767
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 60.2

### Beryllium 95% UCL Calculation

| DATA | ID |
|---|---|
| 0.33 | J1RMJ4/J1RMK0 |
| 0.38 | J1RMH8 |
| 0.36 | J1RMH9 |
| 0.31 | J1RMJ0 |
| 0.30 | J1RMJ1 |
| 0.37 | J1RMJ2 |
| 0.33 | J1RMJ3 |
| 0.40 | J1RMJ5 |
| 0.31 | J1RMJ6 |
| 0.39 | J1RMJ7 |
| 0.39 | J1RMJ8 |
| 0.31 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 0.35 |
| Censored | | Lognormal mean | 0.35 |
| Detection limit or PQL | | Std. devn. | 0.037 |
| Method detection limit | | Median | 0.35 |
| TOTAL | 12 | Min. | 0.30 |
| | | Max. | 0.40 |

Lognormal distribution? r-squared is: 0.905
Normal distribution? r-squared is: 0.905
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.37

### Cadmium 95% UCL Calculation

| DATA | ID |
|---|---|
| 0.16 | J1RMJ4/J1RMK0 |
| 0.20 | J1RMH8 |
| 0.21 | J1RMH9 |
| 0.17 | J1RMJ0 |
| 0.18 | J1RMJ1 |
| 0.18 | J1RMJ2 |
| 0.19 | J1RMJ3 |
| 0.24 | J1RMJ5 |
| 0.18 | J1RMJ6 |
| 0.24 | J1RMJ7 |
| 0.24 | J1RMJ8 |
| 0.24 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 0.20 |
| Censored | | Lognormal mean | 0.20 |
| Detection limit or PQL | | Std. devn. | 0.030 |
| Method detection limit | | Median | 0.20 |
| TOTAL | 12 | Min. | 0.16 |
| | | Max. | 0.24 |

Lognormal distribution? r-squared is: 0.900
Normal distribution? r-squared is: 0.885
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.22

### Chromium 95% UCL Calculation

| DATA | ID |
|---|---|
| 5.0 | J1RMJ4/J1RMK0 |
| 8.1 | J1RMH8 |
| 9.2 | J1RMH9 |
| 12.6 | J1RMJ0 |
| 9.6 | J1RMJ1 |
| 4.6 | J1RMJ2 |
| 11.1 | J1RMJ3 |
| 7.0 | J1RMJ5 |
| 10.7 | J1RMJ6 |
| 6.9 | J1RMJ7 |
| 6.8 | J1RMJ8 |
| 12.6 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 8.7 |
| Censored | | Lognormal mean | 8.7 |
| Detection limit or PQL | | Std. devn. | 2.7 |
| Method detection limit | | Median | 8.7 |
| TOTAL | 12 | Min. | 4.6 |
| | | Max. | 12.6 |

Lognormal distribution? r-squared is: 0.953
Normal distribution? r-squared is: 0.964
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 10.7

### Cobalt 95% UCL Calculation

| DATA | ID |
|---|---|
| 6.1 | J1RMJ4/J1RMK0 |
| 7.4 | J1RMH8 |
| 7.1 | J1RMH9 |
| 5.9 | J1RMJ0 |
| 5.7 | J1RMJ1 |
| 8.3 | J1RMJ2 |
| 6.2 | J1RMJ3 |
| 7.9 | J1RMJ5 |
| 5.7 | J1RMJ6 |
| 8.0 | J1RMJ7 |
| 8.3 | J1RMJ8 |
| 5.1 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 6.8 |
| Censored | | Lognormal mean | 6.8 |
| Detection limit or PQL | | Std. devn. | 1.2 |
| Method detection limit | | Median | 6.7 |
| TOTAL | 12 | Min. | 5.1 |
| | | Max. | 8.3 |

Lognormal distribution? r-squared is: 0.925
Normal distribution? r-squared is: 0.920
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 7.5

### Copper 95% UCL Calculation

| DATA | ID |
|---|---|
| 12.1 | J1RMJ4/J1RMK0 |
| 14.9 | J1RMH8 |
| 14.7 | J1RMH9 |
| 14.0 | J1RMJ0 |
| 13.8 | J1RMJ1 |
| 15.2 | J1RMJ2 |
| 14.8 | J1RMJ3 |
| 17.2 | J1RMJ5 |
| 13.7 | J1RMJ6 |
| 18.4 | J1RMJ7 |
| 16.7 | J1RMJ8 |
| 10.5 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 14.7 |
| Censored | | Lognormal mean | 14.7 |
| Detection limit or PQL | | Std. devn. | 2.2 |
| Method detection limit | | Median | 14.8 |
| TOTAL | 12 | Min. | 10.5 |
| | | Max. | 18.4 |

Lognormal distribution? r-squared is: 0.946
Normal distribution? r-squared is: 0.964
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 16.0

### Lead 95% UCL Calculation

| DATA | ID |
|---|---|
| 4.0 | J1RMJ4/J1RMK0 |
| 6.9 | J1RMH8 |
| 5.1 | J1RMH9 |
| 4.8 | J1RMJ0 |
| 6.8 | J1RMJ1 |
| 3.2 | J1RMJ2 |
| 4.9 | J1RMJ3 |
| 12.8 | J1RMJ5 |
| 3.4 | J1RMJ6 |
| 5.9 | J1RMJ7 |
| 19.2 | J1RMJ8 |
| 5.1 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 6.8 |
| Censored | | Lognormal mean | 6.8 |
| Detection limit or PQL | | Std. devn. | 4.6 |
| Method detection limit | | Median | 5.1 |
| TOTAL | 12 | Min. | 3.2 |
| | | Max. | 19.2 |

Lognormal distribution? r-squared is: 0.877
Normal distribution? r-squared is: 0.697
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 9.0

### Manganese 95% UCL Calculation

| DATA | ID |
|---|---|
| 226 | J1RMJ4/J1RMK0 |
| 299 | J1RMH8 |
| 336 | J1RMH9 |
| 250 | J1RMJ0 |
| 258 | J1RMJ1 |
| 308 | J1RMJ2 |
| 273 | J1RMJ3 |
| 304 | J1RMJ5 |
| 248 | J1RMJ6 |
| 330 | J1RMJ7 |
| 442 | J1RMJ8 |
| 227 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 292 |
| Censored | | Lognormal mean | 292 |
| Detection limit or PQL | | Std. devn. | 60.4 |
| Method detection limit | | Median | 286 |
| TOTAL | 12 | Min. | 226 |
| | | Max. | 442 |

Lognormal distribution? r-squared is: 0.930
Normal distribution? r-squared is: 0.873
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 325

Qualifiers are defined on page 3.

**CALCULATION SHEET**

***Washington Closure Hanford***

**Originator** N. K. Schiffern
**Project** 100-N Field Remediation
**Subject** 124-N-2 Waste Site Cleanup Verification 95% UCL Calculations

**Date** 06/11/13
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**Date** 06/11/13
**Sheet No.** 13 of 17

**Ecology Software (MTCAStat) Results, 124-N-2 Excavation (EXC)**

**Molybdenum 95% UCL Calculation**

| DATA | ID |
|---|---|
| 0.18 | J1RMJ4/J1RMK0 |
| 0.25 | J1RMH8 |
| 0.29 | J1RMH9 |
| 0.26 | J1RMJ0 |
| 0.24 | J1RMJ1 |
| 0.13 | J1RMJ2 |
| 0.13 | J1RMJ3 |
| 0.24 | J1RMJ5 |
| 0.13 | J1RMJ6 |
| 0.13 | J1RMJ7 |
| 0.30 | J1RMJ8 |
| 0.13 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 0.20 |
| Censored | | Lognormal mean | 0.20 |
| Detection limit or PQL | | Std. devn. | 0.071 |
| Method detection limit | | Median | 0.21 |
| TOTAL | 12 | Min. | 0.13 |
| | | Max. | 0.30 |

Lognormal distribution? r-squared is: 0.838
Normal distribution? r-squared is: 0.860
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.23

**Nickel 95% UCL Calculation**

| DATA | ID |
|---|---|
| 6.8 | J1RMJ4/J1RMK0 |
| 10.3 | J1RMH8 |
| 11.0 | J1RMH9 |
| 12.7 | J1RMJ0 |
| 10.6 | J1RMJ1 |
| 7.7 | J1RMJ2 |
| 13.4 | J1RMJ3 |
| 8.4 | J1RMJ5 |
| 13.1 | J1RMJ6 |
| 9.0 | J1RMJ7 |
| 12.1 | J1RMJ8 |
| 11.6 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 10.6 |
| Censored | | Lognormal mean | 10.6 |
| Detection limit or PQL | | Std. devn. | 2.2 |
| Method detection limit | | Median | 10.8 |
| TOTAL | 12 | Min. | 6.8 |
| | | Max. | 13.4 |

Lognormal distribution? r-squared is: 0.943
Normal distribution? r-squared is: 0.966
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 12.0

**Vanadium 95% UCL Calculation**

| DATA | ID |
|---|---|
| 52.9 | J1RMJ4/J1RMK0 |
| 51.2 | J1RMH8 |
| 46.6 | J1RMH9 |
| 33.7 | J1RMJ0 |
| 36.7 | J1RMJ1 |
| 55.8 | J1RMJ2 |
| 37.4 | J1RMJ3 |
| 59.8 | J1RMJ5 |
| 33.3 | J1RMJ6 |
| 56.0 | J1RMJ7 |
| 60.6 | J1RMJ8 |
| 33.4 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 46.4 |
| Censored | | Lognormal mean | 46.6 |
| Detection limit or PQL | | Std. devn. | 10.9 |
| Method detection limit | | Median | 48.9 |
| TOTAL | 12 | Min. | 33.3 |
| | | Max. | 60.6 |

Lognormal distribution? r-squared is: 0.882
Normal distribution? r-squared is: 0.894
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 51.6

**Zinc 95% UCL Calculation**

| DATA | ID |
|---|---|
| 36.2 | J1RMJ4/J1RMK0 |
| 40.9 | J1RMH8 |
| 41.8 | J1RMH9 |
| 38.9 | J1RMJ0 |
| 38.8 | J1RMJ1 |
| 42.3 | J1RMJ2 |
| 37.8 | J1RMJ3 |
| 52.9 | J1RMJ5 |
| 34.8 | J1RMJ6 |
| 58.2 | J1RMJ7 |
| 49.2 | J1RMJ8 |
| 35.8 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 42.3 |
| Censored | | Lognormal mean | 42.3 |
| Detection limit or PQL | | Std. devn. | 7.4 |
| Method detection limit | | Median | 39.9 |
| TOTAL | 12 | Min. | 34.8 |
| | | Max. | 58.2 |

Lognormal distribution? r-squared is: 0.898
Normal distribution? r-squared is: 0.862
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 45.8

**Chloride 95% UCL Calculation**

| DATA | ID |
|---|---|
| 10.5 | J1RMJ4/J1RMK0 |
| 4.8 | J1RMH8 |
| 5.5 | J1RMH9 |
| 4.5 | J1RMJ0 |
| 10.9 | J1RMJ1 |
| 6.3 | J1RMJ2 |
| 4.7 | J1RMJ3 |
| 8.3 | J1RMJ5 |
| 6.1 | J1RMJ6 |
| 8.7 | J1RMJ7 |
| 7.7 | J1RMJ8 |
| 7.2 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 7.1 |
| Censored | | Lognormal mean | 7.1 |
| Detection limit or PQL | | Std. devn. | 2.2 |
| Method detection limit | | Median | 6.8 |
| TOTAL | 12 | Min. | 4.5 |
| | | Max. | 10.9 |

Lognormal distribution? r-squared is: 0.966
Normal distribution? r-squared is: 0.946
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 8.5

**Nitrogen in Nitrate 95% UCL Calculation**

| DATA | ID |
|---|---|
| 0.93 | J1RMJ4/J1RMK0 |
| 1.1 | J1RMH8 |
| 0.95 | J1RMH9 |
| 1.3 | J1RMJ0 |
| 1.6 | J1RMJ1 |
| 1.2 | J1RMJ2 |
| 0.67 | J1RMJ3 |
| 0.83 | J1RMJ5 |
| 0.16 | J1RMJ6 |
| 0.16 | J1RMJ7 |
| 1.2 | J1RMJ8 |
| 0.16 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 0.85 |
| Censored | | Lognormal mean | 0.97 |
| Detection limit or PQL | | Std. devn. | 0.48 |
| Method detection limit | | Median | 0.94 |
| TOTAL | 12 | Min. | 0.16 |
| | | Max. | 1.6 |

Lognormal distribution? r-squared is: 0.778
Normal distribution? r-squared is: 0.923
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 1.1

**Nitrogen in Nitrite and Nitrate 95% UCL Calculation**

| DATA | ID |
|---|---|
| 0.35 | J1RMJ4/J1RMK0 |
| 1.2 | J1RMH8 |
| 0.62 | J1RMH9 |
| 0.35 | J1RMJ0 |
| 1.7 | J1RMJ1 |
| 1.5 | J1RMJ2 |
| 0.45 | J1RMJ3 |
| 0.87 | J1RMJ5 |
| 0.15 | J1RMJ6 |
| 0.15 | J1RMJ7 |
| 0.39 | J1RMJ8 |
| 0.15 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 0.66 |
| Censored | | Lognormal mean | 0.69 |
| Detection limit or PQL | | Std. devn. | 0.54 |
| Method detection limit | | Median | 0.42 |
| TOTAL | 12 | Min. | 0.15 |
| | | Max. | 1.7 |

Lognormal distribution? r-squared is: 0.941
Normal distribution? r-squared is: 0.865
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 1.4

**Sulfate 95% UCL Calculation**

| DATA | ID |
|---|---|
| 23.1 | J1RMJ4/J1RMK0 |
| 45.1 | J1RMH8 |
| 35.3 | J1RMH9 |
| 11.0 | J1RMJ0 |
| 70.0 | J1RMJ1 |
| 43.7 | J1RMJ2 |
| 7.4 | J1RMJ3 |
| 32.0 | J1RMJ5 |
| 11.8 | J1RMJ6 |
| 42.2 | J1RMJ7 |
| 25.1 | J1RMJ8 |
| 31.9 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 31.6 |
| Censored | | Lognormal mean | 33.1 |
| Detection limit or PQL | | Std. devn. | 17.7 |
| Method detection limit | | Median | 32.0 |
| TOTAL | 12 | Min. | 7.4 |
| | | Max. | 70.0 |

Lognormal distribution? r-squared is: 0.927
Normal distribution? r-squared is: 0.942
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 53.3

**TPH - Diesel 95% UCL Calculation**

| DATA | ID |
|---|---|
| 43500 | J1RMJ4/J1RMK0 |
| 35000 | J1RMH8 |
| 39000 | J1RMH9 |
| 38000 | J1RMJ0 |
| 44000 | J1RMJ1 |
| 13000 | J1RMJ2 |
| 5600 | J1RMJ3 |
| 34000 | J1RMJ5 |
| 12000 | J1RMJ6 |
| 63000 | J1RMJ7 |
| 51000 | J1RMJ8 |
| 30000 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 34008 |
| Censored | | Lognormal mean | 36737 |
| Detection limit or PQL | | Std. devn. | 16813.98 |
| Method detection limit | | Median | 36500 |
| TOTAL | 12 | Min. | 5600 |
| | | Max. | 63000 |

Lognormal distribution? r-squared is: 0.832
Normal distribution? r-squared is: 0.952
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 42726

Qualifiers are defined on page 3.

**CALCULATION SHEET**

***Washington Closure Hanford***

**Originator** N. K. Schiffern
**Project** 100-N Field Remediation
**Subject** 124-N-2 Waste Site Cleanup Verification 95% UCL Calculations

**Date** 06/11/13
**Job No.** 14655

**Calc. No.** 0100N-CA-V0189
**Checked** I. B. Berezovskiy

**Rev. No.** 0
**Date** 06/11/13
**Sheet No.** 14 of 17

**Ecology Software (MTCAStat) Results, 124-N-2 Excavation (EXC)**

### TPH - Diesel EXT 95% UCL Calculation

| DATA | ID |
|---|---|
| 58000 | J1RMJ4/J1RMK0 |
| 50000 | J1RMH8 |
| 55000 | J1RMH9 |
| 50000 | J1RMJ0 |
| 66000 | J1RMJ1 |
| 20000 | J1RMJ2 |
| 8300 | J1RMJ3 |
| 48000 | J1RMJ5 |
| 16000 | J1RMJ6 |
| 91000 | J1RMJ7 |
| 70000 | J1RMJ8 |
| 43000 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 47942 |
| Censored | | Lognormal mean | 51541 |
| Detection limit or PQL | | Std. devn. | 23785 |
| Method detection limit | | Median | 50000 |
| TOTAL | 12 | Min. | 8300 |
| | | Max. | 91000 |

Lognormal distribution? r-squared is: 0.842
Normal distribution? r-squared is: 0.953
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 60273

### Acenaphthene 95% UCL Calculation

| DATA | ID |
|---|---|
| 220 | J1RMJ4/J1RMK0 |
| 130 | J1RMH8 |
| 530 | J1RMH9 |
| 250 | J1RMJ0 |
| 220 | J1RMJ1 |
| 31 | J1RMJ2 |
| 5.0 | J1RMJ3 |
| 240 | J1RMJ5 |
| 60 | J1RMJ6 |
| 580 | J1RMJ7 |
| 390 | J1RMJ8 |
| 190 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 237 |
| Censored | | Lognormal mean | 359 |
| Detection limit or PQL | | Std. devn. | 183 |
| Method detection limit | | Median | 220 |
| TOTAL | 12 | Min. | 5.0 |
| | | Max. | 580 |

Lognormal distribution? r-squared is: 0.832
Normal distribution? r-squared is: 0.927
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 332

### Anthracene 95% UCL Calculation

| DATA | ID |
|---|---|
| 415 | J1RMJ4/J1RMK0 |
| 210 | J1RMH8 |
| 1300 | J1RMH9 |
| 450 | J1RMJ0 |
| 310 | J1RMJ1 |
| 27 | J1RMJ2 |
| 1.5 | J1RMJ3 |
| 320 | J1RMJ5 |
| 94 | J1RMJ6 |
| 820 | J1RMJ7 |
| 540 | J1RMJ8 |
| 250 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 395 |
| Censored | | Lognormal mean | 1001 |
| Detection limit or PQL | | Std. devn. | 366 |
| Method detection limit | | Median | 315 |
| TOTAL | 12 | Min. | 1.5 |
| | | Max. | 1300 |

Lognormal distribution? r-squared is: 0.782
Normal distribution? r-squared is: 0.862
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 569

### Benzo(a)anthracene 95% UCL Calculation

| DATA | ID |
|---|---|
| 775 | J1RMJ4/J1RMK0 |
| 630 | J1RMH8 |
| 2300 | J1RMH9 |
| 1100 | J1RMJ0 |
| 980 | J1RMJ1 |
| 130 | J1RMJ2 |
| 1.6 | J1RMJ3 |
| 830 | J1RMJ5 |
| 230 | J1RMJ6 |
| 1500 | J1RMJ7 |
| 920 | J1RMJ8 |
| 800 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 850 |
| Censored | | Lognormal mean | 2829 |
| Detection limit or PQL | | Std. devn. | 624 |
| Method detection limit | | Median | 815 |
| TOTAL | 12 | Min. | 1.6 |
| | | Max. | 2300 |

Lognormal distribution? r-squared is: 0.645
Normal distribution? r-squared is: 0.910
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 1173

### Benzo(a)pyrene 95% UCL Calculation

| DATA | ID |
|---|---|
| 485 | J1RMJ4/J1RMK0 |
| 420 | J1RMH8 |
| 1300 | J1RMH9 |
| 520 | J1RMJ0 |
| 620 | J1RMJ1 |
| 65 | J1RMJ2 |
| 7.0 | J1RMJ3 |
| 540 | J1RMJ5 |
| 150 | J1RMJ6 |
| 1300 | J1RMJ7 |
| 540 | J1RMJ8 |
| 450 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 533 |
| Censored | | Lognormal mean | 909 |
| Detection limit or PQL | | Std. devn. | 410 |
| Method detection limit | | Median | 503 |
| TOTAL | 12 | Min. | 7.0 |
| | | Max. | 1300 |

Lognormal distribution? r-squared is: 0.760
Normal distribution? r-squared is: 0.858
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 728

### Benzo(b)fluoranthene 95% UCL Calculation

| DATA | ID |
|---|---|
| 590 | J1RMJ4/J1RMK0 |
| 490 | J1RMH8 |
| 1400 | J1RMH9 |
| 610 | J1RMJ0 |
| 670 | J1RMJ1 |
| 96 | J1RMJ2 |
| 6.5 | J1RMJ3 |
| 590 | J1RMJ5 |
| 180 | J1RMJ6 |
| 1100 | J1RMJ7 |
| 700 | J1RMJ8 |
| 580 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 584 |
| Censored | | Lognormal mean | 1043 |
| Detection limit or PQL | | Std. devn. | 393 |
| Method detection limit | | Median | 590 |
| TOTAL | 12 | Min. | 6.5 |
| | | Max. | 1400 |

Lognormal distribution? r-squared is: 0.706
Normal distribution? r-squared is: 0.914
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 788

### Benzo(ghi)perylene 95% UCL Calculation

| DATA | ID |
|---|---|
| 300 | J1RMJ4/J1RMK0 |
| 200 | J1RMH8 |
| 610 | J1RMH9 |
| 230 | J1RMJ0 |
| 330 | J1RMJ1 |
| 40 | J1RMJ2 |
| 3.6 | J1RMJ3 |
| 290 | J1RMJ5 |
| 90 | J1RMJ6 |
| 690 | J1RMJ7 |
| 210 | J1RMJ8 |
| 170 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 264 |
| Censored | | Lognormal mean | 435 |
| Detection limit or PQL | | Std. devn. | 207 |
| Method detection limit | | Median | 220 |
| TOTAL | 12 | Min. | 3.6 |
| | | Max. | 690 |

Lognormal distribution? r-squared is: 0.784
Normal distribution? r-squared is: 0.898
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 362

### Benzo(k)fluoranthene 95% UCL Calculation

| DATA | ID |
|---|---|
| 230 | J1RMJ4/J1RMK0 |
| 240 | J1RMH8 |
| 540 | J1RMH9 |
| 250 | J1RMJ0 |
| 280 | J1RMJ1 |
| 26 | J1RMJ2 |
| 2.0 | J1RMJ3 |
| 260 | J1RMJ5 |
| 60 | J1RMJ6 |
| 510 | J1RMJ7 |
| 230 | J1RMJ8 |
| 220 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 237 |
| Censored | | Lognormal mean | 477 |
| Detection limit or PQL | | Std. devn. | 165 |
| Method detection limit | | Median | 235 |
| TOTAL | 12 | Min. | 2.0 |
| | | Max. | 540 |

Lognormal distribution? r-squared is: 0.707
Normal distribution? r-squared is: 0.887
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 316

### Chrysene 95% UCL Calculation

| DATA | ID |
|---|---|
| 890 | J1RMJ4/J1RMK0 |
| 700 | J1RMH8 |
| 2200 | J1RMH9 |
| 1000 | J1RMJ0 |
| 1000 | J1RMJ1 |
| 160 | J1RMJ2 |
| 16 | J1RMJ3 |
| 910 | J1RMJ5 |
| 260 | J1RMJ6 |
| 1900 | J1RMJ7 |
| 1100 | J1RMJ8 |
| 900 | J1RMJ9 |

| Number of samples | | Uncensored values | |
|---|---|---|---|
| Uncensored | 12 | Mean | 920 |
| Censored | | Lognormal mean | 1448 |
| Detection limit or PQL | | Std. devn. | 641 |
| Method detection limit | | Median | 905 |
| TOTAL | 12 | Min. | 16 |
| | | Max. | 2200 |

Lognormal distribution? r-squared is: 0.751
Normal distribution? r-squared is: 0.909
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 1252

Qualifiers are defined on page 3.

**CALCULATION SHEET**

*Washington Closure Hanford*

| | | | | | |
|---|---|---|---|---|---|
| **Originator** | N. K. Schiffern | **Date** | 06/11/13 | **Calc. No.** | 0100N-CA-V0189 |
| **Project** | 100-N Field Remediation | **Job No.** | 14655 | **Checked** | I. B. Berezovskiy |
| **Subject** | 124-N-2 Waste Site Cleanup Verification 95% UCL Calculations | | | **Rev. No.** | 0 |
| | | | | **Date** | 06/11/13 |
| | | | | **Sheet No.** | 15 of 17 |

**Ecology Software (MTCAStat) Results, 124-N-2 Excavation (EXC)**

**Dibenz(a,h)anthracene 95% UCL Calculation**

| DATA | ID | | | | |
|---|---|---|---|---|---|
| 64 | J1RMJ4/J1RMK0 | | | | |
| 5.5 | J1RMH8 | | | | |
| 130 | J1RMH9 | Number of samples | | Uncensored values | |
| 5.5 | J1RMJ0 | Uncensored | 12 | Mean | 56 |
| 5.5 | J1RMJ1 | Censored | | Lognormal mean | 72 |
| 5.5 | J1RMJ2 | Detection limit or PQL | | Std. devn. | 61 |
| 5.5 | J1RMJ3 | Method detection limit | | Median | 40 |
| 62 | J1RMJ5 | TOTAL | 12 | Min. | 5.5 |
| 17 | J1RMJ6 | | | Max. | 190 |
| 190 | J1RMJ7 | | | | |
| 110 | J1RMJ8 | | | | |
| 67 | J1RMJ9 | | | | |

Lognormal distribution? r-squared is: 0.843
Normal distribution? r-squared is: 0.831
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 85

**Fluoranthene 95% UCL Calculation**

| DATA | ID | | | | |
|---|---|---|---|---|---|
| 1600 | J1RMJ4/J1RMK0 | | | | |
| 1300 | J1RMH8 | | | | |
| 4900 | J1RMH9 | Number of samples | | Uncensored values | |
| 2200 | J1RMJ0 | Uncensored | 12 | Mean | 1754 |
| 1600 | J1RMJ1 | Censored | | Lognormal mean | 2987 |
| 210 | J1RMJ2 | Detection limit or PQL | | Std. devn. | 1344 |
| 24 | J1RMJ3 | Method detection limit | | Median | 1600 |
| 2000 | J1RMJ5 | TOTAL | 12 | Min. | 24 |
| 410 | J1RMJ6 | | | Max. | 4900 |
| 3200 | J1RMJ7 | | | | |
| 2100 | J1RMJ8 | | | | |
| 1500 | J1RMJ9 | | | | |

Lognormal distribution? r-squared is: 0.780
Normal distribution? r-squared is: 0.902
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 2450

**Fluorene 95% UCL Calculation**

| DATA | ID | | | | |
|---|---|---|---|---|---|
| 180 | J1RMJ4/J1RMK0 | | | | |
| 100 | J1RMH8 | | | | |
| 500 | J1RMH9 | Number of samples | | Uncensored values | |
| 200 | J1RMJ0 | Uncensored | 12 | Mean | 187 |
| 150 | J1RMJ1 | Censored | | Lognormal mean | 314 |
| 19 | J1RMJ2 | Detection limit or PQL | | Std. devn. | 154 |
| 2.6 | J1RMJ3 | Method detection limit | | Median | 160 |
| 170 | J1RMJ5 | TOTAL | 12 | Min. | 2.6 |
| 48 | J1RMJ6 | | | Max. | 500 |
| 430 | J1RMJ7 | | | | |
| 290 | J1RMJ8 | | | | |
| 150 | J1RMJ9 | | | | |

Lognormal distribution? r-squared is: 0.825
Normal distribution? r-squared is: 0.909
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 266

**Indeno(1,2,3-cd)pyrene 95% UCL Calculation**

| DATA | ID | | | | |
|---|---|---|---|---|---|
| 225 | J1RMJ4/J1RMK0 | | | | |
| 150 | J1RMH8 | | | | |
| 540 | J1RMH9 | Number of samples | | Uncensored values | |
| 190 | J1RMJ0 | Uncensored | 12 | Mean | 258 |
| 300 | J1RMJ1 | Censored | | Lognormal mean | 381 |
| 38 | J1RMJ2 | Detection limit or PQL | | Std. devn. | 180 |
| 6.0 | J1RMJ3 | Method detection limit | | Median | 243 |
| 260 | J1RMJ5 | TOTAL | 12 | Min. | 6.0 |
| 98 | J1RMJ6 | | | Max. | 540 |
| 510 | J1RMJ7 | | | | |
| 490 | J1RMJ8 | | | | |
| 290 | J1RMJ9 | | | | |

Lognormal distribution? r-squared is: 0.803
Normal distribution? r-squared is: 0.951
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 351

**Phenanthrene 95% UCL Calculation**

| DATA | ID | | | | |
|---|---|---|---|---|---|
| 1020 | J1RMJ4/J1RMK0 | | | | |
| 440 | J1RMH8 | | | | |
| 2900 | J1RMH9 | Number of samples | | Uncensored values | |
| 1100 | J1RMJ0 | Uncensored | 12 | Mean | 992 |
| 820 | J1RMJ1 | Censored | | Lognormal mean | 2108 |
| 99 | J1RMJ2 | Detection limit or PQL | | Std. devn. | 872 |
| 6.0 | J1RMJ3 | Method detection limit | | Median | 860 |
| 900 | J1RMJ5 | TOTAL | 12 | Min. | 6.0 |
| 200 | J1RMJ6 | | | Max. | 2900 |
| 2200 | J1RMJ7 | | | | |
| 1600 | J1RMJ8 | | | | |
| 620 | J1RMJ9 | | | | |

Lognormal distribution? r-squared is: 0.811
Normal distribution? r-squared is: 0.910
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 1444

**Pyrene 95% UCL Calculation**

| DATA | ID | | | | |
|---|---|---|---|---|---|
| 1650 | J1RMJ4/J1RMK0 | | | | |
| 1200 | J1RMH8 | | | | |
| 4700 | J1RMH9 | Number of samples | | Uncensored values | |
| 2000 | J1RMJ0 | Uncensored | 12 | Mean | 1780 |
| 1700 | J1RMJ1 | Censored | | Lognormal mean | 3047 |
| 210 | J1RMJ2 | Detection limit or PQL | | Std. devn. | 1327 |
| 24 | J1RMJ3 | Method detection limit | | Median | 1700 |
| 2000 | J1RMJ5 | TOTAL | 12 | Min. | 24 |
| 480 | J1RMJ6 | | | Max. | 4700 |
| 3500 | J1RMJ7 | | | | |
| 2200 | J1RMJ8 | | | | |
| 1700 | J1RMJ9 | | | | |

Lognormal distribution? r-squared is: 0.771
Normal distribution? r-squared is: 0.913
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 2468

**Aroclor-1254 95% UCL Calculation**

| DATA | ID | | | | |
|---|---|---|---|---|---|
| 8.1 | J1RMJ4/J1RMK0 | | | | |
| 35 | J1RMH8 | | | | |
| 30 | J1RMH9 | Number of samples | | Uncensored values | |
| 1.3 | J1RMJ0 | Uncensored | 12 | Mean | 15 |
| 60 | J1RMJ1 | Censored | | Lognormal mean | 19 |
| 1.3 | J1RMJ2 | Detection limit or PQL | | Std. devn. | 18 |
| 1.3 | J1RMJ3 | Method detection limit | | Median | 9.7 |
| 9.4 | J1RMJ5 | TOTAL | 12 | Min. | 1.3 |
| 1.3 | J1RMJ6 | | | Max. | 60 |
| 10 | J1RMJ7 | | | | |
| 10 | J1RMJ8 | | | | |
| 13 | J1RMJ9 | | | | |

Lognormal distribution? r-squared is: 0.892
Normal distribution? r-squared is: 0.763
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 24

Qualifiers are defined on page 3.

**CALCULATION SHEET**

***Washington Closure Hanford***

**Originator** N. K. Schiffern M
**Project** 100-N Field Remediation
**Subject** 124-N-2 Waste Site Cleanup Verification 95% UCL Calculations

**Date** 06/12/13
**Job No.** 14655

**Calc. No.** 0100N-CA-V0189
**Checked** I. B. Berezovskiy

**Rev. No.** 0
**Date** 06/12/13
**Sheet No.** 16 of 17

**Duplicate/Split Analysis - 124-N-2 Excavation (EXC)**

| Sampling Area | Sample Number | Sample Date | Aluminum | | | Arsenic | | | Barium | | | Beryllium | | | Cadmium | | | Calcium | | | Chromium | | | Cobalt | | | Copper | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL |
| EXC-7 | J1RMJ4 | 5/14/2013 | 2770 | X | 1.4 | 1.0 | | 0.59 | 24.3 | X | 0.068 | 0.28 | | 0.029 | 0.14 | B | 0.037 | 2880 | X | 12.6 | 4.1 | X | 0.052 | 4.7 | X | 0.089 | 9.4 | X | 0.19 |
| Duplicate of J1RMJ4 | J1RMK0 | 5/14/2013 | 4890 | X | 1.4 | 1.8 | | 0.58 | 46.3 | X | 0.067 | 0.37 | | 0.029 | 0.18 | | 0.036 | 5740 | X | 12.4 | 5.9 | X | 0.051 | 7.4 | X | 0.088 | 14.8 | X | 0.19 |
| Split of J1RMJ4 | J1RMK1 | 5/14/2013 | 3940 | | 27 | 1.1 | B | 0.61 | 37.3 | | 0.48 | 0.33 | U | 0.33 | 0.19 | U | 0.19 | 6370 | | 25.6 | 5.1 | | 0.59 | 7.1 | B | 1.8 | 12.7 | | 1.4 |

**Analysis:**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TDL | | 5 | 10 | 2 | 0.2 | 0.2 | 100 | 1 | 2 | 1 |
| Duplicate Analysis | Both > PQL? | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** |
| | Both >5xTDL? | **Yes (calc RPD)** | No-Stop (acceptable) | **Yes (calc RPD)** | No-Stop (acceptable) | No-Stop (acceptable) | **Yes (calc RPD)** | No-Stop (acceptable) | No-Stop (acceptable) | **Yes (calc RPD)** |
| | RPD | *55.4%* | | *62.3%* | | | *66.4%* | | | *44.6%* |
| | Difference > 2 TDL? | Not applicable | No - acceptable | Not applicable | No - acceptable | No - acceptable | Not applicable | No - acceptable | No - acceptable | Not applicable |
| Split Analysis | Both > PQL? | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | No-Stop (acceptable) | No-Stop (acceptable) | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** |
| | Both >5xTDL? | **Yes (calc RPD)** | No-Stop (acceptable) | **Yes (calc RPD)** | | | **Yes (calc RPD)** | No-Stop (acceptable) | No-Stop (acceptable) | **Yes (calc RPD)** |
| | RPD | *34.9%* | | *42.2%* | | | *75.5%* | | | 29.9% |
| | Difference > 2 TDL? | Not applicable | No - acceptable | Not applicable | Not applicable | Not applicable | Not applicable | No - acceptable | No - acceptable | Not applicable |

**Duplicate/Split Analysis - 124-N-2 Excavation (EXC)**

| Sampling Area | HEIS Number | Sample Date | Iron | | | Lead | | | Magnesium | | | Manganese | | | Nickel | | | Potassium | | | Silicon | | | Sodium | | | Vanadium | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL |
| EXC-7 | J1RMJ4 | 5/14/2013 | 14900 | X | 3.4 | 4.6 | | 0.24 | 2330 | X | 3.3 | 179 | X | 0.089 | 5.0 | X | 0.11 | 396 | | 36.6 | 147 | J | 5.1 | 175 | | 52.7 | 50.0 | X | 0.084 |
| Duplicate of J1RMJ4 | J1RMK0 | 5/14/2013 | 20900 | X | 3.3 | 3.3 | | 0.24 | 3810 | X | 3.3 | 272 | X | 0.088 | 8.5 | X | 0.11 | 733 | | 36.1 | 215 | J | 5.0 | 266 | | 51.9 | 55.7 | X | 0.083 |
| Split of J1RMJ4 | J1RMK1 | 5/14/2013 | 17900 | | 5.7 | 4.2 | | 0.33 | 3300 | N | 16.0 | 240 | | 0.30 | 6.4 | B | 0.43 | 649 | UN | 649 | 204 | J | 5.0 | 213 | | 90.7 | 46.7 | | 2.4 |

**Analysis:**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TDL | | 5 | 5 | 75 | 5 | 4 | 400 | 2 | 50 | 2.5 |
| Duplicate Analysis | Both > PQL? | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** |
| | Both >5xTDL? | **Yes (calc RPD)** | No-Stop (acceptable) | **Yes (calc RPD)** | **Yes (calc RPD)** | No-Stop (acceptable) | No-Stop (acceptable) | **Yes (calc RPD)** | No-Stop (acceptable) | **Yes (calc RPD)** |
| | RPD | *33.5%* | | *48.2%* | *41.2%* | | | *37.6%* | | 10.8% |
| | Difference > 2 TDL? | Not applicable | No - acceptable | Not applicable | Not applicable | No - acceptable | No - acceptable | Not applicable | No - acceptable | Not applicable |
| Split Analysis | Both > PQL? | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | No-Stop (acceptable) | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** |
| | Both >5xTDL? | **Yes (calc RPD)** | No-Stop (acceptable) | **Yes (calc RPD)** | **Yes (calc RPD)** | No-Stop (acceptable) | | **Yes (calc RPD)** | No-Stop (acceptable) | **Yes (calc RPD)** |
| | RPD | 18.3% | | *34.5%* | 29.1% | | | *32.5%* | | 6.8% |
| | Difference > 2 TDL? | Not applicable | No - acceptable | Not applicable | Not applicable | No - acceptable | Not applicable | Not applicable | No - acceptable | Not applicable |

**Duplicate/Split Analysis - 124-N-2 Excavation (EXC)**

| Sampling Area | HEIS Number | Sample Date | Zinc | | | Chloride | | | Nitrogen in Nitrate | | | Sulfate | | | TPH - Diesel | | | TPH - Diesel EXT | | | Acenaphthene | | | Anthracene | | | Benzo(a)anthracene | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL |
| EXC-7 | J1RMJ4 | 5/14/2013 | 30.8 | X | 0.36 | 11.4 | | 1.9 | 0.75 | BJ | 0.31 | 26.3 | | 1.7 | 27000 | | 670 | 37000 | | 990 | 130 | X | 9.4 | 190 | X | 2.9 | 600 | J | 3.0 |
| Duplicate of J1RMJ4 | J1RMK0 | 5/14/2013 | 41.5 | X | 0.35 | 9.5 | | 1.9 | 1.1 | BJ | 0.31 | 19.9 | | 1.7 | 60000 | | 670 | 79000 | | 990 | 310 | X | 9.8 | 640 | | 3.0 | 950 | J | 3.1 |
| Split of J1RMJ4 | J1RMK1 | 5/14/2013 | 46.5 | | 3.8 | 10.0 | | 0.20 | 0.60 | | 0.041 | 36.5 | | 0.51 | 340 | U | 340 | | | | 1000 | DN | 98 | 95 | JDN | 15 | 290 | D | 15 |

**Analysis:**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TDL | | 1 | 2 | 0.75 | 5 | 5000 | 5000 | 15 | 15 | 15 |
| Duplicate Analysis | Both > PQL? | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** |
| | Both >5xTDL? | **Yes (calc RPD)** | No-Stop (acceptable) | No-Stop (acceptable) | No-Stop (acceptable) | **Yes (calc RPD)** | **Yes (calc RPD)** | **Yes (calc RPD)** | **Yes (calc RPD)** | **Yes (calc RPD)** |
| | RPD | 29.6% | | | | *75.9%* | *72.4%* | *81.8%* | *108.4%* | *45.2%* |
| | Difference > 2 TDL? | Not applicable | No - acceptable | No - acceptable | No - acceptable | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable |
| Split Analysis | Both > PQL? | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | No-Stop (acceptable) | | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** |
| | Both >5xTDL? | **Yes (calc RPD)** | No-Stop (acceptable) | No-Stop (acceptable) | **Yes (calc RPD)** | | | **Yes (calc RPD)** | **Yes (calc RPD)** | **Yes (calc RPD)** |
| | RPD | *40.6%* | | | *32.5%* | | | *154.0%* | *66.7%* | *69.7%* |
| | Difference > 2 TDL? | Not applicable | No - acceptable | No - acceptable | Not applicable | Not applicable | | Not applicable | Not applicable | Not applicable |

Qualifiers are defined on page 3.

**CALCULATION SHEET**

***Washington Closure Hanford***

**Originator** N. K. Schiffern
**Project** 100-N Field Remediation
**Subject** 124-N-2 Waste Site Cleanup Verification 95% UCL Calculations

**Date** 06/12/13
**Job No.** 14655

**Calc. No.** 0100N-CA-V0189
**Checked** I. B. Berezovskiy

**Rev. No.** 0
**Date** 06/12/13
**Sheet No.** 17 of 17

1 **Duplicate/Split Analysis - 124-N-2 Excavation (EXC)**

| 2 Sampling Area | HEIS Number | Sample Date | Benzo(a)pyrene | | | Benzo(b)fluoranthene | | | Benzo(ghi)perylene | | | Benzo(k)fluoranthene | | | Chrysene | | | Dibenz(a,h)anthracene | | | Fluoranthene | | | Fluorene | | | Indeno(1,2,3-cd)pyrene | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | | | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL |
| 4 | EXC-7 | J1RMJ4 | 420 | | 6.0 | 470 | X | 3.9 | 200 | | 6.7 | 190 | | 3.7 | 680 | J | 4.5 | 39 | X | 10 | 1100 | J | 12 | 110 | 0 | 4.9 | 150 | X | 11 |
| 5 | Duplicate of J1RMJ4 | J1RMK0 | 550 | X | 6.3 | 710 | X | 4.1 | 400 | | 7.1 | 270 | | 3.9 | 1100 | J | 4.8 | 88 | X | 11 | 2100 | J | 13 | 250 | 0 | 5.2 | 300 | | 12 |
| 6 | Split of J1RMJ4 | J1RMK1 | 270 | DN | 15 | 260 | DN | 15 | 95 | JDN | 15 | 110 | DN | 15 | 380 | D | 15 | 30 | UN | 30 | 600 | D | 30 | 93 | JDN | 30 | 110 | DN | 15 |

7 **Analysis:**

| 8 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **TDL** | | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| 9 | Duplicate Analysis | Both > PQL? | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** |
| 10 | | Both >5xTDL? | **Yes (calc RPD)** | **Yes (calc RPD)** | **Yes (calc RPD)** | **Yes (calc RPD)** | **Yes (calc RPD)** | No-Stop (acceptable) | **Yes (calc RPD)** | **Yes (calc RPD)** | **Yes (calc RPD)** |
| 11 | | RPD | 26.8% | *40.7%* | *66.7%* | *34.8%* | *47.2%* | | *62.5%* | *77.8%* | *66.7%* |
| 12 | | Difference > 2 TDL? | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable | Yes - assess further | Not applicable | Not applicable | Not applicable |
| 13 | Split Analysis | Both > PQL? | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** | No-Stop (acceptable) | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** |
| 14 | | Both >5xTDL? | **Yes (calc RPD)** | **Yes (calc RPD)** | **Yes (calc RPD)** | **Yes (calc RPD)** | **Yes (calc RPD)** | | **Yes (calc RPD)** | **Yes (calc RPD)** | **Yes (calc RPD)** |
| 15 | | RPD | *43.5%* | *57.5%* | *71.2%* | *53.3%* | *56.6%* | | *58.8%* | 16.7% | *30.8%* |
| 16 | | Difference > 2 TDL? | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable |

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18 **Duplicate/Split Analysis - 124-N-2 Excavation (EXC)**

| 19 Sampling Area | HEIS Number | Sample Date | Phenanthrene | | | Pyrene | | | Aroclor-1254 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | | | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL |
| 21 | EXC-7 | J1RMJ4 | 540 | J | 11 | 1100 | J | 11 | 9.2 | J | 2.6 |
| 22 | Duplicate of J1RMJ4 | J1RMK0 | 1500 | J | 12 | 2200 | J | 12 | 6.9 | J | 2.6 |
| 23 | Split of J1RMJ4 | J1RMK1 | 260 | DN | 30 | 680 | D | 15 | 13 | J | 5.6 |

24 **Analysis:**

| 25 | | | | | |
|---|---|---|---|---|---|
| | **TDL** | | 15 | 15 | 20 |
| 26 | Duplicate Analysis | Both > PQL? | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** |
| 27 | | Both >5xTDL? | **Yes (calc RPD)** | **Yes (calc RPD)** | No-Stop (acceptable) |
| 28 | | RPD | *94.1%* | *66.7%* | |
| 29 | | Difference > 2 TDL? | Not applicable | Not applicable | No - acceptable |
| 30 | Split Analysis | Both > PQL? | **Yes (continue)** | **Yes (continue)** | **Yes (continue)** |
| 31 | | Both >5xTDL? | **Yes (calc RPD)** | **Yes (calc RPD)** | No-Stop (acceptable) |
| 32 | | RPD | *70.0%* | *47.2%* | |
| 33 | | Difference > 2 TDL? | Not applicable | Not applicable | No - acceptable |

34 Qualifiers are defined on page 3.

**Attachment 1. 124-N-2 Waste Site Verification Sample Results (Metals).**

| Sample Area | HEIS Number | Sample Date | Aluminum | | | Antimony | | | Arsenic | | | Barium | | | Beryllium | | | Boron | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL |
| EXC-7 | J1RMJ4 | 5/14/2013 | 2770 | X | 1.4 | 0.34 | UJ | 0.34 | 1.0 | | 0.59 | 24.3 | X | 0.068 | 0.28 | | 0.029 | 0.88 | U | 0.88 |
| Duplicate of J1RMJ4 | J1RMK0 | 5/14/2013 | 4890 | X | 1.4 | 0.33 | UJ | 0.33 | 1.8 | | 0.58 | 46.3 | X | 0.067 | 0.37 | | 0.029 | 0.86 | U | 0.86 |
| EXC-1 | J1RMH8 | 5/14/2013 | 5710 | X | 1.4 | 0.34 | UJ | 0.34 | 2.0 | | 0.58 | 56.1 | X | 0.067 | 0.38 | | 0.029 | 0.87 | U | 0.87 |
| EXC-2 | J1RMH9 | 5/14/2013 | 5750 | X | 1.4 | 0.35 | UJ | 0.35 | 1.9 | | 0.61 | 60.8 | X | 0.070 | 0.36 | | 0.030 | 0.90 | U | 0.90 |
| EXC-3 | J1RMJ0 | 5/14/2013 | 6160 | X | 1.5 | 0.37 | UJ | 0.37 | 3.3 | | 0.64 | 44.4 | X | 0.073 | 0.31 | | 0.032 | 0.95 | U | 0.95 |
| EXC-4 | J1RMJ1 | 5/14/2013 | 5760 | X | 1.4 | 0.33 | UJ | 0.33 | 1.9 | | 0.58 | 50.1 | X | 0.067 | 0.30 | | 0.029 | 0.86 | U | 0.86 |
| EXC-5 | J1RMJ2 | 5/14/2013 | 4600 | X | 1.5 | 0.37 | UJ | 0.37 | 1.4 | | 0.64 | 46.8 | X | 0.074 | 0.37 | | 0.032 | 0.96 | U | 0.96 |
| EXC-6 | J1RMJ3 | 5/14/2013 | 7150 | X | 1.5 | 0.37 | UJ | 0.37 | 2.1 | | 0.64 | 54.1 | X | 0.074 | 0.33 | | 0.032 | 1.1 | B | 0.95 |
| EXC-8 | J1RMJ5 | 5/14/2013 | 5130 | X | 1.4 | 0.35 | UJ | 0.35 | 2.1 | | 0.62 | 51.3 | X | 0.071 | 0.40 | | 0.031 | 0.92 | U | 0.92 |
| EXC-9 | J1RMJ6 | 5/14/2013 | 5980 | X | 1.6 | 0.38 | UJ | 0.38 | 1.9 | | 0.67 | 46.2 | X | 0.077 | 0.31 | | 0.033 | 0.99 | U | 0.99 |
| EXC-10 | J1RMJ7 | 5/14/2013 | 5730 | X | 1.5 | 0.36 | UJ | 0.36 | 2.1 | | 0.63 | 49.3 | X | 0.072 | 0.39 | | 0.031 | 0.93 | U | 0.93 |
| EXC-11 | J1RMJ8 | 5/14/2013 | 5270 | X | 1.5 | 0.36 | UJ | 0.36 | 2.1 | | 0.62 | 92.2 | X | 0.071 | 0.39 | | 0.031 | 0.92 | U | 0.92 |
| EXC-12 | J1RMJ9 | 5/14/2013 | 7240 | X | 1.5 | 0.36 | UJ | 0.36 | 2.9 | | 0.62 | 57.3 | X | 0.072 | 0.31 | | 0.031 | 0.96 | B | 0.93 |
| Split of J1RMJ4 | J1RMK1 | 5/14/2013 | 3940 | | 27 | 1.2 | UN | 1.2 | 1.1 | B | 0.61 | 37.3 | | 0.48 | 0.33 | U | 0.33 | 2.9 | UN | 2.9 |
| Equipment Blank | J1RMK2 | 5/14/2013 | 194 | X | 1.3 | 0.33 | UJ | 0.33 | 0.57 | U | 0.57 | 1.9 | X | 0.066 | 0.085 | B | 0.029 | 0.85 | U | 0.85 |

| Sample Area | HEIS Number | Sample Date | Cadmium | | | Calcium | | | Chromium | | | Cobalt | | | Copper | | | Iron | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL |
| EXC-7 | J1RMJ4 | 5/14/2013 | 0.14 | B | 0.037 | 2880 | X | 12.6 | 4.1 | X | 0.052 | 4.7 | X | 0.089 | 9.4 | X | 0.19 | 14900 | X | 3.4 |
| Duplicate of J1RMJ4 | J1RMK0 | 5/14/2013 | 0.18 | | 0.036 | 5740 | X | 12.4 | 5.9 | X | 0.051 | 7.4 | X | 0.088 | 14.8 | X | 0.19 | 20900 | X | 3.3 |
| EXC-1 | J1RMH8 | 5/14/2013 | 0.20 | | 0.036 | 6410 | X | 12.5 | 8.1 | X | 0.051 | 7.4 | X | 0.088 | 14.9 | X | 0.19 | 20900 | X | 3.4 |
| EXC-2 | J1RMH9 | 5/14/2013 | 0.21 | | 0.038 | 5680 | X | 13.0 | 9.2 | X | 0.053 | 7.1 | X | 0.092 | 14.7 | X | 0.20 | 18900 | X | 3.5 |
| EXC-3 | J1RMJ0 | 5/14/2013 | 0.17 | B | 0.040 | 6010 | X | 13.6 | 12.6 | X | 0.056 | 5.9 | X | 0.097 | 14.0 | X | 0.21 | 15700 | X | 3.7 |
| EXC-4 | J1RMJ1 | 5/14/2013 | 0.18 | | 0.036 | 6180 | X | 12.3 | 9.6 | X | 0.051 | 5.7 | X | 0.088 | 13.8 | X | 0.19 | 15700 | X | 3.3 |
| EXC-5 | J1RMJ2 | 5/14/2013 | 0.18 | B | 0.040 | 5180 | X | 13.7 | 4.6 | X | 0.057 | 8.3 | X | 0.098 | 15.2 | X | 0.21 | 23100 | X | 3.7 |
| EXC-6 | J1RMJ3 | 5/14/2013 | 0.19 | | 0.040 | 5780 | X | 13.7 | 11.1 | X | 0.056 | 6.2 | X | 0.097 | 14.8 | X | 0.21 | 16800 | X | 3.7 |
| EXC-8 | J1RMJ5 | 5/14/2013 | 0.24 | | 0.038 | 5960 | X | 13.2 | 7.0 | X | 0.054 | 7.9 | X | 0.093 | 17.2 | X | 0.20 | 22900 | X | 3.5 |
| EXC-9 | J1RMJ6 | 5/14/2013 | 0.18 | B | 0.041 | 6260 | X | 14.3 | 10.7 | X | 0.059 | 5.7 | X | 0.10 | 13.7 | X | 0.22 | 15000 | X | 3.8 |
| EXC-10 | J1RMJ7 | 5/14/2013 | 0.24 | | 0.039 | 7540 | X | 13.4 | 6.9 | X | 0.055 | 8.0 | X | 0.095 | 18.4 | X | 0.21 | 23300 | X | 3.6 |
| EXC-11 | J1RMJ8 | 5/14/2013 | 0.24 | | 0.039 | 7680 | X | 13.3 | 6.8 | X | 0.055 | 8.3 | X | 0.094 | 16.7 | X | 0.20 | 23600 | X | 3.6 |
| EXC-12 | J1RMJ9 | 5/14/2013 | 0.24 | | 0.039 | 4580 | X | 13.3 | 12.6 | X | 0.055 | 5.1 | X | 0.095 | 10.5 | X | 0.21 | 15300 | X | 3.6 |
| Split of J1RMJ4 | J1RMK1 | 5/14/2013 | 0.19 | U | 0.19 | 6370 | | 25.6 | 5.1 | | 0.59 | 7.1 | B | 1.8 | 12.7 | | 1.4 | 17900 | | 5.7 |
| Equipment Blank | J1RMK2 | 5/14/2013 | 0.036 | U | 0.036 | 37.7 | BX | 12.3 | 0.11 | BX | 0.050 | 0.25 | BX | 0.087 | 0.49 | BX | 0.19 | 1790 | X | 3.3 |

Acronyms and notes apply to all of the tables in this attachment.

[a] Entire data from the first statistical sampling campaign are provided for informational purposes only.

Note: Data qualified with B, D J, M, N, P and/or X are considered acceptable values.

B = Estimated result. Result is less than the RL, but greater than the MDL.

HEIS = Hanford Environmental Information System

D = obtained from dilution.

EXC = excavation

J = estimate

M = sample duplicate precision not met.

MDA = minimum detected activity

N= recovery exceeds upper or lower control limits

P = aroclor flag, greater than 25% difference for detected concentrations between the two GC columns.

PAH = polycyclic aromatic hydrocarbons

PCB = polychlorinated biphenyls

PEST = pesticide

PQL = practical quantitation limit

Q = qualifier

RAG = remedial action goal

RSVP = remaining site verification package

TPH = total petroleum hydrocarbons

U = undetected

X (metals) = serial dilution in the analytical batch indicates that physical and chemical interferences are present.

X (organics) = More than 40% difference between columns, lower result reported.

| | | | |
|---|---|---|---|
| Attachment | 1 | Sheet No. | 1 of 17 |
| Originator | N. K. Schiffern | Date | 06/12/13 |
| Checked | I. B. Berezovskiy | Date | 06/12/13 |
| Calc. No. | 0100N-CA-V0189 | Rev. No. | 0 |

**Attachment 1. 124-N-2 Waste Site Verification Sample Results (Metals).**

| Sample Area | HEIS Number | Sample Date | Lead | | | Lithium | | | Magnesium | | | Manganese | | | Mercury | | | Molybdenum | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL |
| EXC-7 | J1RMJ4 | 5/14/2013 | 4.6 | | 0.24 | | | | 2330 | X | 3.3 | 179 | X | 0.089 | 0.0053 | U | 0.0053 | 0.25 | B | 0.23 |
| Duplicate of J1RMJ4 | J1RMK0 | 5/14/2013 | 3.3 | | 0.24 | | | | 3810 | X | 3.3 | 272 | X | 0.088 | 0.0061 | U | 0.0061 | 0.23 | U | 0.23 |
| EXC-1 | J1RMH8 | 5/14/2013 | 6.9 | | 0.24 | | | | 4230 | X | 3.3 | 299 | X | 0.088 | 0.0053 | U | 0.0053 | 0.25 | B | 0.23 |
| EXC-2 | J1RMH9 | 5/14/2013 | 5.1 | | 0.25 | | | | 3980 | X | 3.4 | 336 | X | 0.092 | 0.0052 | U | 0.0052 | 0.29 | B | 0.24 |
| EXC-3 | J1RMJ0 | 5/14/2013 | 4.8 | | 0.26 | | | | 3740 | X | 3.6 | 250 | X | 0.097 | 0.0051 | U | 0.0051 | 0.26 | B | 0.25 |
| EXC-4 | J1RMJ1 | 5/14/2013 | 6.8 | | 0.24 | | | | 3560 | X | 3.2 | 258 | X | 0.088 | 0.0047 | U | 0.0047 | 0.24 | B | 0.23 |
| EXC-5 | J1RMJ2 | 5/14/2013 | 3.2 | | 0.26 | | | | 4460 | X | 3.6 | 308 | X | 0.098 | 0.0057 | U | 0.0057 | 0.25 | U | 0.25 |
| EXC-6 | J1RMJ3 | 5/14/2013 | 4.9 | | 0.26 | | | | 4040 | X | 3.6 | 273 | X | 0.097 | 0.0048 | U | 0.0048 | 0.25 | U | 0.25 |
| EXC-8 | J1RMJ5 | 5/14/2013 | 12.8 | | 0.25 | | | | 4090 | X | 3.5 | 304 | X | 0.093 | 0.0055 | U | 0.0055 | 0.24 | B | 0.24 |
| EXC-9 | J1RMJ6 | 5/14/2013 | 3.4 | | 0.27 | | | | 3940 | X | 3.7 | 248 | X | 0.10 | 0.0048 | U | 0.0048 | 0.26 | U | 0.26 |
| EXC-10 | J1RMJ7 | 5/14/2013 | 5.9 | | 0.26 | | | | 4700 | X | 3.5 | 330 | X | 0.095 | 0.0079 | B | 0.0063 | 0.25 | U | 0.25 |
| EXC-11 | J1RMJ8 | 5/14/2013 | 19.2 | | 0.25 | | | | 4350 | X | 3.5 | 442 | X | 0.094 | 0.0050 | U | 0.0050 | 0.30 | B | 0.24 |
| EXC-12 | J1RMJ9 | 5/14/2013 | 5.1 | | 0.26 | | | | 4070 | X | 3.5 | 227 | X | 0.095 | 0.0055 | U | 0.0055 | 0.25 | U | 0.25 |
| Split of J1RMJ4 | J1RMK1 | 5/14/2013 | 4.2 | | 0.33 | 3.6 | B | 1.3 | 3300 | N | 16.0 | 240 | | 0.30 | 0.017 | B | 0.011 | 0.61 | U | 0.61 |
| Equipment Blank | J1RMK2 | 5/14/2013 | 0.65 | | 0.23 | | | | 21 | X | 3.2 | 58.6 | X | 0.087 | 0.0054 | U | 0.0054 | 0.23 | U | 0.23 |

| Sample Area | HEIS Number | Sample Date | Nickel | | | Potassium | | | Selenium | | | Silicon | | | Silver | | | Sodium | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL |
| EXC-7 | J1RMJ4 | 5/14/2013 | 5.0 | X | 0.11 | 396 | | 36.6 | 0.77 | U | 0.77 | 147 | J | 5.1 | 0.14 | U | 0.14 | 175 | | 52.7 |
| Duplicate of J1RMJ4 | J1RMK0 | 5/14/2013 | 8.5 | X | 0.11 | 733 | | 36.1 | 0.76 | U | 0.76 | 215 | J | 5.0 | 0.14 | U | 0.14 | 266 | | 51.9 |
| EXC-1 | J1RMH8 | 5/14/2013 | 10.3 | X | 0.11 | 866 | | 36.2 | 0.76 | U | 0.76 | 204 | J | 5.0 | 0.14 | U | 0.14 | 277 | | 52.1 |
| EXC-2 | J1RMH9 | 5/14/2013 | 11.0 | X | 0.11 | 880 | | 37.7 | 0.79 | U | 0.79 | 197 | J | 5.2 | 0.15 | U | 0.15 | 231 | | 54.2 |
| EXC-3 | J1RMJ0 | 5/14/2013 | 12.7 | X | 0.12 | 892 | | 39.6 | 0.83 | U | 0.83 | 176 | J | 5.5 | 0.15 | U | 0.15 | 189 | | 57.0 |
| EXC-4 | J1RMJ1 | 5/14/2013 | 10.6 | X | 0.11 | 856 | | 35.9 | 0.75 | U | 0.75 | 196 | J | 5.0 | 0.14 | U | 0.14 | 222 | | 51.7 |
| EXC-5 | J1RMJ2 | 5/14/2013 | 7.7 | X | 0.12 | 624 | | 40.0 | 0.84 | U | 0.84 | 188 | J | 5.5 | 0.16 | U | 0.16 | 274 | | 57.5 |
| EXC-6 | J1RMJ3 | 5/14/2013 | 13.4 | X | 0.12 | 1180 | | 39.8 | 0.83 | U | 0.83 | 206 | J | 5.5 | 0.16 | U | 0.16 | 209 | | 57.2 |
| EXC-8 | J1RMJ5 | 5/14/2013 | 8.4 | X | 0.11 | 911 | | 38.3 | 0.80 | U | 0.80 | 169 | J | 5.3 | 0.15 | U | 0.15 | 262 | | 55.1 |
| EXC-9 | J1RMJ6 | 5/14/2013 | 13.1 | X | 0.12 | 835 | | 41.4 | 0.87 | U | 0.87 | 158 | J | 5.7 | 0.16 | U | 0.16 | 199 | | 59.6 |
| EXC-10 | J1RMJ7 | 5/14/2013 | 9.0 | X | 0.12 | 917 | | 39.1 | 0.82 | U | 0.82 | 199 | J | 5.4 | 0.15 | U | 0.15 | 258 | | 56.3 |
| EXC-11 | J1RMJ8 | 5/14/2013 | 12.1 | X | 0.12 | 835 | | 38.5 | 0.81 | U | 0.81 | 193 | J | 5.3 | 0.15 | U | 0.15 | 261 | | 55.5 |
| EXC-12 | J1RMJ9 | 5/14/2013 | 11.6 | X | 0.12 | 1270 | | 38.8 | 0.81 | U | 0.81 | 211 | J | 5.4 | 0.15 | U | 0.15 | 210 | | 55.9 |
| Split of J1RMJ4 | J1RMK1 | 5/14/2013 | 6.4 | B | 0.43 | 649 | UN | 649 | 0.56 | U | 0.56 | 731 | N | 3.0 | 0.45 | U | 0.45 | 213 | | 90.7 |
| Equipment Blank | J1RMK2 | 5/14/2013 | 0.82 | BX | 0.11 | 35.7 | B | 35.7 | 0.75 | U | 0.75 | 101 | J | 4.9 | 0.14 | U | 0.14 | 51.3 | U | 51.3 |

| | | | |
|---|---|---|---|
| Attachment | 1 | Sheet No. | 2 of 17 |
| Originator | N. K. Schiffern | Date | 06/11/13 |
| Checked | I. B. Berezovskiy | Date | 06/11/13 |
| Calc. No. | 0100N-CA-V0189 | Rev. No. | 0 |

**Attachment 1. 124-N-2 Waste Site Verification Sample Results (Metals).**

| Sample Area | HEIS Number | Sample Date | Vanadium | | | Zinc | | |
|---|---|---|---|---|---|---|---|---|
| | | | mg/kg | Q | PQL | mg/kg | Q | PQL |
| EXC-7 | J1RMJ4 | 5/14/2013 | 50.0 | X | 0.084 | 30.8 | X | 0.36 |
| Duplicate of J1RMJ4 | J1RMK0 | 5/14/2013 | 55.7 | X | 0.083 | 41.5 | X | 0.35 |
| EXC-1 | J1RMH8 | 5/14/2013 | 51.2 | X | 0.083 | 40.9 | X | 0.35 |
| EXC-2 | J1RMH9 | 5/14/2013 | 46.6 | X | 0.086 | 41.8 | X | 0.37 |
| EXC-3 | J1RMJ0 | 5/14/2013 | 33.7 | X | 0.091 | 38.9 | X | 0.38 |
| EXC-4 | J1RMJ1 | 5/14/2013 | 36.7 | X | 0.082 | 38.8 | X | 0.35 |
| EXC-5 | J1RMJ2 | 5/14/2013 | 55.8 | X | 0.092 | 42.3 | X | 0.39 |
| EXC-6 | J1RMJ3 | 5/14/2013 | 37.4 | X | 0.091 | 37.8 | X | 0.39 |
| EXC-8 | J1RMJ5 | 5/14/2013 | 59.8 | X | 0.088 | 52.9 | X | 0.37 |
| EXC-9 | J1RMJ6 | 5/14/2013 | 33.3 | X | 0.095 | 34.8 | X | 0.40 |
| EXC-10 | J1RMJ7 | 5/14/2013 | 56.0 | X | 0.090 | 58.2 | X | 0.38 |
| EXC-11 | J1RMJ8 | 5/14/2013 | 60.6 | X | 0.088 | 49.2 | X | 0.37 |
| EXC-12 | J1RMJ9 | 5/14/2013 | 33.4 | X | 0.089 | 35.8 | X | 0.38 |
| Split of J1RMJ4 | J1RMK1 | 5/14/2013 | 46.7 | | 2.4 | 46.5 | | 3.8 |
| Equipment Blank | J1RMK2 | 5/14/2013 | 1.3 | BX | 0.082 | 2.9 | X | 0.35 |

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|---|---|---|---|
| Attachment | 1 | Sheet No. | 3 of 17 |
| Originator | N. K. Schiffern | Date | 06/11/13 |
| Checked | I. B. Berezovskiy | Date | 06/11/13 |
| Calc. No. | 0100N-CA-V0189 | Rev. No. | 0 |

**Attachment 1. 124-N-2 Waste Site Verification Sample Results (Anions, Physical, and TPH).**

| Sample Area | HEIS Number | Sample Date | Bromide | | | Chloride | | | Fluoride | | | Nitrogen in Nitrate | | | Nitrogen in Nitrite and Nitrate | | | Nitrogen in Nitrite | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL |
| EXC-7 | J1RMJ4 | 5/14/2013 | 0.38 | U | 0.38 | 11.4 | | 1.9 | 0.81 | UJ | 0.81 | 0.75 | BJ | 0.31 | 0.55 | B | 0.30 | 0.33 | UJ | 0.33 |
| Duplicate of J1RMJ4 | J1RMK0 | 5/14/2013 | 0.38 | U | 0.38 | 9.5 | | 1.9 | 0.85 | BJ | 0.81 | 1.1 | BJ | 0.31 | 0.29 | U | 0.29 | 0.33 | UJ | 0.33 |
| EXC-1 | J1RMH8 | 5/14/2013 | 0.39 | U | 0.39 | 4.8 | B | 2.0 | 0.83 | UNJ | 0.83 | 1.1 | BJ | 0.32 | 1.2 | M | 0.30 | 0.34 | UJ | 0.34 |
| EXC-2 | J1RMH9 | 5/14/2013 | 0.37 | U | 0.37 | 5.5 | | 1.9 | 0.79 | UJ | 0.79 | 0.95 | BJ | 0.30 | 0.62 | B | 0.29 | 0.32 | UJ | 0.32 |
| EXC-3 | J1RMJ0 | 5/14/2013 | 0.39 | U | 0.39 | 4.5 | B | 2.0 | 0.83 | UJ | 0.83 | 1.3 | BJ | 0.32 | 0.35 | B | 0.30 | 0.34 | UJ | 0.34 |
| EXC-4 | J1RMJ1 | 5/14/2013 | 0.38 | U | 0.38 | 10.9 | | 1.9 | 0.81 | UJ | 0.81 | 1.6 | BJ | 0.31 | 1.7 | | 0.30 | 0.33 | UJ | 0.33 |
| EXC-5 | J1RMJ2 | 5/14/2013 | 0.38 | U | 0.38 | 6.3 | | 1.9 | 0.80 | UJ | 0.80 | 1.2 | BJ | 0.31 | 1.5 | | 0.29 | 0.33 | UJ | 0.33 |
| EXC-6 | J1RMJ3 | 5/14/2013 | 0.38 | U | 0.38 | 4.7 | B | 1.9 | 0.80 | UJ | 0.80 | 0.67 | BJ | 0.31 | 0.45 | B | 0.29 | 0.33 | UJ | 0.33 |
| EXC-8 | J1RMJ5 | 5/14/2013 | 0.38 | U | 0.38 | 8.3 | | 1.9 | 0.80 | UJ | 0.80 | 0.83 | BJ | 0.30 | 0.87 | | 0.29 | 0.33 | UJ | 0.33 |
| EXC-9 | J1RMJ6 | 5/14/2013 | 0.38 | U | 0.38 | 6.1 | | 2.0 | 1.1 | BJ | 0.82 | 0.31 | UJ | 0.31 | 0.30 | U | 0.30 | 0.33 | UJ | 0.33 |
| EXC-10 | J1RMJ7 | 5/14/2013 | 0.39 | U | 0.39 | 8.7 | | 2.0 | 0.84 | BJ | 0.83 | 0.32 | UJ | 0.32 | 0.30 | U | 0.30 | 0.34 | UJ | 0.34 |
| EXC-11 | J1RMJ8 | 5/14/2013 | 0.39 | U | 0.39 | 7.7 | | 2.0 | 0.83 | UJ | 0.83 | 1.2 | BJ | 0.32 | 0.39 | B | 0.30 | 0.34 | UJ | 0.34 |
| EXC-12 | J1RMJ9 | 5/14/2013 | 0.39 | U | 0.39 | 7.2 | | 2.0 | 0.96 | BNJ | 0.82 | 0.31 | UJ | 0.31 | 0.30 | U | 0.30 | 0.33 | UJ | 0.33 |
| Split of J1RMJ4 | J1RMK1 | 5/14/2013 | 0.25 | U | 0.25 | 10.0 | | 0.20 | 0.27 | B | 0.10 | 0.60 | | 0.041 | 0.66 | MN | 0.047 | 0.031 | U | 0.031 |
| Equipment Blank | J1RMK2 | 5/14/2013 | | | | | | | | | | | | | | | | | | |

| Sample Area | HEIS Number | Sample Date | Phosphate | | | Phosphorous in Phosphate | | | Sulfate | | | TPH - Diesel | | | TPH - Diesel EXT | | | TPH - motor oil (high boiling) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL |
| EXC-7 | J1RMJ4 | 5/14/2013 | | | | 1.2 | UJ | 1.2 | 26.3 | | 1.7 | 27000 | J | 670 | 37000 | J | 990 | | | |
| Duplicate of J1RMJ4 | J1RMK0 | 5/14/2013 | | | | 1.2 | UJ | 1.2 | 19.9 | | 1.7 | 60000 | J | 670 | 79000 | J | 990 | | | |
| EXC-1 | J1RMH8 | 5/14/2013 | | | | 1.5 | BMNJ | 1.2 | 45.1 | | 1.7 | 35000 | J | 680 | 50000 | J | 1000 | | | |
| EXC-2 | J1RMH9 | 5/14/2013 | | | | 2.3 | BJ | 1.2 | 35.3 | | 1.7 | 39000 | J | 660 | 55000 | J | 970 | | | |
| EXC-3 | J1RMJ0 | 5/14/2013 | | | | 1.3 | UJ | 1.3 | 11.0 | | 1.8 | 38000 | J | 690 | 50000 | J | 1000 | | | |
| EXC-4 | J1RMJ1 | 5/14/2013 | | | | 1.2 | UJ | 1.2 | 70.0 | | 1.7 | 44000 | J | 680 | 66000 | J | 1000 | | | |
| EXC-5 | J1RMJ2 | 5/14/2013 | | | | 1.2 | UJ | 1.2 | 43.7 | | 1.7 | 13000 | | 670 | 20000 | | 980 | | | |
| EXC-6 | J1RMJ3 | 5/14/2013 | | | | 1.2 | UJ | 1.2 | 7.4 | | 1.7 | 5600 | | 690 | 8300 | | 1000 | | | |
| EXC-8 | J1RMJ5 | 5/14/2013 | | | | 1.2 | UJ | 1.2 | 32.0 | | 1.7 | 34000 | J | 680 | 48000 | J | 1000 | | | |
| EXC-9 | J1RMJ6 | 5/14/2013 | | | | 1.2 | UJ | 1.2 | 11.8 | | 1.7 | 12000 | | 680 | 16000 | | 990 | | | |
| EXC-10 | J1RMJ7 | 5/14/2013 | | | | 1.3 | UJ | 1.3 | 42.2 | | 1.7 | 63000 | J | 690 | 91000 | J | 1000 | | | |
| EXC-11 | J1RMJ8 | 5/14/2013 | | | | 1.3 | UJ | 1.3 | 25.1 | | 1.8 | 51000 | J | 680 | 70000 | J | 1000 | | | |
| EXC-12 | J1RMJ9 | 5/14/2013 | | | | 1.2 | UNJ | 1.2 | 31.9 | | 1.7 | 30000 | J | 680 | 43000 | J | 990 | | | |
| Split of J1RMJ4 | J1RMK1 | 5/14/2013 | 6.1 | | 0.40 | | | | 36.5 | | 0.51 | 340 | U | 340 | | | | 17000 | J | 650 |
| Equipment Blank | J1RMK2 | 5/14/2013 | | | | | | | | | | | | | | | | | | |

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|---|---|---|---|
| Attachment | 1 | Sheet No. | 4 of 17 |
| Originator | N. K. Schiffern | Date | 06/11/13 |
| Checked | I. B. Berezovskiy | Date | 06/11/13 |
| Calc. No. | 0100N-CA-V0189 | Rev. No. | 0 |

**Attachment 1. 124-N-2 Waste Site Verification Sample Results (Physicals).**

| Sample Area | HEIS Number | Sample Date | Percent moisture (wet sample) | | | Percent Solids | | | pH Measurement | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | % | Q | PQL | % | Q | PQL | pH | Q | PQL |
| EXC-7 | J1RMJ4 | 5/14/2013 | | | | 1.8 | | 0.10 | 9.14 | J | 0.100 |
| Duplicate of J1RMJ4 | J1RMK0 | 5/14/2013 | | | | 1.2 | | 0.10 | 9.23 | J | 0.100 |
| EXC-1 | J1RMH8 | 5/14/2013 | | | | 1.5 | | 0.10 | 7.25 | J | 0.100 |
| EXC-2 | J1RMH9 | 5/14/2013 | | | | 1.0 | | 0.10 | 6.23 | J | 0.100 |
| EXC-3 | J1RMJ0 | 5/14/2013 | | | | 2.3 | | 0.10 | 8.61 | J | 0.100 |
| EXC-4 | J1RMJ1 | 5/14/2013 | | | | 1.5 | | 0.10 | 8.48 | J | 0.100 |
| EXC-5 | J1RMJ2 | 5/14/2013 | | | | 1.4 | | 0.10 | 8.65 | J | 0.100 |
| EXC-6 | J1RMJ3 | 5/14/2013 | | | | 2.7 | | 0.10 | 9.05 | J | 0.100 |
| EXC-8 | J1RMJ5 | 5/14/2013 | | | | 1.8 | | 0.10 | 9.28 | J | 0.100 |
| EXC-9 | J1RMJ6 | 5/14/2013 | | | | 3.0 | | 0.10 | 9.28 | J | 0.100 |
| EXC-10 | J1RMJ7 | 5/14/2013 | | | | 2.0 | | 0.10 | 9.15 | J | 0.100 |
| EXC-11 | J1RMJ8 | 5/14/2013 | | | | 1.5 | | 0.10 | 9.31 | J | 0.100 |
| EXC-12 | J1RMJ9 | 5/14/2013 | | | | 1.3 | | 0.10 | 9.20 | J | 0.100 |
| Split of J1RMJ4 | J1RMK1 | 5/14/2013 | 98.3 | | 0.10 | 1.7 | | 0.10 | 8.49 | | 0.100 |
| Equipment Blank | J1RMK2 | 5/14/2013 | | | | 0.10 | U | 0.10 | | | |

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|---|---|---|---|
| Attachment | 1 | Sheet No. | 5 of 17 |
| Originator | N. K. Schiffern | Date | 06/11/13 |
| Checked | I. B. Berezovskiy | Date | 06/11/13 |
| Calc. No. | 0100N-CA-V0189 | Rev. No. | 0 |

**Attachment 1. 124-N-2 Waste Site Verification Sample Results (Organics).**

| CONSTITUENT | CLASS | J1RMJ4, EXC-7 | | | J1RMK0, Duplicate of J1RMJ4 | | | J1RMH8, EXC-1 | | | J1RMH9, EXC-2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5/14/2013 | | | 5/14/2013 | | | 5/14/2013 | | | 5/14/2013 | | |
| | | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL |
| Acenaphthene | PAH | 130 | X | 9.4 | 310 | X | 9.8 | 130 | X | 10 | 530 | X | 9.7 |
| Acenaphthylene | PAH | 8.4 | U | 8.4 | 8.8 | U | 8.8 | 9.0 | U | 9.0 | 8.7 | U | 8.7 |
| Anthracene | PAH | 190 | X | 2.9 | 640 | | 3.0 | 210 | | 3.0 | 1300 | | 2.9 |
| Benzo(a)anthracene | PAH | 600 | J | 3.0 | 950 | J | 3.1 | 630 | J | 3.2 | 2300 | J | 3.1 |
| Benzo(a)pyrene | PAH | 420 | | 6.0 | 550 | X | 6.3 | 420 | | 6.4 | 1300 | | 6.2 |
| Benzo(b)fluoranthene | PAH | 470 | X | 3.9 | 710 | X | 4.1 | 490 | | 4.2 | 1400 | | 4.1 |
| Benzo(ghi)perylene | PAH | 200 | | 6.7 | 400 | | 7.1 | 200 | | 7.2 | 610 | | 7.0 |
| Benzo(k)fluoranthene | PAH | 190 | | 3.7 | 270 | | 3.9 | 240 | | 3.9 | 540 | | 3.8 |
| Chrysene | PAH | 680 | J | 4.5 | 1100 | J | 4.8 | 700 | J | 4.8 | 2200 | J | 4.7 |
| Dibenz[a,h]anthracene | PAH | 39 | X | 10 | 88 | X | 11 | 11 | U | 11 | 130 | X | 11 |
| Fluoranthene | PAH | 1100 | J | 12 | 2100 | J | 13 | 1300 | J | 13 | 4900 | J | 13 |
| Fluorene | PAH | 110 | | 4.9 | 250 | | 5.2 | 100 | | 5.3 | 500 | | 5.1 |
| Indeno(1,2,3-cd)pyrene | PAH | 150 | X | 11 | 300 | | 12 | 150 | X | 12 | 540 | | 12 |
| Naphthalene | PAH | 11 | U | 11 | 12 | U | 12 | 12 | U | 12 | 12 | U | 12 |
| Phenanthrene | PAH | 540 | J | 11 | 1500 | J | 12 | 440 | J | 12 | 2900 | J | 12 |
| Pyrene | PAH | 1100 | J | 11 | 2200 | J | 12 | 1200 | J | 12 | 4700 | J | 12 |
| Aroclor-1016 | PCB | 2.7 | UJ | 2.7 | 2.7 | UJ | 2.7 | 2.8 | U | 2.8 | 2.8 | UJ | 2.8 |
| Aroclor-1221 | PCB | 7.9 | UJ | 7.9 | 7.9 | UJ | 7.9 | 8.0 | U | 8.0 | 8.0 | UJ | 8.0 |
| Aroclor-1232 | PCB | 2.0 | UJ | 2.0 | 2.0 | UJ | 2.0 | 2.0 | U | 2.0 | 2.0 | UJ | 2.0 |
| Aroclor-1242 | PCB | 4.6 | UJ | 4.6 | 4.6 | UJ | 4.6 | 4.7 | U | 4.7 | 4.6 | UJ | 4.6 |
| Aroclor-1248 | PCB | 4.6 | UJ | 4.6 | 4.6 | UJ | 4.6 | 4.7 | U | 4.7 | 4.6 | UJ | 4.6 |
| Aroclor-1254 | PCB | 9.2 | J | 2.6 | 6.9 | J | 2.6 | 35 | | 2.6 | 30 | J | 2.6 |
| Aroclor-1260 | PCB | 2.6 | UJ | 2.6 | 2.6 | UJ | 2.6 | 2.6 | U | 2.6 | 2.6 | UJ | 2.6 |

| CONSTITUENT | CLASS | J1RMJ0, EXC-3 | | | J1RMJ1, EXC-4 | | | J1RMJ2, EXC-5 | | | J1RMJ3, EXC-6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5/14/2013 | | | 5/14/2013 | | | 5/14/2013 | | | 5/14/2013 | | |
| | | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL |
| Acenaphthene | PAH | 250 | X | 10 | 220 | X | 10 | 31 | JX | 9.9 | 9.9 | U | 9.9 |
| Acenaphthylene | PAH | 9.0 | UN | 9.0 | 9.1 | U | 9.1 | 8.9 | U | 8.9 | 8.9 | U | 8.9 |
| Anthracene | PAH | 450 | N | 3.1 | 310 | | 3.1 | 27 | X | 3.0 | 3.0 | U | 3.0 |
| Benzo(a)anthracene | PAH | 1100 | NJ | 3.2 | 980 | J | 3.2 | 130 | J | 3.2 | 3.2 | U | 3.2 |
| Benzo(a)pyrene | PAH | 520 | N | 6.4 | 620 | | 6.5 | 65 | | 6.4 | 7.0 | J | 6.3 |
| Benzo(b)fluoranthene | PAH | 610 | N | 4.2 | 670 | | 4.3 | 96 | | 4.2 | 6.5 | JX | 4.2 |
| Benzo(ghi)perylene | PAH | 230 | | 7.2 | 330 | | 7.3 | 40 | | 7.2 | 7.1 | U | 7.1 |
| Benzo(k)fluoranthene | PAH | 250 | N | 4.0 | 280 | | 4.0 | 26 | | 3.9 | 3.9 | U | 3.9 |
| Chrysene | PAH | 1000 | NJ | 4.9 | 1000 | J | 4.9 | 160 | J | 4.8 | 16 | J | 4.8 |
| Dibenz[a,h]anthracene | PAH | 11 | U | 11 | 11 | U | 11 | 11 | U | 11 | 11 | U | 11 |
| Fluoranthene | PAH | 2200 | NJ | 13 | 1600 | J | 13 | 210 | J | 13 | 24 | J | 13 |
| Fluorene | PAH | 200 | X | 5.3 | 150 | X | 5.3 | 19 | J | 5.2 | 5.2 | U | 5.2 |
| Indeno(1,2,3-cd)pyrene | PAH | 190 | X | 12 | 300 | | 12 | 38 | | 12 | 12 | U | 12 |
| Naphthalene | PAH | 12 | U | 12 | 12 | U | 12 | 12 | U | 12 | 12 | U | 12 |
| Phenanthrene | PAH | 1100 | NJ | 12 | 820 | J | 12 | 99 | J | 12 | 12 | UJ | 12 |
| Pyrene | PAH | 2000 | NJ | 12 | 1700 | J | 12 | 210 | J | 12 | 24 | J | 12 |
| Aroclor-1016 | PCB | 2.8 | UJ | 2.8 | 2.7 | U | 2.7 | 2.7 | U | 2.7 | 2.8 | U | 2.8 |
| Aroclor-1221 | PCB | 8.0 | UJ | 8.0 | 7.8 | U | 7.8 | 7.9 | U | 7.9 | 8.1 | U | 8.1 |
| Aroclor-1232 | PCB | 2.0 | UJ | 2.0 | 2.0 | U | 2.0 | 2.0 | U | 2.0 | 2.0 | U | 2.0 |
| Aroclor-1242 | PCB | 4.7 | UJ | 4.7 | 4.6 | U | 4.6 | 4.6 | U | 4.6 | 4.7 | U | 4.7 |
| Aroclor-1248 | PCB | 4.7 | UJ | 4.7 | 4.6 | U | 4.6 | 4.6 | U | 4.6 | 4.7 | U | 4.7 |
| Aroclor-1254 | PCB | 2.6 | UJ | 2.6 | 20 | P | 2.5 | 2.6 | U | 2.6 | 2.6 | U | 2.6 |
| Aroclor-1260 | PCB | 2.6 | UJ | 2.6 | 2.5 | U | 2.5 | 2.6 | U | 2.6 | 2.6 | U | 2.6 |

| | | | |
|---|---|---|---|
| Attachment | 1 | Sheet No. | 6 of 17 |
| Originator | N. K. Schiffern | Date | 06/11/13 |
| Checked | I. B. Berezovskiy | Date | 06/11/13 |
| Calc. No. | 0100N-CA-V0189 | Rev. No. | 0 |

**Attachment 1. 124-N-2 Waste Site Verification Sample Results (Organics).**

| CONSTITUENT | CLASS | J1RMJ5, EXC-8 | | | J1RMJ6, EXC-9 | | | J1RMJ7, EXC-10 | | | J1RMJ8, EXC-11 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5/14/2013 | | | 5/14/2013 | | | 5/14/2013 | | | 5/14/2013 | | |
| | | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL |
| Acenaphthene | PAH | 240 | X | 10 | 60 | JX | 9.8 | 580 | X | 10 | 390 | X | 9.4 |
| Acenaphthylene | PAH | 9.0 | U | 9.0 | 8.8 | U | 8.8 | 9.0 | U | 9.0 | 8.5 | U | 8.5 |
| Anthracene | PAH | 320 | | 3.0 | 94 | | 3.0 | 820 | | 3.0 | 540 | | 2.9 |
| Benzo(a)anthracene | PAH | 830 | J | 3.2 | 230 | J | 3.1 | 1500 | J | 3.2 | 920 | J | 3.0 |
| Benzo(a)pyrene | PAH | 540 | | 6.4 | 150 | | 6.3 | 1300 | | 6.4 | 540 | | 6.0 |
| Benzo(b)fluoranthene | PAH | 590 | X | 4.2 | 180 | | 4.1 | 1100 | X | 4.2 | 700 | X | 4.0 |
| Benzo(ghi)perylene | PAH | 290 | | 7.2 | 90 | | 7.0 | 690 | | 7.2 | 210 | X | 6.8 |
| Benzo(k)fluoranthene | PAH | 260 | | 3.9 | 60 | | 3.8 | 510 | | 3.9 | 230 | | 3.7 |
| Chrysene | PAH | 910 | J | 4.8 | 260 | J | 4.7 | 1900 | J | 4.8 | 1100 | J | 4.6 |
| Dibenz[a,h]anthracene | PAH | 62 | X | 11 | 17 | JX | 11 | 190 | X | 11 | 110 | X | 10 |
| Fluoranthene | PAH | 2000 | J | 13 | 410 | J | 13 | 3200 | J | 13 | 2100 | J | 12 |
| Fluorene | PAH | 170 | | 5.3 | 48 | | 5.2 | 430 | | 5.3 | 290 | | 5.0 |
| Indeno(1,2,3-cd)pyrene | PAH | 260 | | 12 | 98 | | 12 | 510 | X | 12 | 490 | | 11 |
| Naphthalene | PAH | 12 | U | 12 | 12 | U | 12 | 12 | U | 12 | 11 | U | 11 |
| Phenanthrene | PAH | 900 | J | 12 | 200 | J | 12 | 2200 | J | 12 | 1600 | J | 11 |
| Pyrene | PAH | 2000 | J | 12 | 480 | J | 12 | 3500 | J | 12 | 2200 | J | 11 |
| Aroclor-1016 | PCB | 2.8 | UJ | 2.8 | 2.7 | UJ | 2.7 | 2.7 | UJ | 2.7 | 2.7 | UJ | 2.7 |
| Aroclor-1221 | PCB | 8.0 | UJ | 8.0 | 8.0 | UJ | 8.0 | 7.9 | UJ | 7.9 | 7.8 | UJ | 7.8 |
| Aroclor-1232 | PCB | 2.0 | UJ | 2.0 | 2.0 | UJ | 2.0 | 2.0 | UJ | 2.0 | 1.9 | UJ | 1.9 |
| Aroclor-1242 | PCB | 4.7 | UJ | 4.7 | 4.6 | UJ | 4.6 | 4.6 | UJ | 4.6 | 4.5 | UJ | 4.5 |
| Aroclor-1248 | PCB | 4.7 | UJ | 4.7 | 4.6 | UJ | 4.6 | 4.6 | UJ | 4.6 | 4.5 | UJ | 4.5 |
| Aroclor-1254 | PCB | 9.4 | JP | 2.6 | 2.6 | UJ | 2.6 | 10 | J | 2.6 | 10 | J | 2.5 |
| Aroclor-1260 | PCB | 2.6 | UJ | 2.6 | 2.6 | UJ | 2.6 | 2.6 | UJ | 2.6 | 2.5 | UJ | 2.5 |

| CONSTITUENT | CLASS | J1RMJ9, EXC-12 | | | J1RMK1, Split of J1RMJ4 | | | J1RMK2, Equipment Blank | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 5/14/2013 | | | 5/14/2013 | | | 5/14/2013 | | |
| | | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL |
| Acenaphthene | PAH | 190 | X | 10 | 1000 | DN | 98 | 9.8 | U | 9.8 |
| Acenaphthylene | PAH | 9.0 | U | 9.0 | 160 | JDN | 140 | 8.8 | U | 8.8 |
| Anthracene | PAH | 250 | | 3.1 | 95 | JDN | 15 | 3.0 | U | 3.0 |
| Benzo(a)anthracene | PAH | 800 | J | 3.2 | 290 | D | 15 | 3.1 | U | 3.1 |
| Benzo(a)pyrene | PAH | 450 | X | 6.4 | 270 | DN | 15 | 6.3 | U | 6.3 |
| Benzo(b)fluoranthene | PAH | 580 | | 4.2 | 260 | DN | 15 | 4.1 | U | 4.1 |
| Benzo(ghi)perylene | PAH | 170 | X | 7.2 | 95 | JDN | 15 | 7.0 | U | 7.0 |
| Benzo(k)fluoranthene | PAH | 220 | | 4.0 | 110 | DN | 15 | 3.9 | U | 3.9 |
| Chrysene | PAH | 900 | J | 4.9 | 380 | D | 15 | 4.7 | U | 4.7 |
| Dibenz[a,h]anthracene | PAH | 67 | | 11 | 30 | UN | 30 | 11 | U | 11 |
| Fluoranthene | PAH | 1500 | J | 13 | 600 | D | 30 | 13 | UJ | 13 |
| Fluorene | PAH | 150 | | 5.3 | 93 | JDN | 30 | 5.2 | U | 5.2 |
| Indeno(1,2,3-cd)pyrene | PAH | 290 | | 12 | 110 | DN | 15 | 12 | U | 12 |
| Naphthalene | PAH | 12 | U | 12 | 610 | DN | 110 | 12 | U | 12 |
| Phenanthrene | PAH | 620 | J | 12 | 260 | DN | 30 | 12 | UJ | 12 |
| Pyrene | PAH | 1700 | J | 12 | 680 | D | 15 | 12 | UJ | 12 |
| Aroclor-1016 | PCB | 2.8 | UJ | 2.8 | 8.9 | U | 8.9 | | | |
| Aroclor-1221 | PCB | 8.1 | UJ | 8.1 | 8.9 | U | 8.9 | | | |
| Aroclor-1232 | PCB | 2.0 | UJ | 2.0 | 8.9 | U | 8.9 | | | |
| Aroclor-1242 | PCB | 4.7 | UJ | 4.7 | 8.9 | U | 8.9 | | | |
| Aroclor-1248 | PCB | 4.7 | UJ | 4.7 | 8.9 | U | 8.9 | | | |
| Aroclor-1254 | PCB | 13 | J | 2.6 | 13 | J | 5.6 | | | |
| Aroclor-1260 | PCB | 2.6 | UJ | 2.6 | 6.2 | J | 5.6 | | | |

| | | | |
|---|---|---|---|
| Attachment | 1 | Sheet No. | 7 of 17 |
| Originator | N. K. Schiffern | Date | 06/12/13 |
| Checked | I. B. Berezovskiy | Date | 06/12/13 |
| Calc. No. | 0100N-CA-V0189 | Rev. No. | 0 |

Attachment 1. 124-N-2 Waste Site Verification Sample Results (Radionuclides) Informational Purposes Only [a].

| Sample Area | HEIS Number | Sample Date | Americium-241 | | | Cesium-137 | | | Cobalt-60 | | | Europium-152 | | | Europium-154 | | | Europium-155 | | | Potassium-40 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | pCi/g | Q | MDA | pCi/g | Q | MDA | pCi/g | Q | MDA | pCi/g | Q | MDA | pCi/g | Q | MDA | pCi/g | Q | MDA | pCi/g | Q | MDA |
| EXC-12 | J1R1R7 | 9/10/2012 | 0.0401 | U | 0.139 | -0.00379 | U | 0.0432 | 0.0161 | U | 0.0490 | -0.0683 | U | 0.102 | -0.0748 | U | 0.131 | -0.0175 | U | 0.103 | | | |
| Duplicate of J1R1R7 | J1R1R8 | 9/10/2012 | 0.00946 | U | 0.0396 | 0.00756 | U | 0.0284 | -0.0130 | U | 0.0297 | -0.00540 | U | 0.0557 | -0.00993 | U | 0.0967 | 0.0721 | U | 0.0578 | | | |
| EXC-1 | J1R1P6 | 9/10/2012 | -0.0340 | U | 0.278 | -0.0143 | U | 0.0305 | 0.00799 | U | 0.0319 | 0.00447 | U | 0.0742 | -0.0211 | U | 0.108 | 0.0279 | U | 0.0915 | | | |
| EXC-2 | J1R1P7 | 9/10/2012 | 0.00671 | U | 0.0347 | 0.0264 | | 0.0243 | 0.00506 | U | 0.0289 | -0.0147 | U | 0.0510 | -0.00610 | U | 0.0817 | 0.0629 | U | 0.0517 | | | |
| EXC-3 | J1R1P8 | 9/10/2012 | 0.0115 | U | 0.0384 | -0.00925 | U | 0.0252 | 0.00338 | U | 0.0302 | 0.00581 | U | 0.0581 | 0.000434 | U | 0.0956 | 0.0642 | U | 0.0560 | | | |
| EXC-4 | J1R1P9 | 9/10/2012 | -0.0234 | U | 0.114 | -0.00340 | U | 0.0265 | 0.0132 | U | 0.0285 | -0.0320 | U | 0.0647 | 0.0159 | U | 0.0844 | -0.00190 | U | 0.0832 | | | |
| EXC-5 | J1R1R0 | 9/10/2012 | 0.0179 | U | 0.139 | 0.00472 | U | 0.0416 | -0.00688 | U | 0.0389 | -0.0111 | U | 0.104 | -0.0169 | U | 0.135 | 0.0671 | U | 0.109 | | | |
| EXC-6 | J1R1R1 | 9/10/2012 | -0.00608 | U | 0.0293 | 0.00983 | U | 0.0236 | -0.0127 | U | 0.0192 | -0.0412 | U | 0.0432 | 0.0196 | U | 0.0757 | 0.0257 | U | 0.0450 | | | |
| EXC-7 | J1R1R2 | 9/10/2012 | -0.00455 | U | 0.0849 | 0.0241 | U | 0.0479 | 0.00691 | U | 0.0452 | -0.0305 | U | 0.111 | -0.0590 | U | 0.137 | 0.0660 | U | 0.117 | | | |
| EXC-8 | J1R1R3 | 9/10/2012 | -0.131 | U | 0.171 | -0.00994 | U | 0.0269 | 0.00685 | U | 0.0313 | 0.0141 | U | 0.0684 | -0.0422 | U | 0.0860 | 0.0180 | U | 0.0767 | | | |
| EXC-9 | J1R1R4 | 9/10/2012 | -0.000573 | U | 0.0279 | 0.0273 | U | 0.0267 | -0.000397 | U | 0.0248 | -0.0264 | U | 0.0441 | -0.0240 | U | 0.0759 | 0.0511 | U | 0.0432 | | | |
| EXC-10 | J1R1R5 | 9/10/2012 | -0.00712 | U | 0.0453 | 0.00679 | U | 0.0284 | 0.00535 | U | 0.0317 | -0.00772 | U | 0.0658 | -0.00914 | U | 0.0912 | -0.0147 | U | 0.0630 | | | |
| EXC-11 | J1R1R6 | 9/10/2012 | 0.0740 | U | 0.0800 | -0.00725 | U | 0.0387 | 0.0256 | U | 0.0425 | -0.0148 | U | 0.100 | 0.123 | U | 0.145 | 0.0276 | U | 0.107 | | | |
| Split of J1R1R7 | J1R1T1 | 9/10/2012 | 0.118 | U | 0.118 | 0.025 | U | 0.025 | 0.022 | U | 0.022 | 0.073 | U | 0.073 | 0.091 | U | 0.091 | 0.093 | U | 0.093 | 18.2 | | 0.243 |

| Sample Area | HEIS Number | Sample Date | Radium-226 | | | Radium-228 | | | Thorium-228 | | | Thorium-232 | | | Uranium-235 | | | Uranium-238 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | pCi/g | Q | MDA | pCi/g | Q | MDA | pCi/g | Q | MDA | pCi/g | Q | MDA | pCi/g | Q | MDA | pCi/g | Q | MDA |
| EXC-12 | J1R1R7 | 9/10/2012 | 0.752 | | 0.0763 | | | | | | | | | | | | | | | |
| Duplicate of J1R1R7 | J1R1R8 | 9/10/2012 | 0.595 | | 0.0464 | | | | | | | | | | | | | | | |
| EXC-1 | J1R1P6 | 9/10/2012 | 0.588 | | 0.0574 | | | | | | | | | | | | | | | |
| EXC-2 | J1R1P7 | 9/10/2012 | 0.598 | | 0.0423 | | | | | | | | | | | | | | | |
| EXC-3 | J1R1P8 | 9/10/2012 | 0.636 | | 0.0388 | | | | | | | | | | | | | | | |
| EXC-4 | J1R1P9 | 9/10/2012 | 0.532 | | 0.0427 | | | | | | | | | | | | | | | |
| EXC-5 | J1R1R0 | 9/10/2012 | 0.666 | | 0.0715 | | | | | | | | | | | | | | | |
| EXC-6 | J1R1R1 | 9/10/2012 | 0.414 | | 0.0388 | | | | | | | | | | | | | | | |
| EXC-7 | J1R1R2 | 9/10/2012 | 0.680 | | 0.0786 | | | | | | | | | | | | | | | |
| EXC-8 | J1R1R3 | 9/10/2012 | 0.559 | | 0.0469 | | | | | | | | | | | | | | | |
| EXC-9 | J1R1R4 | 9/10/2012 | 0.463 | | 0.0378 | | | | | | | | | | | | | | | |
| EXC-10 | J1R1R5 | 9/10/2012 | 0.475 | | 0.0489 | | | | | | | | | | | | | | | |
| EXC-11 | J1R1R6 | 9/10/2012 | 0.492 | | 0.0803 | | | | | | | | | | | | | | | |
| Split of J1R1R7 | J1R1T1 | 9/10/2012 | 0.588 | | 0.051 | 1.10 | | 0.099 | 0.941 | | 0.034 | 1.10 | | 0.099 | 0.186 | U | 0.186 | 3.14 | U | 3.14 |

| | | | |
|---|---|---|---|
| Attachment | 1 | Sheet No. | 8 of 17 |
| Originator | N. K. Schiffern | Date | 06/11/13 |
| Checked | I. B. Berezovskiy | Date | 06/11/13 |
| Calc. No. | 0100N-CA-V0189 | Rev. No. | 0 |

**Attachment 1. 124-N-2 Waste Site Verification Sample Results (Metals) Informational Purposes Only [a].**

| Sample Area | HEIS Number | Sample Date | Aluminum | | | Antimony | | | Arsenic | | | Barium | | | Beryllium | | | Boron | | | Cadmium | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL |
| EXC-12 | J1R1R7 | 9/10/2012 | 8230 | | 1.5 | 0.37 | UJ | 0.37 | 2.7 | | 0.65 | 59.8 | | 0.074 | 0.26 | | 0.032 | 0.96 | U | 0.96 | 0.12 | B | 0.040 |
| Duplicate of J1R1R7 | J1R1R8 | 9/10/2012 | 8090 | | 1.4 | 0.35 | UJ | 0.35 | 2.8 | | 0.61 | 58.1 | | 0.071 | 0.24 | | 0.031 | 0.91 | U | 0.91 | 0.12 | B | 0.038 |
| EXC-1 | J1R1P6 | 9/10/2012 | 8920 | | 1.4 | 0.35 | UJ | 0.35 | 1.7 | | 0.60 | 40.9 | | 0.070 | 0.25 | | 0.030 | 0.90 | U | 0.90 | 0.10 | B | 0.038 |
| EXC-2 | J1R1P7 | 9/10/2012 | 8550 | | 1.4 | 0.35 | UJ | 0.35 | 2.3 | | 0.61 | 70.8 | | 0.070 | 0.24 | | 0.031 | 0.91 | U | 0.91 | 0.19 | | 0.038 |
| EXC-3 | J1R1P8 | 9/10/2012 | 8600 | | 1.4 | 0.34 | UJ | 0.34 | 2.9 | | 0.60 | 84.4 | | 0.069 | 0.25 | | 0.030 | 0.88 | U | 0.88 | 0.15 | B | 0.037 |
| EXC-4 | J1R1P9 | 9/10/2012 | 5550 | | 1.5 | 0.36 | UJ | 0.36 | 2.3 | | 0.62 | 54.7 | | 0.072 | 0.16 | B | 0.031 | 0.92 | U | 0.92 | 0.12 | B | 0.039 |
| EXC-5 | J1R1R0 | 9/10/2012 | 8100 | | 1.5 | 0.37 | UJ | 0.37 | 3.2 | | 0.64 | 60.7 | | 0.073 | 0.26 | | 0.032 | 0.94 | U | 0.94 | 0.18 | B | 0.040 |
| EXC-6 | J1R1R1 | 9/10/2012 | 5920 | | 1.4 | 0.34 | UJ | 0.34 | 2.5 | | 0.59 | 52.1 | | 0.068 | 0.17 | B | 0.030 | 0.88 | U | 0.88 | 0.13 | B | 0.037 |
| EXC-7 | J1R1R2 | 9/10/2012 | 7650 | | 1.5 | 0.37 | UJ | 0.37 | 2.4 | | 0.64 | 55.1 | | 0.074 | 0.24 | | 0.032 | 0.95 | U | 0.95 | 0.14 | B | 0.040 |
| EXC-8 | J1R1R3 | 9/10/2012 | 8020 | | 1.4 | 0.34 | UJ | 0.34 | 3.2 | | 0.58 | 61.8 | | 0.067 | 0.26 | | 0.029 | 0.87 | U | 0.87 | 0.15 | B | 0.036 |
| EXC-9 | J1R1R4 | 9/10/2012 | 5380 | | 1.5 | 0.38 | UJ | 0.38 | 2.5 | | 0.65 | 56.7 | | 0.075 | 0.16 | U | 0.16 | 0.97 | U | 0.97 | 0.15 | B | 0.040 |
| EXC-10 | J1R1R5 | 9/10/2012 | 7680 | | 1.4 | 0.34 | UJ | 0.34 | 2.0 | | 0.59 | 54.8 | | 0.068 | 0.23 | | 0.029 | 0.87 | U | 0.87 | 0.13 | B | 0.037 |
| EXC-11 | J1R1R6 | 9/10/2012 | 7600 | | 1.5 | 0.37 | UJ | 0.37 | 2.5 | | 0.65 | 58.1 | | 0.075 | 0.24 | | 0.032 | 0.96 | U | 0.96 | 0.12 | B | 0.040 |
| Split of J1R1R7 | J1R1T1 | 9/10/2012 | 8400 | | 4.18 | 0.502 | U | 0.502 | 2.71 | | 0.836 | 60.1 | | 0.418 | 0.266 | | 0.167 | 1.35 | B | 1.67 | 0.0644 | B | 0.167 |
| Equipment Blank | J1R1R9 | 9/10/2012 | 246 | | 1.5 | 0.37 | UJ | 0.37 | 0.63 | U | 0.63 | 2.3 | | 0.073 | 0.040 | B | 0.032 | 0.94 | U | 0.94 | 0.039 | U | 0.039 |

| Sample Area | HEIS Number | Sample Date | Calcium | | | Chromium | | | Cobalt | | | Copper | | | Hexavalent Chromium | | | Iron | | | Lead | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL |
| EXC-12 | J1R1R7 | 9/10/2012 | 3380 | | 13.8 | 13.9 | | 0.057 | 5.2 | | 0.098 | 8.8 | | 0.21 | 0.155 | U | 0.155 | 16400 | | 3.7 | 3.9 | | 0.26 |
| Duplicate of J1R1R7 | J1R1R8 | 9/10/2012 | 3240 | | 13.1 | 13.6 | | 0.054 | 5.1 | | 0.093 | 8.9 | | 0.20 | 0.155 | U | 0.155 | 16100 | | 3.5 | 3.9 | | 0.25 |
| EXC-1 | J1R1P6 | 9/10/2012 | 2920 | | 12.9 | 16.1 | | 0.053 | 4.7 | | 0.092 | 9.3 | | 0.20 | 0.289 | | 0.155 | 18200 | | 3.5 | 4.5 | | 0.25 |
| EXC-2 | J1R1P7 | 9/10/2012 | 6250 | | 13.1 | 15.3 | | 0.054 | 7.1 | | 0.093 | 16.3 | | 0.20 | 0.155 | U | 0.155 | 19900 | | 3.5 | 7.6 | | 0.25 |
| EXC-3 | J1R1P8 | 9/10/2012 | 7850 | | 12.7 | 17.0 | | 0.052 | 5.8 | | 0.090 | 12.5 | | 0.20 | 0.155 | U | 0.155 | 17600 | | 3.4 | 4.5 | | 0.24 |
| EXC-4 | J1R1P9 | 9/10/2012 | 6260 | | 13.3 | 7.3 | | 0.055 | 6.8 | | 0.094 | 12.1 | | 0.20 | 0.169 | | 0.155 | 21200 | | 3.6 | 3.9 | | 0.25 |
| EXC-5 | J1R1R0 | 9/10/2012 | 5310 | | 13.6 | 13.5 | | 0.056 | 5.7 | | 0.096 | 11.6 | | 0.21 | 0.155 | U | 0.155 | 17300 | | 3.7 | 11.7 | | 0.26 |
| EXC-6 | J1R1R1 | 9/10/2012 | 6460 | | 12.7 | 8.8 | | 0.052 | 7.0 | | 0.090 | 18.0 | | 0.19 | 0.155 | U | 0.155 | 20800 | | 3.4 | 4.5 | | 0.24 |
| EXC-7 | J1R1R2 | 9/10/2012 | 4710 | | 13.7 | 12.0 | | 0.056 | 6.3 | | 0.097 | 12.9 | | 0.21 | 0.155 | U | 0.155 | 18700 | | 3.7 | 4.2 | | 0.26 |
| EXC-8 | J1R1R3 | 9/10/2012 | 7050 | | 12.5 | 12.5 | | 0.051 | 6.9 | | 0.088 | 15.3 | | 0.19 | 0.155 | U | 0.155 | 19500 | | 3.4 | 9.0 | | 0.24 |
| EXC-9 | J1R1R4 | 9/10/2012 | 4940 | | 13.9 | 6.3 | | 0.057 | 8.8 | | 0.49 | 18.3 | | 1.1 | 0.155 | U | 0.155 | 24900 | | 3.8 | 4.7 | | 1.3 |
| EXC-10 | J1R1R5 | 9/10/2012 | 4120 | | 12.6 | 13.8 | | 0.052 | 6.9 | | 0.089 | 13.9 | | 0.19 | 0.155 | U | 0.155 | 16800 | | 3.4 | 6.0 | | 0.24 |
| EXC-11 | J1R1R6 | 9/10/2012 | 6440 | | 13.8 | 12.4 | | 0.057 | 5.7 | | 0.098 | 11.4 | | 0.21 | 0.155 | U | 0.155 | 17200 | | 3.7 | 3.9 | | 0.26 |
| Split of J1R1R7 | J1R1T1 | 9/10/2012 | 3690 | | 83.6 | 15.1 | | 0.167 | 4.73 | | 1.67 | 8.4 | | 0.836 | 0.20 | U | 0.20 | 16900 | | 16.7 | 3.56 | | 0.418 |
| Equipment Blank | J1R1R9 | 9/10/2012 | 37.4 | B | 13.6 | 0.13 | B | 0.056 | 0.10 | B | 0.096 | 0.21 | U | 0.21 | | | | 375 | | 3.7 | 0.47 | B | 0.26 |

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|---|---|---|---|
| Attachment | 1 | Sheet No. | 9 of 17 |
| Originator | N. K. Schiffern | Date | 06/11/13 |
| Checked | I. B. Berezovskiy | Date | 06/11/13 |
| Calc. No. | 0100N-CA-V0189 | Rev. No. | 0 |

Attachment 1. 124-N-2 Waste Site Verification Sample Results (Metals) Informational Purposes Only [a].

| Sample Area | HEIS Number | Sample Date | Magnesium | | | Manganese | | | Mercury | | | Molybdenum | | | Nickel | | | Potassium | | | Selenium | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL |
| EXC-12 | J1R1R7 | 9/10/2012 | 4300 | | 3.6 | 230 | | 0.098 | 0.0054 | U | 0.0054 | 0.25 | U | 0.25 | 13.9 | | 0.12 | 1390 | | 40.1 | 0.84 | U | 0.84 |
| Duplicate of J1R1R7 | J1R1R8 | 9/10/2012 | 4240 | | 3.4 | 227 | | 0.093 | 0.0060 | U | 0.0060 | 0.24 | U | 0.24 | 13.8 | | 0.11 | 1370 | | 38.2 | 0.80 | U | 0.80 |
| EXC-1 | J1R1P6 | 9/10/2012 | 4260 | | 3.4 | 136 | | 0.092 | 0.0067 | U | 0.0067 | 0.66 | B | 0.24 | 14.1 | | 0.11 | 1250 | | 37.5 | 0.81 | B | 0.79 |
| EXC-2 | J1R1P7 | 9/10/2012 | 4720 | | 3.4 | 256 | | 0.093 | 0.011 | B | 0.0047 | 0.38 | B | 0.24 | 14.1 | | 0.11 | 1270 | | 38.0 | 0.80 | U | 0.80 |
| EXC-3 | J1R1P8 | 9/10/2012 | 4800 | | 3.3 | 247 | | 0.090 | 0.0062 | U | 0.0062 | 0.23 | U | 0.23 | 14.5 | | 0.11 | 1450 | | 37.0 | 0.78 | U | 0.78 |
| EXC-4 | J1R1P9 | 9/10/2012 | 4080 | | 3.5 | 271 | | 0.094 | 0.012 | B | 0.0050 | 0.28 | B | 0.24 | 12.7 | | 0.12 | 895 | | 38.6 | 0.81 | U | 0.81 |
| EXC-5 | J1R1R0 | 9/10/2012 | 4500 | | 3.6 | 257 | | 0.096 | 0.012 | B | 0.0052 | 0.25 | U | 0.25 | 13.8 | | 0.12 | 1340 | | 39.5 | 0.83 | U | 0.83 |
| EXC-6 | J1R1R1 | 9/10/2012 | 4380 | | 3.3 | 277 | | 0.090 | 0.0054 | U | 0.0054 | 0.28 | B | 0.23 | 11.9 | | 0.11 | 944 | | 36.8 | 0.77 | U | 0.77 |
| EXC-7 | J1R1R2 | 9/10/2012 | 4440 | | 3.6 | 265 | | 0.097 | 0.23 | | 0.0053 | 0.25 | U | 0.25 | 12.9 | | 0.12 | 1140 | | 39.8 | 0.83 | U | 0.83 |
| EXC-8 | J1R1R3 | 9/10/2012 | 4390 | | 3.3 | 289 | | 0.088 | 0.0068 | B | 0.0050 | 0.23 | U | 0.23 | 13.1 | | 0.11 | 1270 | | 36.3 | 0.76 | U | 0.76 |
| EXC-9 | J1R1R4 | 9/10/2012 | 4680 | | 18.3 | 313 | | 0.099 | 0.0051 | U | 0.0051 | 0.29 | B | 0.26 | 10.5 | | 0.12 | 859 | | 40.5 | 0.85 | U | 0.85 |
| EXC-10 | J1R1R5 | 9/10/2012 | 4100 | | 3.3 | 324 | | 0.089 | 0.025 | | 0.0052 | 0.23 | U | 0.23 | 16.1 | | 0.11 | 1020 | | 36.5 | 0.77 | U | 0.77 |
| EXC-11 | J1R1R6 | 9/10/2012 | 4060 | | 3.6 | 253 | | 0.098 | 0.0059 | U | 0.0059 | 0.25 | U | 0.25 | 12.7 | | 0.12 | 1260 | | 40.2 | 0.84 | U | 0.84 |
| Split of J1R1R7 | J1R1T1 | 9/10/2012 | 4370 | | 62.7 | 235 | | 4.18 | 0.0274 | U | 0.0274 | 0.237 | B | 1.67 | 12.4 | | 3.34 | 1470 | | 334 | 0.251 | U | 0.251 |
| Equipment Blank | J1R1R9 | 9/10/2012 | 24.2 | | 3.6 | 6.4 | | 0.096 | 0.0055 | U | 0.0055 | 0.25 | U | 0.25 | 0.12 | U | 0.12 | 54.5 | B | 39.4 | 0.83 | U | 0.83 |

| Sample Area | HEIS Number | Sample Date | Silicon | | | Silver | | | Sodium | | | Vanadium | | | Zinc | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL | mg/kg | Q | PQL |
| EXC-12 | J1R1R7 | 9/10/2012 | 337 | J | 5.5 | 0.16 | U | 0.16 | 214 | | 57.7 | 33.3 | | 0.092 | 36.4 | | 0.39 |
| Duplicate of J1R1R7 | J1R1R8 | 9/10/2012 | 383 | J | 5.3 | 0.15 | U | 0.15 | 207 | | 55.0 | 33.0 | | 0.088 | 35.5 | | 0.37 |
| EXC-1 | J1R1P6 | 9/10/2012 | 357 | NJ | 5.2 | 0.15 | U | 0.15 | 194 | | 54.0 | 34.0 | | 0.086 | 36.9 | | 0.36 |
| EXC-2 | J1R1P7 | 9/10/2012 | 422 | J | 5.2 | 0.15 | U | 0.15 | 251 | | 54.7 | 45.4 | | 0.087 | 52.3 | | 0.37 |
| EXC-3 | J1R1P8 | 9/10/2012 | 383 | J | 5.1 | 0.14 | U | 0.14 | 237 | | 53.2 | 38.0 | | 0.085 | 38.4 | | 0.36 |
| EXC-4 | J1R1P9 | 9/10/2012 | 320 | J | 5.3 | 0.15 | U | 0.15 | 284 | | 55.5 | 57.3 | | 0.088 | 62.0 | | 0.37 |
| EXC-5 | J1R1R0 | 9/10/2012 | 383 | J | 5.5 | 0.15 | U | 0.15 | 215 | | 56.9 | 37.5 | | 0.091 | 51.0 | | 0.38 |
| EXC-6 | J1R1R1 | 9/10/2012 | 309 | J | 5.1 | 0.14 | U | 0.14 | 269 | | 53.0 | 56.5 | | 0.084 | 62.9 | | 0.36 |
| EXC-7 | J1R1R2 | 9/10/2012 | 431 | J | 5.5 | 0.16 | U | 0.16 | 254 | | 57.2 | 44.4 | | 0.091 | 51.8 | | 0.39 |
| EXC-8 | J1R1R3 | 9/10/2012 | 430 | J | 5.0 | 0.14 | U | 0.14 | 290 | | 52.2 | 45.6 | | 0.083 | 59.5 | | 0.35 |
| EXC-9 | J1R1R4 | 9/10/2012 | 320 | J | 5.6 | 0.16 | U | 0.16 | 311 | | 58.3 | 74.3 | | 0.46 | 171 | | 0.39 |
| EXC-10 | J1R1R5 | 9/10/2012 | 416 | J | 5.0 | 0.14 | U | 0.14 | 237 | | 52.5 | 34.8 | | 0.084 | 44.3 | | 0.35 |
| EXC-11 | J1R1R6 | 9/10/2012 | 387 | J | 5.5 | 0.16 | U | 0.16 | 300 | | 57.8 | 39.1 | | 0.092 | 53.0 | | 0.39 |
| Split of J1R1R7 | J1R1T1 | 9/10/2012 | 237 | | 1.67 | 0.167 | U | 0.167 | 209 | | 41.8 | 39.5 | | 2.09 | 36.1 | | 8.36 |
| Equipment Blank | J1R1R9 | 9/10/2012 | 211 | J | 5.4 | 0.15 | U | 0.15 | 56.7 | U | 56.7 | 0.34 | B | 0.090 | 1.4 | | 0.38 |

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|---|---|---|---|
| Attachment | 1 | Sheet No. | 10 of 17 |
| Originator | N. K. Schiffern | Date | 06/11/13 |
| Checked | I. B. Berezovskiy | Date | 06/11/13 |
| Calc. No. | 0100N-CA-V0189 | Rev. No. | 0 |

**Attachment 1. 124-N-2 Waste Site Verification Sample Results (Anions, Physical, and TPH)_Informational Purposes Only [a].**

| Sample Area | HEIS Number | Sample Date | Nitrogen in Nitrite and Nitrate | | | TPH - Diesel | | | TPH - Motor Oil | | | TPH - Diesel EXT | | | Percent moisture (wet sample) | | | Percent Solids | | | pH Measurement | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mg/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | % | Q | PQL | % | Q | PQL | pH | Q | PQL |
| EXC-12 | J1R1R7 | 9/10/2012 | 5.3 | | 0.30 | 1000 | J | 660 | | | | 1400 | J | 970 | 0.76 | | 0.10 | | | | 8.17 | J | 0.01 |
| Duplicate of J1R1R7 | J1R1R8 | 9/10/2012 | 4.7 | | 0.30 | 950 | J | 660 | | | | 1100 | J | 970 | 0.63 | | 0.10 | | | | 8.51 | J | 0.01 |
| EXC-1 | J1R1P6 | 9/10/2012 | 2.8 | N | 0.31 | 2000 | J | 670 | | | | 3900 | J | 990 | 4.2 | | 0.10 | | | | 7.12 | J | 0.01 |
| EXC-2 | J1R1P7 | 9/10/2012 | 9.1 | | 0.30 | 21000 | J | 660 | | | | 39000 | J | 970 | 1.0 | | 0.10 | | | | 8.01 | J | 0.01 |
| Re-sample of J1R1P7 | J1RDM7 | 2/5/2013 | | | | | | | | | | | | | 9.4 | | 0.10 | | | | | | |
| EXC-3 | J1R1P8 | 9/10/2012 | 0.31 | U | 0.31 | 370000 | DJ | 1300 | | | | 440000 | DJ | 2000 | 2.8 | | 0.10 | | | | 9.23 | J | 0.01 |
| Re-sample of J1R1P8 | J1RDM8 | 2/5/2013 | | | | 820000 | BN | 720 | | | | 980000 | BN | 1100 | 8.8 | | 0.10 | | | | | | |
| EXC-4 | J1R1P9 | 9/10/2012 | 0.45 | B | 0.31 | 84000 | J | 680 | | | | 160000 | J | 1000 | 1.6 | | 0.10 | | | | 9.27 | J | 0.01 |
| Re-sample of J1R1P9 | J1RDM9 | 2/5/2013 | | | | | | | | | | | | | 9.5 | | 0.10 | | | | | | |
| EXC-5 | J1R1R0 | 9/10/2012 | 0.30 | U | 0.30 | 49000 | J | 660 | | | | 68000 | J | 970 | 1.2 | | 0.10 | | | | 9.19 | J | 0.01 |
| EXC-6 | J1R1R1 | 9/10/2012 | 0.62 | B | 0.30 | 9100 | J | 680 | | | | 12000 | J | 990 | 0.62 | | 0.10 | | | | 9.29 | J | 0.01 |
| EXC-7 | J1R1R2 | 9/10/2012 | 8.3 | | 0.30 | 42000 | J | 680 | | | | 48000 | J | 1000 | 0.90 | | 0.10 | | | | 8.51 | J | 0.01 |
| EXC-8 | J1R1R3 | 9/10/2012 | 2.5 | | 0.30 | 21000 | J | 640 | | | | 30000 | J | 940 | 0.80 | | 0.10 | | | | 9.09 | J | 0.01 |
| EXC-9 | J1R1R4 | 9/10/2012 | 5.2 | | 0.30 | 6300 | J | 650 | | | | 8600 | J | 950 | 0.73 | | 0.10 | | | | 9.07 | J | 0.01 |
| EXC-10 | J1R1R5 | 9/10/2012 | 1.6 | | 0.30 | 9000 | J | 670 | | | | 14000 | J | 990 | 0.63 | | 0.10 | | | | 9.00 | J | 0.01 |
| EXC-11 | J1R1R6 | 9/10/2012 | 17.2 | | 0.30 | 110000 | NDJ | 1300 | | | | 120000 | NDJ | 2000 | 0.96 | | 0.10 | | | | 7.38 | J | 0.01 |
| Split of J1R1R7 | J1R1T1 | 9/10/2012 | 5.03 | | 0.10 | 1700 | J | 3320 | 9970 | U | 9970 | | | | | | | 99.7 | | 0.10 | 8.26 | | 0.01 |
| Equipment Blank | J1R1R9 | 9/10/2012 | | | | | | | | | | | | | 0.10 | | 0.10 | | | | | | |

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| Attachment | 1 | Sheet No. | 11 of 17 |
| Originator | N. K. Schiffern | Date | 06/11/13 |
| Checked | I. B. Berezovskiy | Date | 06/11/13 |
| Calc. No. | 0100N-CA-V0189 | Rev. No. | 0 |

**Attachment 1. 124-N-2 Waste Site Verification Sample Results (Organics)_Informational Purposes Only [a].**

| CONSTITUENT | CLASS | J1R1R7, EXC-12 | | | J1R1R8, Duplicate of J1R1R7 | | | J1R1P6, EXC-1 | | | J1R1P7, EXC-2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 9/10/2012 | | | 9/10/2012 | | | 9/10/2012 | | | 9/10/2012 | | |
| | | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL |
| Acenaphthene | PAH | 9.9 | U | 9.9 | 23 | JX | 9.9 | 10 | U | 10 | 10 | U | 10 |
| Acenaphthylene | PAH | 8.9 | U | 8.9 | 8.9 | U | 8.9 | 9.0 | U | 9.0 | 9.5 | JX | 9.0 |
| Anthracene | PAH | 3.0 | U | 3.0 | 15 | J | 3.0 | 3.1 | U | 3.1 | 320 | J | 3.1 |
| Benzo(a)anthracene | PAH | 5.0 | J | 3.2 | 160 | | 3.1 | 3.2 | U | 3.2 | 530 | J | 3.2 |
| Benzo(a)pyrene | PAH | 6.3 | U | 6.3 | 63 | | 6.3 | 6.4 | U | 6.4 | 340 | J | 6.4 |
| Benzo(b)fluoranthene | PAH | 4.1 | U | 4.1 | 97 | | 4.1 | 4.2 | U | 4.2 | 380 | NJ | 4.2 |
| Benzo(ghi)perylene | PAH | 7.1 | U | 7.1 | 37 | | 7.1 | 7.2 | U | 7.2 | 260 | J | 7.2 |
| Benzo(k)fluoranthene | PAH | 3.9 | U | 3.9 | 36 | | 3.9 | 3.9 | U | 3.9 | 140 | J | 3.9 |
| Chrysene | PAH | 9.7 | J | 4.8 | 120 | | 4.8 | 4.8 | U | 4.8 | 630 | J | 4.8 |
| Dibenz[a,h]anthracene | PAH | 11 | U | 11 | 11 | U | 11 | 11 | U | 11 | 11 | UJ | 11 |
| Fluoranthene | PAH | 27 | J | 13 | 220 | | 13 | 13 | U | 13 | 1000 | NJ | 13 |
| Fluorene | PAH | 5.2 | U | 5.2 | 10 | JX | 5.2 | 5.3 | U | 5.3 | 140 | J | 5.3 |
| Indeno(1,2,3-cd)pyrene | PAH | 12 | U | 12 | 28 | J | 12 | 12 | U | 12 | 270 | J | 12 |
| Naphthalene | PAH | 12 | U | 12 | 12 | U | 12 | 12 | U | 12 | 12 | U | 12 |
| Phenanthrene | PAH | 12 | JX | 12 | 61 | | 12 | 12 | U | 12 | 680 | J | 12 |
| Pyrene | PAH | 20 | J | 12 | 210 | | 12 | 12 | U | 12 | 1100 | J | 12 |
| Aroclor-1016 | PCB | 2.8 | U | 2.8 | 2.6 | U | 2.6 | 2.8 | U | 2.8 | 2.6 | UJ | 2.6 |
| Aroclor-1221 | PCB | 8.0 | U | 8.0 | 7.7 | U | 7.7 | 8.1 | U | 8.1 | 7.7 | UJ | 7.7 |
| Aroclor-1232 | PCB | 2.0 | U | 2.0 | 1.9 | U | 1.9 | 2.0 | U | 2.0 | 1.9 | UJ | 1.9 |
| Aroclor-1242 | PCB | 4.6 | U | 4.6 | 4.5 | U | 4.5 | 4.7 | U | 4.7 | 4.5 | UJ | 4.5 |
| Aroclor-1248 | PCB | 4.6 | U | 4.6 | 4.5 | U | 4.5 | 4.7 | U | 4.7 | 4.5 | UJ | 4.5 |
| Aroclor-1254 | PCB | 2.6 | U | 2.6 | 2.5 | U | 2.5 | 2.6 | U | 2.6 | 82 | J | 2.5 |
| Aroclor-1260 | PCB | 2.6 | U | 2.6 | 2.5 | U | 2.5 | 2.6 | U | 2.6 | 2.5 | UJ | 2.5 |
| Aldrin | PEST | 2.5 | UDJ | 2.5 | 0.25 | U | 0.25 | 0.26 | U | 0.26 | 0.25 | U | 0.25 |
| Alpha-BHC | PEST | 2.1 | UDJ | 2.1 | 0.21 | U | 0.21 | 0.22 | U | 0.22 | 0.21 | U | 0.21 |
| alpha-Chlordane | PEST | 3.2 | UDJ | 3.2 | 0.32 | U | 0.32 | 0.33 | U | 0.33 | 0.32 | U | 0.32 |
| beta-1,2,3,4,5,6-Hexachlorocyclohexane | PEST | 6.6 | UDJ | 6.6 | 0.66 | U | 0.66 | 0.68 | U | 0.68 | 0.66 | U | 0.66 |
| Delta-BHC | PEST | 4.0 | UDJ | 4.0 | 0.40 | U | 0.40 | 0.41 | U | 0.41 | 0.40 | U | 0.40 |
| Dichlorodiphenyldichloroethane | PEST | 5.4 | UDJ | 5.4 | 0.54 | U | 0.54 | 0.56 | U | 0.56 | 0.55 | U | 0.55 |
| Dichlorodiphenyldichloroethylene | PEST | 2.4 | UDJ | 2.4 | 0.24 | U | 0.24 | 0.24 | U | 0.24 | 0.24 | U | 0.24 |
| Dichlorodiphenyltrichloroethane | PEST | 5.9 | UDJ | 5.9 | 0.58 | U | 0.58 | 0.61 | U | 0.61 | 0.59 | U | 0.59 |
| Dieldrin | PEST | 2.1 | UDJ | 2.1 | 0.21 | U | 0.21 | 0.22 | U | 0.22 | 0.21 | U | 0.21 |
| Endosulfan I | PEST | 1.8 | UDJ | 1.8 | 0.17 | U | 0.17 | 0.18 | U | 0.18 | 0.18 | U | 0.18 |
| Endosulfan II | PEST | 2.9 | UDJ | 2.9 | 0.28 | U | 0.28 | 0.29 | U | 0.29 | 0.29 | U | 0.29 |
| Endosulfan sulfate | PEST | 2.8 | UDJ | 2.8 | 0.27 | U | 0.27 | 0.28 | U | 0.28 | 0.28 | U | 0.28 |
| Endrin | PEST | 3.1 | UDJ | 3.1 | 0.30 | U | 0.30 | 0.31 | U | 0.31 | 0.31 | U | 0.31 |
| Endrin aldehyde | PEST | 1.7 | UDJ | 1.7 | 0.17 | U | 0.17 | 0.18 | U | 0.18 | 0.17 | U | 0.17 |
| Endrin ketone | PEST | 4.9 | UDJ | 4.9 | 0.48 | U | 0.48 | 0.50 | U | 0.50 | 0.49 | U | 0.49 |
| Gamma-BHC (Lindane) | PEST | 4.6 | UDJ | 4.6 | 0.46 | U | 0.46 | 0.48 | U | 0.48 | 0.46 | U | 0.46 |
| gamma-Chlordane | PEST | 2.7 | UDJ | 2.7 | 0.26 | U | 0.26 | 0.27 | U | 0.27 | 0.27 | U | 0.27 |
| Heptachlor | PEST | 2.1 | UDJ | 2.1 | 0.21 | U | 0.21 | 0.22 | U | 0.22 | 0.21 | U | 0.21 |
| Heptachlor epoxide | PEST | 4.2 | UDJ | 4.2 | 0.42 | U | 0.42 | 0.44 | U | 0.44 | 0.43 | U | 0.43 |
| Methoxychlor | PEST | 4.5 | UDJ | 4.5 | 0.45 | U | 0.45 | 0.46 | U | 0.46 | 0.45 | U | 0.45 |
| Toxaphene | PEST | 160 | UDJ | 160 | 16 | UJ | 16 | 16 | UJ | 16 | 16 | UJ | 16 |

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| Attachment | 1 | Sheet No. | 12 of 17 |
| Originator | N. K. Schiffern | Date | 06/11/13 |
| Checked | I. B. Berezovskiy | Date | 06/11/13 |
| Calc. No. | 0100N-CA-V0189 | Rev. No. | 0 |

**Attachment 1. 124-N-2 Waste Site Verification Sample Results (Organics)_Informational Purposes Only [a].**

| CONSTITUENT | CLASS | J1RDM7, Resample of J1R1P7 | | | J1R1P8, EXC-3 | | | J1RDM8, Resample of J1R1P8 | | | J1R1P9, EXC-4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2/5/2013 | | | 9/10/2012 | | | 2/5/2013 | | | 9/10/2012 | | |
| | | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL |
| Acenaphthene | PAH | 670 | NX | 11 | 150 | X | 10 | 210 | XN | 11 | 49 | UD | 49 |
| Acenaphthylene | PAH | 9.7 | U | 9.7 | 9.2 | U | 9.2 | 9.6 | U | 9.6 | 44 | UD | 44 |
| Anthracene | PAH | 1400 | N | 3.3 | 190 | J | 3.1 | 340 | N | 3.2 | 440 | DJ | 15 |
| Benzo(a)anthracene | PAH | 3400 | N | 3.4 | 1300 | J | 3.2 | 800 | N | 3.4 | 1400 | DJ | 16 |
| Benzo(a)pyrene | PAH | 1200 | N | 6.9 | 460 | J | 6.5 | 340 | XN | 6.8 | 990 | DJ | 31 |
| Benzo(b)fluoranthene | PAH | 1800 | N | 4.5 | 720 | J | 4.3 | 500 | N | 4.5 | 990 | DJ | 21 |
| Benzo(ghi)perylene | PAH | 950 | | 7.8 | 360 | J | 7.3 | 240 | N | 7.6 | 730 | DJ | 35 |
| Benzo(k)fluoranthene | PAH | 750 | N | 4.2 | 340 | J | 4.0 | 190 | N | 4.2 | 410 | DJ | 19 |
| Chrysene | PAH | 3000 | N | 5.2 | 1000 | J | 4.9 | 840 | N | 5.1 | 1300 | DJ | 24 |
| Dibenz[a,h]anthracene | PAH | 190 | | 12 | 11 | U | 11 | 53 | X | 12 | 210 | DXJ | 54 |
| Fluoranthene | PAH | 6900 | N | 14 | 1600 | J | 13 | 1600 | N | 14 | 2000 | DJ | 64 |
| Fluorene | PAH | 630 | | 5.7 | 110 | J | 5.4 | 180 | N | 5.6 | 260 | DJ | 26 |
| Indeno(1,2,3-cd)pyrene | PAH | 720 | N | 13 | 260 | J | 12 | 210 | N | 13 | 600 | DJ | 59 |
| Naphthalene | PAH | 13 | U | 13 | 12 | U | 12 | 13 | U | 13 | 59 | UD | 59 |
| Phenanthrene | PAH | 3500 | N | 13 | 350 | J | 12 | 900 | N | 13 | 1100 | DJ | 59 |
| Pyrene | PAH | 6500 | N | 13 | 1800 | J | 12 | 1700 | N | 13 | 2500 | DJ | 59 |
| Aroclor-1016 | PCB | | | | 2.8 | U | 2.8 | | | | 2.8 | U | 2.8 |
| Aroclor-1221 | PCB | | | | 8.1 | U | 8.1 | | | | 8.1 | U | 8.1 |
| Aroclor-1232 | PCB | | | | 2.0 | U | 2.0 | | | | 2.0 | U | 2.0 |
| Aroclor-1242 | PCB | | | | 4.7 | U | 4.7 | | | | 4.7 | U | 4.7 |
| Aroclor-1248 | PCB | | | | 4.7 | U | 4.7 | | | | 4.7 | U | 4.7 |
| Aroclor-1254 | PCB | | | | 41 | | 2.6 | | | | 87 | P | 2.6 |
| Aroclor-1260 | PCB | | | | 2.6 | U | 2.6 | | | | 96 | | 2.6 |
| Aldrin | PEST | | | | 2.6 | UDJ | 2.6 | | | | 2.5 | UDJ | 2.5 |
| Alpha-BHC | PEST | | | | 2.2 | UDJ | 2.2 | | | | 2.2 | UDJ | 2.2 |
| alpha-Chlordane | PEST | | | | 3.3 | UDJ | 3.3 | | | | 3.3 | UDJ | 3.3 |
| beta-1,2,3,4,5,6-Hexachlorocyclohexane | PEST | | | | 6.8 | UDJ | 6.8 | | | | 6.7 | UDJ | 6.7 |
| Delta-BHC | PEST | | | | 4.1 | UDJ | 4.1 | | | | 4.1 | UDJ | 4.1 |
| Dichlorodiphenyldichloroethane | PEST | | | | 5.6 | UDJ | 5.6 | | | | 5.5 | UDJ | 5.5 |
| Dichlorodiphenyldichloroethylene | PEST | | | | 2.4 | UDJ | 2.4 | | | | 2.4 | UDJ | 2.4 |
| Dichlorodiphenyltrichloroethane | PEST | | | | 6.0 | UDJ | 6.0 | | | | 6.0 | UDJ | 6.0 |
| Dieldrin | PEST | | | | 2.2 | UDJ | 2.2 | | | | 2.1 | UDJ | 2.1 |
| Endosulfan I | PEST | | | | 1.8 | UDJ | 1.8 | | | | 1.8 | UDJ | 1.8 |
| Endosulfan II | PEST | | | | 2.9 | UDJ | 2.9 | | | | 2.9 | UDJ | 2.9 |
| Endosulfan sulfate | PEST | | | | 2.8 | UDJ | 2.8 | | | | 2.8 | UDJ | 2.8 |
| Endrin | PEST | | | | 3.1 | UDJ | 3.1 | | | | 3.1 | UDJ | 3.1 |
| Endrin aldehyde | PEST | | | | 1.8 | UDJ | 1.8 | | | | 1.7 | UDJ | 1.7 |
| Endrin ketone | PEST | | | | 5.0 | UDJ | 5.0 | | | | 4.9 | UDJ | 4.9 |
| Gamma-BHC (Lindane) | PEST | | | | 4.8 | UDJ | 4.8 | | | | 4.7 | UDJ | 4.7 |
| gamma-Chlordane | PEST | | | | 2.7 | UDJ | 2.7 | | | | 2.7 | UDJ | 2.7 |
| Heptachlor | PEST | | | | 2.2 | UDJ | 2.2 | | | | 2.2 | UDJ | 2.2 |
| Heptachlor epoxide | PEST | | | | 4.4 | UDJ | 4.4 | | | | 4.3 | UDJ | 4.3 |
| Methoxychlor | PEST | | | | 4.6 | UDJ | 4.6 | | | | 4.5 | UDJ | 4.5 |
| Toxaphene | PEST | | | | 160 | UDJ | 160 | | | | 160 | UDJ | 160 |

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|---|---|---|---|
| Attachment | 1 | Sheet No. | 13 of 17 |
| Originator | N. K. Schiffern | Date | 06/11/13 |
| Checked | I. B. Berezovskiy | Date | 06/11/13 |
| Calc. No. | 0100N-CA-V0189 | Rev. No. | 0 |

**Attachment 1. 124-N-2 Waste Site Verification Sample Results (Organics)_Informational Purposes Only [a].**

| CONSTITUENT | CLASS | J1RDM9, Resample of J1R1P9 | | | J1R1R0, EXC-5 | | | J1RD68, Resample of J1R1R0 | | | J1R1R1, EXC-6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2/5/2013 | | | 9/10/2012 | | | 1/24/2013 | | | 9/10/2012 | | |
| | | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL |
| Acenaphthene | PAH | 16000 | DX | 550 | 930 | X | 10 | 355 | UD | 355 | 1200 | DXJ | 100 |
| Acenaphthylene | PAH | 490 | UD | 490 | 36 | JX | 9.1 | 355 | UD | 355 | 90 | UD | 90 |
| Anthracene | PAH | 12000 | D | 170 | 1200 | J | 3.1 | 12800 | D | 355 | 2900 | DJ | 31 |
| Benzo(a)anthracene | PAH | 99000 | D | 170 | 1900 | J | 3.2 | 18200 | D | 355 | 8700 | DJ | 32 |
| Benzo(a)pyrene | PAH | 28000 | D | 350 | 1500 | J | 6.5 | 14700 | D | 355 | 3000 | DJ | 64 |
| Benzo(b)fluoranthene | PAH | 52000 | D | 230 | 1400 | J | 4.2 | 6220 | D | 355 | 4400 | DJ | 42 |
| Benzo(ghi)perylene | PAH | 21000 | D | 390 | 940 | J | 7.3 | 8120 | D | 355 | 880 | DXJ | 72 |
| Benzo(k)fluoranthene | PAH | 24000 | D | 210 | 550 | J | 4.0 | 4860 | D | 355 | 1600 | DJ | 40 |
| Chrysene | PAH | 86000 | D | 260 | 2000 | XJ | 4.9 | 16400 | D | 355 | 7900 | DJ | 49 |
| Dibenz[a,h]anthracene | PAH | 3700 | D | 600 | 280 | XJ | 11 | 472 | D | 355 | 380 | DXJ | 110 |
| Fluoranthene | PAH | 220000 | D | 710 | 4200 | J | 13 | 51900 | D | 355 | 24000 | DJ | 130 |
| Fluorene | PAH | 8400 | DX | 290 | 720 | J | 5.3 | 3150 | D | 355 | 1600 | DJ | 53 |
| Indeno(1,2,3-cd)pyrene | PAH | 18000 | D | 650 | 780 | J | 12 | 3040 | D | 355 | 1100 | DJ | 120 |
| Naphthalene | PAH | 650 | UD | 650 | 12 | U | 12 | 14100 | D | 355 | 120 | UD | 120 |
| Phenanthrene | PAH | 38000 | D | 650 | 3200 | J | 12 | 36600 | D | 355 | 8500 | DJ | 120 |
| Pyrene | PAH | 200000 | D | 650 | 4800 | J | 12 | 46300 | D | 355 | 22000 | DJ | 120 |
| Aroclor-1016 | PCB | | | | 2.7 | U | 2.7 | | | | 2.6 | U | 2.6 |
| Aroclor-1221 | PCB | | | | 7.9 | U | 7.9 | | | | 7.4 | U | 7.4 |
| Aroclor-1232 | PCB | | | | 2.0 | U | 2.0 | | | | 1.9 | U | 1.9 |
| Aroclor-1242 | PCB | | | | 4.6 | U | 4.6 | | | | 4.3 | U | 4.3 |
| Aroclor-1248 | PCB | | | | 4.6 | U | 4.6 | | | | 4.3 | U | 4.3 |
| Aroclor-1254 | PCB | | | | 2.6 | U | 2.6 | | | | 2.4 | U | 2.4 |
| Aroclor-1260 | PCB | | | | 2.6 | U | 2.6 | | | | 2.4 | U | 2.4 |
| Aldrin | PEST | | | | 2.4 | UDJ | 2.4 | | | | 0.24 | U | 0.24 |
| Alpha-BHC | PEST | | | | 2.1 | UDJ | 2.1 | | | | 0.21 | U | 0.21 |
| alpha-Chlordane | PEST | | | | 3.1 | UDJ | 3.1 | | | | 0.31 | U | 0.31 |
| beta-1,2,3,4,5,6-Hexachlorocyclohexane | PEST | | | | 6.4 | UDJ | 6.4 | | | | 0.64 | U | 0.64 |
| Delta-BHC | PEST | | | | 3.9 | UDJ | 3.9 | | | | 0.39 | U | 0.39 |
| Dichlorodiphenyldichloroethane | PEST | | | | 5.3 | UDJ | 5.3 | | | | 0.53 | U | 0.53 |
| Dichlorodiphenyldichloroethylene | PEST | | | | 2.3 | UDJ | 2.3 | | | | 0.23 | U | 0.23 |
| Dichlorodiphenyltrichloroethane | PEST | | | | 5.7 | UDJ | 5.7 | | | | 0.57 | U | 0.57 |
| Dieldrin | PEST | | | | 2.0 | UDJ | 2.0 | | | | 0.20 | U | 0.20 |
| Endosulfan I | PEST | | | | 1.7 | UDJ | 1.7 | | | | 0.17 | U | 0.17 |
| Endosulfan II | PEST | | | | 2.8 | UDJ | 2.8 | | | | 0.28 | U | 0.28 |
| Endosulfan sulfate | PEST | | | | 2.7 | UDJ | 2.7 | | | | 0.27 | U | 0.27 |
| Endrin | PEST | | | | 3.0 | UDJ | 3.0 | | | | 0.30 | U | 0.30 |
| Endrin aldehyde | PEST | | | | 1.7 | UDJ | 1.7 | | | | 0.17 | U | 0.17 |
| Endrin ketone | PEST | | | | 4.7 | UDJ | 4.7 | | | | 0.47 | U | 0.47 |
| Gamma-BHC (Lindane) | PEST | | | | 4.5 | UDJ | 4.5 | | | | 0.45 | U | 0.45 |
| gamma-Chlordane | PEST | | | | 2.6 | UDJ | 2.6 | | | | 0.26 | U | 0.26 |
| Heptachlor | PEST | | | | 2.1 | UDJ | 2.1 | | | | 0.21 | U | 0.21 |
| Heptachlor epoxide | PEST | | | | 4.1 | UDJ | 4.1 | | | | 0.41 | U | 0.41 |
| Methoxychlor | PEST | | | | 4.4 | UDJ | 4.4 | | | | 0.44 | U | 0.44 |
| Toxaphene | PEST | | | | 150 | UDJ | 150 | | | | 15 | UJ | 15 |

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|---|---|---|---|
| Attachment | 1 | Sheet No. | 14 of 17 |
| Originator | N. K. Schiffern | Date | 06/11/13 |
| Checked | I. B. Berezovskiy | Date | 06/11/13 |
| Calc. No. | 0100N-CA-V0189 | Rev. No. | 0 |

**Attachment 1. 124-N-2 Waste Site Verification Sample Results (Organics)_Informational Purposes Only [a].**

| CONSTITUENT | CLASS | J1RD69, Resample of J1R1R1 | | | J1R1R2, EXC-7 | | | J1RD70, Resample of J1R1R2 | | | J1R1R3, EXC-8 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1/24/2013 | | | 9/10/2012 | | | 1/24/2013 | | | 9/10/2012 | | |
| | | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL |
| Acenaphthene | PAH | 92.5 | UD | 92.5 | 580 | X | 10 | 389 | UD | 389 | 720 | DX | 50 |
| Acenaphthylene | PAH | 186 | D | 92.5 | 9.0 | U | 9.0 | 7820 | D | 389 | 45 | UD | 45 |
| Anthracene | PAH | 1300 | D | 92.5 | 1000 | XJ | 3.0 | 14700 | D | 389 | 1500 | DJ | 15 |
| Benzo(a)anthracene | PAH | 2770 | D | 92.5 | 650 | J | 3.2 | 32000 | D | 389 | 3700 | DJ | 16 |
| Benzo(a)pyrene | PAH | 2720 | D | 92.5 | 270 | J | 6.4 | 24100 | D | 389 | 1000 | DJ | 32 |
| Benzo(b)fluoranthene | PAH | 1240 | D | 92.5 | 330 | J | 4.2 | 9800 | D | 389 | 1500 | DJ | 21 |
| Benzo(ghi)perylene | PAH | 1680 | D | 92.5 | 120 | J | 7.2 | 14700 | D | 389 | 380 | DXJ | 36 |
| Benzo(k)fluoranthene | PAH | 972 | D | 92.5 | 130 | J | 3.9 | 8940 | D | 389 | 600 | DJ | 20 |
| Chrysene | PAH | 3290 | D | 92.5 | 540 | J | 4.8 | 47100 | D | 389 | 2600 | DJ | 24 |
| Dibenz[a,h]anthracene | PAH | 123 | D | 92.5 | 35 | XJ | 11 | 604 | D | 389 | 130 | JD | 55 |
| Fluoranthene | PAH | 9470 | D | 92.5 | 2000 | J | 13 | 75600 | D | 389 | 8500 | DJ | 64 |
| Fluorene | PAH | 124 | D | 92.5 | 1000 | J | 5.3 | 3610 | D | 389 | 580 | DX | 26 |
| Indeno(1,2,3-cd)pyrene | PAH | 676 | D | 92.5 | 90 | J | 12 | 5170 | D | 389 | 460 | DJ | 59 |
| Naphthalene | PAH | 1680 | D | 92.5 | 12 | U | 12 | 16500 | D | 389 | 59 | UD | 59 |
| Phenanthrene | PAH | 3170 | D | 92.5 | 3800 | J | 12 | 42500 | D | 389 | 3700 | DJ | 59 |
| Pyrene | PAH | 8000 | D | 92.5 | 1800 | J | 12 | 58100 | D | 389 | 7900 | DJ | 59 |
| Aroclor-1016 | PCB | | | | 2.7 | UJ | 2.7 | | | | 2.6 | U | 2.6 |
| Aroclor-1221 | PCB | | | | 7.7 | UJ | 7.7 | | | | 7.5 | U | 7.5 |
| Aroclor-1232 | PCB | | | | 1.9 | UJ | 1.9 | | | | 1.9 | U | 1.9 |
| Aroclor-1242 | PCB | | | | 4.5 | UJ | 4.5 | | | | 4.4 | U | 4.4 |
| Aroclor-1248 | PCB | | | | 4.5 | UJ | 4.5 | | | | 4.4 | U | 4.4 |
| Aroclor-1254 | PCB | | | | 2.5 | UJ | 2.5 | | | | 52 | | 2.4 |
| Aroclor-1260 | PCB | | | | 2.5 | UJ | 2.5 | | | | 2.4 | U | 2.4 |
| Aldrin | PEST | | | | 0.25 | U | 0.25 | | | | 0.25 | U | 0.25 |
| Alpha-BHC | PEST | | | | 0.21 | U | 0.21 | | | | 0.21 | U | 0.21 |
| alpha-Chlordane | PEST | | | | 0.32 | U | 0.32 | | | | 0.32 | U | 0.32 |
| beta-1,2,3,4,5,6-Hexachlorocyclohexane | PEST | | | | 0.66 | U | 0.66 | | | | 0.66 | U | 0.66 |
| Delta-BHC | PEST | | | | 0.40 | U | 0.40 | | | | 0.40 | U | 0.40 |
| Dichlorodiphenyldichloroethane | PEST | | | | 0.54 | U | 0.54 | | | | 0.54 | U | 0.54 |
| Dichlorodiphenyldichloroethylene | PEST | | | | 0.24 | U | 0.24 | | | | 0.24 | U | 0.24 |
| Dichlorodiphenyltrichloroethane | PEST | | | | 0.59 | U | 0.59 | | | | 0.59 | U | 0.59 |
| Dieldrin | PEST | | | | 0.21 | U | 0.21 | | | | 0.21 | U | 0.21 |
| Endosulfan I | PEST | | | | 0.17 | U | 0.17 | | | | 0.17 | U | 0.17 |
| Endosulfan II | PEST | | | | 0.28 | U | 0.28 | | | | 0.28 | U | 0.28 |
| Endosulfan sulfate | PEST | | | | 0.27 | U | 0.27 | | | | 0.27 | U | 0.27 |
| Endrin | PEST | | | | 0.30 | U | 0.30 | | | | 0.30 | U | 0.30 |
| Endrin aldehyde | PEST | | | | 0.17 | U | 0.17 | | | | 0.17 | U | 0.17 |
| Endrin ketone | PEST | | | | 0.49 | U | 0.49 | | | | 0.48 | U | 0.48 |
| Gamma-BHC (Lindane) | PEST | | | | 0.46 | U | 0.46 | | | | 0.46 | U | 0.46 |
| gamma-Chlordane | PEST | | | | 0.26 | U | 0.26 | | | | 0.26 | U | 0.26 |
| Heptachlor | PEST | | | | 0.21 | U | 0.21 | | | | 0.21 | U | 0.21 |
| Heptachlor epoxide | PEST | | | | 0.42 | U | 0.42 | | | | 0.42 | U | 0.42 |
| Methoxychlor | PEST | | | | 1.4 | JX | 0.45 | | | | 0.45 | U | 0.45 |
| Toxaphene | PEST | | | | 16 | UJ | 16 | | | | 16 | UJ | 16 |

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|---|---|---|---|
| Attachment | 1 | Sheet No. | 15 of 17 |
| Originator | N. K. Schiffern | Date | 06/11/13 |
| Checked | I. B. Berezovskiy | Date | 06/11/13 |
| Calc. No. | 0100N-CA-V0189 | Rev. No. | 0 |

**Attachment 1. 124-N-2 Waste Site Verification Sample Results (Organics)_Informational Purposes Only [a].**

| CONSTITUENT | CLASS | J1RD71, Resample of J1R1R3 | | | J1R1R4, EXC-9 | | | J1RD72, Resample of J1R1R4 | | | J1R1R5, EXC-10 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1/24/2013 | | | 9/10/2012 | | | 1/24/2013 | | | 9/10/2012 | | |
| | | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL |
| Acenaphthene | PAH | 3.56 | U | 3.56 | 51 | JX | 10 | 37.0 | UD | 37.0 | 9.8 | U | 9.8 |
| Acenaphthylene | PAH | 3.56 | U | 3.56 | 9.0 | U | 9.0 | 37.0 | UD | 37.0 | 8.8 | U | 8.8 |
| Anthracene | PAH | 2.41 | J | 3.56 | 37 | | 3.1 | 980 | D | 37.0 | 21 | | 3.0 |
| Benzo(a)anthracene | PAH | 12.5 | | 3.56 | 550 | | 3.2 | 1550 | D | 37.0 | 140 | | 3.1 |
| Benzo(a)pyrene | PAH | 15.8 | | 3.56 | 320 | | 6.4 | 1730 | D | 37.0 | 81 | | 6.3 |
| Benzo(b)fluoranthene | PAH | 5.03 | | 3.56 | 460 | | 4.2 | 693 | D | 37.0 | 86 | | 4.1 |
| Benzo(ghi)perylene | PAH | 12.0 | | 3.56 | 170 | | 7.2 | 1070 | D | 37.0 | 39 | X | 7.1 |
| Benzo(k)fluoranthene | PAH | 6.54 | | 3.56 | 170 | | 3.9 | 756 | D | 37.0 | 39 | | 3.9 |
| Chrysene | PAH | 19.5 | | 3.56 | 480 | | 4.8 | 1510 | D | 37.0 | 120 | | 4.7 |
| Dibenz[a,h]anthracene | PAH | 0.927 | J | 3.56 | 44 | X | 11 | 37.0 | UD | 37.0 | 11 | U | 11 |
| Fluoranthene | PAH | 31.0 | | 3.56 | 250 | X | 13 | 4080 | D | 37.0 | 190 | | 13 |
| Fluorene | PAH | 3.56 | U | 3.56 | 50 | X | 5.3 | 204 | D | 37.0 | 16 | JX | 5.2 |
| Indeno(1,2,3-cd)pyrene | PAH | 5.13 | | 3.56 | 130 | | 12 | 385 | D | 37.0 | 32 | | 12 |
| Naphthalene | PAH | 6.29 | | 3.56 | 12 | U | 12 | 1380 | D | 37.0 | 12 | U | 12 |
| Phenanthrene | PAH | 14.2 | | 3.56 | 59 | | 12 | 2650 | D | 37.0 | 59 | | 12 |
| Pyrene | PAH | 31.8 | | 3.56 | 290 | | 12 | 3880 | D | 37.0 | 220 | | 12 |
| Aroclor-1016 | PCB | | | | 2.7 | U | 2.7 | | | | 2.7 | U | 2.7 |
| Aroclor-1221 | PCB | | | | 7.7 | U | 7.7 | | | | 7.9 | U | 7.9 |
| Aroclor-1232 | PCB | | | | 1.9 | U | 1.9 | | | | 2.0 | U | 2.0 |
| Aroclor-1242 | PCB | | | | 4.5 | U | 4.5 | | | | 4.6 | U | 4.6 |
| Aroclor-1248 | PCB | | | | 4.5 | U | 4.5 | | | | 4.6 | U | 4.6 |
| Aroclor-1254 | PCB | | | | 2.5 | U | 2.5 | | | | 6.8 | J | 2.6 |
| Aroclor-1260 | PCB | | | | 2.5 | U | 2.5 | | | | 2.6 | U | 2.6 |
| Aldrin | PEST | | | | 0.25 | U | 0.25 | | | | 0.25 | U | 0.25 |
| Alpha-BHC | PEST | | | | 0.21 | U | 0.21 | | | | 0.21 | U | 0.21 |
| alpha-Chlordane | PEST | | | | 0.32 | U | 0.32 | | | | 0.32 | U | 0.32 |
| beta-1,2,3,4,5,6-Hexachlorocyclohexane | PEST | | | | 0.66 | U | 0.66 | | | | 0.65 | U | 0.65 |
| Delta-BHC | PEST | | | | 0.40 | U | 0.40 | | | | 0.39 | U | 0.39 |
| Dichlorodiphenyldichloroethane | PEST | | | | 0.54 | U | 0.54 | | | | 0.54 | U | 0.54 |
| Dichlorodiphenyldichloroethylene | PEST | | | | 0.24 | U | 0.24 | | | | 0.23 | U | 0.23 |
| Dichlorodiphenyltrichloroethane | PEST | | | | 0.58 | U | 0.58 | | | | 0.58 | U | 0.58 |
| Dieldrin | PEST | | | | 0.21 | U | 0.21 | | | | 0.21 | U | 0.21 |
| Endosulfan I | PEST | | | | 0.17 | U | 0.17 | | | | 0.17 | U | 0.17 |
| Endosulfan II | PEST | | | | 0.28 | U | 0.28 | | | | 0.28 | U | 0.28 |
| Endosulfan sulfate | PEST | | | | 0.27 | U | 0.27 | | | | 0.27 | U | 0.27 |
| Endrin | PEST | | | | 0.30 | U | 0.30 | | | | 0.30 | U | 0.30 |
| Endrin aldehyde | PEST | | | | 0.17 | U | 0.17 | | | | 0.17 | U | 0.17 |
| Endrin ketone | PEST | | | | 0.48 | U | 0.48 | | | | 0.48 | U | 0.48 |
| Gamma-BHC (Lindane) | PEST | | | | 0.46 | U | 0.46 | | | | 0.46 | U | 0.46 |
| gamma-Chlordane | PEST | | | | 0.26 | U | 0.26 | | | | 0.26 | U | 0.26 |
| Heptachlor | PEST | | | | 0.21 | U | 0.21 | | | | 0.21 | U | 0.21 |
| Heptachlor epoxide | PEST | | | | 0.42 | U | 0.42 | | | | 0.42 | U | 0.42 |
| Methoxychlor | PEST | | | | 0.44 | U | 0.44 | | | | 0.44 | U | 0.44 |
| Toxaphene | PEST | | | | 16 | UJ | 16 | | | | 16 | UJ | 16 |

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| Attachment | 1 | Sheet No. | 16 of 17 |
| Originator | N. K. Schiffern | Date | 06/11/13 |
| Checked | I. B. Berezovskiy | Date | 06/11/13 |
| Calc. No. | 0100N-CA-V0189 | Rev. No. | 0 |

**Attachment 1. 124-N-2 Waste Site Verification Sample Results (Organics)_Informational Purposes Only [a].**

| CONSTITUENT | CLASS | J1R1R6, EXC-11 | | | J1RD73, Resample of J1R16 | | | J1R1T1, Split of J1R1R7 | | | J1R1R9, Equipment Blank | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 9/10/2012 | | | 1/24/2013 | | | 9/10/2012 | | | 9/10/2012 | | |
| | | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL | ug/kg | Q | PQL |
| Acenaphthene | PAH | 500 | DX | 49 | 36.0 | UD | 36.0 | 3.32 | U | 3.32 | 9.7 | UJ | 9.7 |
| Acenaphthylene | PAH | 45 | UD | 45 | 62.4 | D | 36.0 | 7.42 | | 3.32 | 8.7 | UJ | 8.7 |
| Anthracene | PAH | 1000 | DJ | 15 | 866 | D | 36.0 | 1.33 | J | 3.32 | 3.0 | UJ | 3.0 |
| Benzo(a)anthracene | PAH | 2200 | DJ | 16 | 2120 | D | 36.0 | 17.8 | | 3.32 | 3.1 | UJ | 3.1 |
| Benzo(a)pyrene | PAH | 1300 | DJ | 32 | 1800 | D | 36.0 | 10.5 | | 3.32 | 6.2 | UJ | 6.2 |
| Benzo(b)fluoranthene | PAH | 1900 | DJ | 21 | 659 | D | 36.0 | 10.5 | | 3.32 | 4.1 | UJ | 4.1 |
| Benzo(ghi)perylene | PAH | 1700 | DJ | 36 | 1320 | D | 36.0 | 13.1 | | 3.32 | 7.0 | UJ | 7.0 |
| Benzo(k)fluoranthene | PAH | 620 | DJ | 20 | 684 | D | 36.0 | 5.18 | | 3.32 | 3.8 | UJ | 3.8 |
| Chrysene | PAH | 1700 | DJ | 24 | 2360 | D | 36.0 | 25.5 | | 3.32 | 4.7 | UJ | 4.7 |
| Dibenz[a,h]anthracene | PAH | 54 | UD | 54 | 78.4 | D | 36.0 | 0.832 | J | 3.32 | 11 | UJ | 11 |
| Fluoranthene | PAH | 6600 | DJ | 64 | 4870 | D | 36.0 | 56.3 | | 3.32 | 13 | UJ | 13 |
| Fluorene | PAH | 460 | DJ | 26 | 130 | D | 36.0 | 1.76 | J | 3.32 | 5.1 | UJ | 5.1 |
| Indeno(1,2,3-cd)pyrene | PAH | 1500 | DJ | 59 | 36.0 | UD | 36.0 | 6.52 | | 3.32 | 12 | UJ | 12 |
| Naphthalene | PAH | 59 | UD | 59 | 1490 | D | 36.0 | 376 | | 3.32 | 12 | UJ | 12 |
| Phenanthrene | PAH | 3600 | DJ | 59 | 2190 | D | 36.0 | 27.0 | | 3.32 | 12 | UJ | 12 |
| Pyrene | PAH | 5500 | DJ | 59 | 4330 | D | 36.0 | 28.0 | | 3.32 | 12 | UJ | 12 |
| Aroclor-1016 | PCB | 2.7 | U | 2.7 | | | | 13.3 | U | 13.3 | | | |
| Aroclor-1221 | PCB | 7.7 | U | 7.7 | | | | 13.3 | U | 13.3 | | | |
| Aroclor-1232 | PCB | 1.9 | U | 1.9 | | | | 13.3 | U | 13.3 | | | |
| Aroclor-1242 | PCB | 4.5 | U | 4.5 | | | | 13.3 | U | 13.3 | | | |
| Aroclor-1248 | PCB | 4.5 | U | 4.5 | | | | 13.3 | U | 13.3 | | | |
| Aroclor-1254 | PCB | 2.5 | U | 2.5 | | | | 13.3 | U | 13.3 | | | |
| Aroclor-1260 | PCB | 2.5 | U | 2.5 | | | | 13.3 | U | 13.3 | | | |
| Aroclor-1262 | PCB | | | | | | | 13.3 | U | 13.3 | | | |
| Aroclor-1268 | PCB | | | | | | | 13.3 | U | 13.3 | | | |
| Aldrin | PEST | 2.5 | UDJ | 2.5 | | | | 1.32 | UD | 1.32 | | | |
| Alpha-BHC | PEST | 2.1 | UDJ | 2.1 | | | | 1.32 | UD | 1.32 | | | |
| alpha-Chlordane | PEST | 3.2 | UDJ | 3.2 | | | | 1.32 | UD | 1.32 | | | |
| beta-1,2,3,4,5,6-Hexachlorocyclohexane | PEST | 6.6 | UDJ | 6.6 | | | | 1.32 | UD | 1.32 | | | |
| Delta-BHC | PEST | 4.0 | UDJ | 4.0 | | | | 1.32 | UD | 1.32 | | | |
| Dichlorodiphenyldichloroethane | PEST | 5.4 | UDJ | 5.4 | | | | 1.32 | UD | 1.32 | | | |
| Dichlorodiphenyldichloroethylene | PEST | 2.3 | UDJ | 2.3 | | | | 1.32 | UD | 1.32 | | | |
| Dichlorodiphenyltrichloroethane | PEST | 5.8 | UDJ | 5.8 | | | | 1.32 | UD | 1.32 | | | |
| Dieldrin | PEST | 2.1 | UDJ | 2.1 | | | | 1.32 | UD | 1.32 | | | |
| Endosulfan I | PEST | 1.7 | UDJ | 1.7 | | | | 1.32 | UD | 1.32 | | | |
| Endosulfan II | PEST | 2.8 | UDJ | 2.8 | | | | 1.32 | UD | 1.32 | | | |
| Endosulfan sulfate | PEST | 2.7 | UDJ | 2.7 | | | | 1.32 | UD | 1.32 | | | |
| Endrin | PEST | 3.0 | UDJ | 3.0 | | | | 1.32 | UD | 1.32 | | | |
| Endrin aldehyde | PEST | 1.7 | UDJ | 1.7 | | | | 1.32 | UD | 1.32 | | | |
| Endrin ketone | PEST | 4.8 | UDJ | 4.8 | | | | 1.32 | UD | 1.32 | | | |
| Gamma-BHC (Lindane) | PEST | 4.6 | UDJ | 4.6 | | | | 1.32 | UD | 1.32 | | | |
| gamma-Chlordane | PEST | 2.6 | UDJ | 2.6 | | | | 1.32 | UD | 1.32 | | | |
| Heptachlor | PEST | 2.1 | UDJ | 2.1 | | | | 1.32 | UD | 1.32 | | | |
| Heptachlor epoxide | PEST | 4.2 | UDJ | 4.2 | | | | 1.32 | UD | 1.32 | | | |
| Methoxychlor | PEST | 4.4 | UDJ | 4.4 | | | | 1.32 | UD | 1.32 | | | |
| Toxaphene | PEST | 160 | UDJ | 160 | | | | 13.2 | UD | 13.2 | | | |

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|---|---|---|---|
| Attachment | 1 | Sheet No. | 17 of 17 |
| Originator | N. K. Schiffern | Date | 06/11/13 |
| Checked | I. B. Berezovskiy | Date | 06/11/13 |
| Calc. No. | 0100N-CA-V0189 | Rev. No. | 0 |

Acrobat 8.0

# CALCULATION COVER SHEET

Project Title: 100-N Field Remediation **Job No. 14655**

Area: 100-N

Discipline: Environmental *Calculation No: 0100N-CA-V0196

Subject: 124-N-2 Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater

Computer Program: Excel Program No: Excel 2003

The attached calculations have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

| Rev. | Sheet Numbers | Originator | Checker | Reviewer | Approval | Date |
|---|---|---|---|---|---|---|
| 0 | Cover = 1<br>Sheets = 3<br>Total = 4 | N. K. Schiffern<br>N. K. Schiffern | I. B. Berezovskiy<br>I. B. Berezovskiy | J. D. Skoglie<br>J. D. Skoglie | O. F. Obenauer<br>O. F. Obenauer | 8/21/13 |
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## SUMMARY OF REVISION

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WCH-DE-018 (05/08/2007) *Obtain Calc. No. from Document Control and Form from Intranet

Washington Closure Hanford, Inc. CALCULATION SHEET

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|---|---|---|---|---|---|---|---|
| Originator: | N. K. Schiffern | Date: | 03/20/13 | Calc. No.: | 0100N-CA-V0196 | Rev.: | 0 |
| Project: | 100-N Area Field Remediation | Job No: | 14655 | Checked: | I. B. Berezovskiy | Date: | 03/20/13 |
| Subject: | 124-N-2 Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater | | | | | Sheet No. | 1 of 3 |

**PURPOSE:**

Provide documentation to support the calculation of the hazard quotient (HQ) and excess carcinogenic risk associated with soil contaminant levels compared to soil cleanup levels for protection of groundwater for the 124-N-2 waste site. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) for the 100-N Area (DOE-RL 2006), the following criteria must be met:

1) An HQ of <1.0 for all individual noncarcinogens
2) A cumulative HQ of <1.0 for noncarcinogens
3) An excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens
4) A cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.

**GIVEN/REFERENCES:**

1) DOE-RL, 2006, *Remedial Design Report/Remedial Action Work Plan for the 100-N Area,* DOE/RL-2005-93, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

2) WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, 1996.

3) WAC 173-340-740 (3)(a)(ii)(A), "Groundwater Protection".

4) WCH, 2013, *124-N-2 Waste Site Cleanup Verification 95% UCL Calculations*, 0100N-CA-V0189, Rev. 0, Washington Closure Hanford, Inc., Richland, Washington

**SOLUTION:**

1) Generate a HQ for each noncarcinogenic constituent detected above background in soil and with a $K_d$ less than that required to show no migration to groundwater in 1,000 years using the RESRAD generic site model (DOE-RL 2006).

2) Sum the HQs and compare this value to the cumulative HQ of <1.0.

3) Generate an excess cancer risk value for each carcinogenic constituent detected above background in soil and with a $K_d$ less than that required to show no migration to groundwater in 1,000 years using the RESRAD generic site model (DOE-RL 2006).

4) Sum the excess cancer risk value(s) and compare it to the cumulative cancer risk of $<1 \times 10^{-5}$.

Washington Closure Hanford, Inc. CALCULATION SHEET

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|---|---|---|---|---|---|---|---|
| Originator: | N. K. Schiffern NS | Date: | 03/20/13 | Calc. No.: | 0100N-CA-V0196 | Rev.: | 0 |
| Project: | 100-N Area Field Remediation | Job No: | 14655 | Checked: | I. B. Berezovskiy | Date: | 03/20/13 |
| Subject: | 124-N-2 Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater | | | | | Sheet No. | 2 of 3 |

## METHODOLOGY:

The 124-N-2 waste site is comprised of one decision unit for verification sampling, consisting of an excavation area. The protection of groundwater hazard quotient and carcinogenic risk calculations for the 124-N-2 waste site was conservatively calculated for the entire waste site using the statistical or maximum value for each analyte (WCH 2013). Based on the generic site RESRAD model (DOE-RL 2006) and a vadose zone of approximately 17 m (56 ft) thickness, a $K_d$ of 4.4 or greater is required to show no predicted migration to groundwater in 1,000 years. Nitrogen in nitrite and nitrate requires HQ and risk calculations because it is detected above a Washington State or Hanford Site background value, and has a $K_d$ of less than 4.4. Hexavalent chromium is included because this analyte has a $K_d$ of less than 4.4, and no Hanford background value has been established. Polycyclic aromatic hydrocarbons (PAHs) and total petroleum hydrocarbons (TPH) were excluded from the HQ and carcinogenic risk calculations as discussed in RSVP (WCH 2013). All other site nonradionuclide COPCs were undetected, quantified below background levels, or have a $K_d$ greater than or equal to 4.4. An example of the HQ and risk calculations for soil constituents with a potential impact to groundwater is presented below:

1) The hazard quotient is defined as the ratio of the dose of a substance obtained over a specified time (mg/kg/day) to a reference dose for the same substance derived over the same specified time (mg/kg/day). The hazard quotient can also be calculated as the ratio of the concentration in soil (maximum or statistical value) (mg/kg) to the soil RAG (mg/kg) for protection of groundwater, where the RAG is the groundwater cleanup level (μg/L) (calculated with, and related to the hazard quotient through, WAC 173-340-720 (3)(a)(ii)(A), (1996) x 100 x 1 mg/1000 μg (conversion factor). This is based on the "100 times rule" of WAC 173-340-740(3)(a)(ii) (A) (1996). For example, the maximum value for hexavalent chromiumof 0.289 mg/kg, divided by the noncarcinogenic RAG value of 4.8 mg/kg is $6.0 \times 10^{-2}$. Comparing this value to the requirement of <1.0, this criterion is met.

2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. (To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation.) The cumulative HQ for the 124-N-2 waste site is $7.9 \times 10^{-2}$. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, and then multiplied by $1 \times 10^{-6}$. There were not any detected constituents with a carcinogenic RAG associated with it. Therefore, the requirement of $<1 \times 10^{-6}$ is met. The criterion for cumulative excess cancer risk for carcinogens is also met.

4) The soil cleanup RAGs for protection of groundwater are based on the "100 times" provision in WAC 173-340-740(3)(a)(ii)(A). WAC 173-340-740(3)(a)(ii)(A) (1996) provides the "100 times rule" but also states "unless it can be demonstrated that a higher soil concentration is protective of ground water at the site." When the "100 times rule" values are exceeded, RESRAD was used to demonstrate that higher soil concentrations may be protective of groundwater.

Washington Closure Hanford, Inc. CALCULATION SHEET

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|---|---|---|---|---|---|---|---|
| Originator: | N. K. Schiffern NS | Date: | 03/20/13 | Calc. No.: | 0100N-CA-V0196 | Rev.: | 0 |
| Project: | 100-N Area Field Remediation | Job No: | 14655 | Checked: | I. B. Berezovskiy IBB | Date: | 03/20/13 |
| Subject: | 124-N-2 Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater | | | | | Sheet No. | 3 of 3 |

## RESULTS:

1) List individual noncarcinogens and corresponding HQs >1.0: None
2) List the cumulative noncarcinogenic HQ >1.0: None
3) List individual carcinogens and corresponding excess cancer risk >1 x $10^{-6}$: None
4) List the cumulative excess cancer risk for carcinogens >1 x $10^{-5}$: None.

Table 1 shows the results of the calculations.

**Table 1. Hazard Quotient and Excess Cancer Risk Results for the Protection of Groundwater for the 124-N-2 Waste Site.**

| Contaminants of Potential Concern | Maximum or Statistical Value[a] (mg/kg) | Noncarcinogen RAG[b] (mg/kg) | Hazard Quotient | Carcinogen RAG[b] (mg/kg) | Carcinogen Risk |
|---|---|---|---|---|---|
| ***Metals*** | | | | | |
| Chromium, hexavalent | 0.289 | 4.8 | 6.0E-02 | -- | -- |
| ***Anions*** | | | | | |
| Nitrogen in nitrite and nitrate | 47.7 | 2,560 | 1.9E-02 | -- | -- |
| ***Totals*** | | | | | |
| **Cumulative Hazard Quotient:** | | | **7.9E-02** | | |
| **Cumulative Excess Cancer Risk:** | | | | | **0.0E+00** |

Notes:
[a] = From WCH (2013).
[b] = Value obtained from the Cleanup Levels and Risk Calculations (CLARC) database using Groundwater, Method B, results and the "100 times" model.
-- = not applicable
RAG = remedial action goal

## CONCLUSION:

This calculation demonstrates that the 124-N-2 waste site meets the requirements for the hazard quotients and excess carcinogenic risk for protection of groundwater as identified in the RDR/RAWP (DOE-RL 2006).

# APPENDIX C

# DATA QUALITY ASSESSMENT

# APPENDIX C

# DATA QUALITY ASSESSMENT

## VERIFICATION SAMPLING

A data quality assessment (DQA) was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample design (WCH 2013b). This DQA was performed in accordance with site-specific data quality objectives found in the *100-N Area Sampling and Analysis Plan for CERCLA Waste Sites* (100-N Area SAP) (DOE-RL 2006).

A review of the sample design (WCH 2013b), the field logbook (WCH 2013a), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample design, with adjustments to sample locations as described in the section below. To ensure quality data, the 100-N Area SAP data assurance requirements and the data validation procedures for chemical analysis (BHI 2000) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2006).

Verification sample data collected at the 124-N-2 waste site were provided by the laboratories in sample delivery groups (SDGs) JP0565 and ZP0013. SDG JP0565 was submitted for third-party validation. No major deficiencies were identified in the analytical data set. Minor deficiencies were identified in the 124-N-2 analytical data set and are discussed as follows below. If no comments are made about a specific analysis, it should be assumed that no deficiencies affecting the quality of the data were found.

## MINOR DEFICIENCIES

### SDG JP0565

This SDG is composed of 13 statistical verification soil samples (J1RMH8, J1RMH9, J1RMJ0 through J1RMJ9, and J1RMK0) from the 124-N-2 excavation collected on May 14, 2013. This SDG includes a field duplicate pair (J1RMJ4/J1RMK0). All samples were analyzed for inductively coupled plasma (ICP) metals, mercury, nitrate/nitrite, polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCBs), and total petroleum hydrocarbons (TPH). Although not required by the sample design (WCH 2013b), the samples were also analyzed for ion chromatography (IC) anions. SDG JP0565 was submitted for third-party validation. In addition, one equipment blank (J1RMK2) was analyzed for ICP metals, mercury, and PAH.

In the PAH analysis, the matrix spike duplicate (MSD) recoveries for benzo(a)anthracene (177%), chrysene (164%), fluoranthene (256%), phenanthrene (183%), pyrene (253%), and the surrogate were outside of quality control (QC) limits. Due to MSD recoveries above QC limits, all benzo(a)anthracene, chrysene, fluoranthene, phenanthrene, and pyrene results were qualified as estimated and flagged with a "J" by third-party validation. Estimated data are usable for decision-making purposes.

In the PAH analysis, the relative percent difference (RPD) calculations from the matrix spike (MS)/MSD recoveries were above QC limits for dibenzo(a,h)anthracene (31%), fluoranthene (41%), phenanthrene (37%), and pyrene (42%). Due to MS/MSD recovery RPD calculations above QC limits, all dibenzo(a,h)anthracene, fluoranthene, phenanthrene, and pyrene results were qualified as estimated and flagged with a "J" by third-party validation. Estimated data are usable for decision-making purposes.

In the IC anions analysis, holding times were exceeded by less than twice the specified holding time for nitrate, nitrite, and orthophosphate. All nitrate, nitrite, and orthophosphate results were qualified as estimated and flagged with a "J" by third-party validation. Estimated data are usable for decision-making purposes.

In the IC anions analysis, the MS recoveries for fluoride associated with samples J1RMJ6 through J1RMJ9 and J1RMK0 (59%) as well as samples J1RMH8, J1RMH9, and J1RMJ0 through J1RMJ5 (42%) were outside of QC criteria. All fluoride results in these samples were qualified as estimated and flagged with a "J" by third-party validation. Estimated data are usable for decision-making purposes.

In the IC anions analysis, the MS recoveries for orthophosphate associated with samples J1RMJ6 through J1RMJ9 and J1RMK0 (57%) as well as samples J1RMH8, J1RMH9, and J1RMJ0 through J1RMJ5 (69%) were outside of QC criteria. All orthophosphate results in these samples were qualified as estimated and flagged with a "J" by third-party validation. Estimated data are usable for decision-making purposes.

In the nitrate/nitrite as nitrogen analysis, the RPD from the laboratory duplicate was above QC limits at 35%. Although not qualified for the laboratory duplicate RPD above QC limits, all nitrate/nitrite as nitrogen results may be considered estimated. Estimated data are acceptable for decision-making purposes.

In the PCB analysis, the surrogate recoveries in samples J1RMH9, J1RMJ0, J1RMJ4 through J14MJ9, J1RMK0, as well as the associated MB, were outside of laboratory QC limits. All PCB results in these samples were qualified as estimates and flagged with a "J" by third-party validation. Estimated data are usable for decision-making purposes.

In the PCB analysis, the surrogate recoveries in sample J1RMJ1 as well as the associated MB, MS, and MSD were outside of laboratory QC limits. Although not qualified for the laboratory surrogate recovery outside of QC limits, all PCB results in sample J1RMJ1 may be considered estimated. Estimated data are acceptable for decision-making purposes.

In the PCB analysis, the laboratory noted that samples J1RMH8, J1RMH9, J1RMJ1, J1RMJ4, J1RMJ5, J1RMJ7 through J1RMJ9, and J1RMK0 appeared to contain PCBs; however, due to weathering or other environmental processes, the PCBs in the samples did not closely match any of the aroclor standards used for instrument calibration. The samples were quantified and reported as aroclor-1254; however, due to the poor match with the aroclor standard(s), there was increased uncertainty associated with these results. The data are usable for decision-making purposes

In the ICP metals analysis, the MS recoveries were out of QC limits for aluminum (1,255%), antimony (42%), iron (3,273%), manganese (193%), and silicon (21%). For aluminum, iron, and manganese, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample and these data may be considered estimated. Antimony and silicon did not have mismatched spike and native concentrations in the original MS. All antimony and silicon data were qualified as estimates and flagged "J" by third-party validation due to the MS recoveries outside the limits. Although not qualified for MS recoveries outside of QC limits, all aluminum, iron, and manganese results may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, all silicon results were qualified as estimates and flagged "J" by third-party validation due to a laboratory control sample (LCS) recovery below QC limits at 18%. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, aluminum and barium were detected at less than twice the method detection limit (MDL) in the method blank (MB). Method blank contamination of this magnitude has no significant impact on the field sample results. The data are usable for decision-making purposes.

In the TPH analysis for diesel range organics, the surrogate recoveries for samples J1RMH8, J1RMH9, J1RMJ0, J1RMJ1, J1RMJ4, J1RMJ5, J1RMJ7-J1RMJ9, and J1RMK0 were above laboratory QC limits. All diesel range organics results in these samples were qualified as estimates and flagged "J" by third-party validation. Estimated data are usable for decision-making purposes.

In the pH analysis, all results were considered estimates and flagged "J" by third-party validation due to the holding time being exceeded by greater than twice the limit. Estimated data are usable for decision-making purposes.

**SDG ZP0013**

This SDG contains one statistical verification soil sample (J1RMK1) from the 124-N-2 excavation collected on May 14, 2013. This sample is a split of sample J1RMJ4. The sample was analyzed for ICP metals, mercury, nitrate/nitrite, pH, pesticides, PAH, PCBs, and TPH. Although not required by the sample design (WCH 2013b), the samples were also analyzed for IC anions.

In the PAH analysis, the recoveries for the surrogate was outside of laboratory QC limits for sample J1RMK1, as well as the MS and MSD. Elevated concentrations of target analytes were present in the sample and dilution was required for analysis. Although not qualified for surrogate recoveries outside of laboratory QC limits, all PAH results may be considered estimated. Estimated data are usable for decision-making purposes.

In the PAH analysis, the MS recoveries for benzo(a)anthracene (44%), benzo(k)fluoranthene (49%), benzo(a)pyrene (27%), chrysene (8%), naphthalene (-6%), phenanthrene (224%), and pyrene (183%). The MSD recoveries were outside QC limits for all PAH analytes. The MS/MSD RPDs for all PAH analytes were also above QC limits. Elevated concentrations of target analytes were present in the samples and dilution was required for analysis. Although not qualified for MS/MSD recoveries and MS/MSD RPDs outside of laboratory QC limits, all PAH results may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the MS/MSD recoveries were outside of QC limits for aluminum (196% and 215%), antimony (60% and 58%), boron (69% [MSD only]), calcium (23% [MS only]), iron (279% and 150%), magnesium (149% [MS only]), potassium (150% and 156%), and silicon (64% and 41%). For aluminum, calcium, and iron, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. Antimony, boron, and silicon did not have mismatched spike and native concentrations in the MS. Although not qualified for MS/MSD recoveries outside of laboratory QC limits, all aluminum, antimony, boron, calcium, iron, manganese, and silicon results may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the LCS recovery was below QC limits for aluminum (65%). Although not qualified for LCS recovery outside of laboratory QC limits, all aluminum results may be considered estimated. Estimated data are usable for decision-making purposes.

In the nitrate and nitrite as nitrogen analysis, contamination was detected at less than twice the MDL in the MB. Method blank contamination of this magnitude has no significant impact on the field sample results. The data are usable for decision-making purposes.

In the IC anions analysis, holding times were exceeded by less than twice the specified holding time for nitrate, nitrite, and orthophosphate. Although not qualified for the holding time exceedance, all nitrate, nitrite, and orthophosphate results may be considered estimated. Estimated data are usable for decision-making purposes.

In the IC anions analysis, chloride was detected at less than twice the MDL in the MB. Method blank contamination of this magnitude has no significant impact on the field sample results. The data are usable for decision-making purposes.

## FIELD QUALITY ASSURANCE/QUALITY CONTROL

The RPD evaluations of main sample(s) versus the laboratory duplicate(s) are routinely performed and reported by the laboratory. Any deficiencies in those calculations are reported by SDG in the previous sections.

Field quality assurance (QA)/QC measures are used to assess potential sources of error and cross contamination of samples that could bias results. Field QA/QC samples, listed in the field logbook (WCH 2013a), are shown in Table C-1. The main and QA/QC sample results are presented in Appendix B.

**Table C-1. Field Quality Assurance/Quality Control Samples.**

| Sample Area | Main Sample | Duplicate Sample | Split Sample |
|---|---|---|---|
| Excavation | J1RMJ4 | J1RMK0 | J1RMK1 |

Field duplicate samples are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates are evaluated by computing the RPD of the sample/duplicate pair(s) for each contaminant of potential concern (COPC). Relative percent differences are not calculated for analytes that are not detected in both the main and duplicate sample at more than five times the target detection limit (TDL). The RPDs of analytes detected at low concentrations (less than five times the detection limit) are not considered to be indicative of the analytical system performance. The calculation brief in Appendix B provides details on duplicate pair evaluation and the RPD calculation.

Split samples are collected to provide a relative measure of the variability in the sampling, sample handling, and analytical techniques used by commercial laboratories. The field main and split samples are evaluated by computing the RPD of the split samples for each COPC to determine the usability of the verification data. The U.S. Environmental Protection Agency Contract Laboratory Program duplicate sample comparison methodology, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 2004), is used as an initial test of the data from the splits. Only analytes that had values above five times the contract-required quantitation limit for both the main and split sample were compared. The 95% UCL calculation brief in Appendix B provides details on the split pair RPD calculation. The RPD acceptance criteria for project-split samples is ≤35% (less than or equal to 35%).

The calculated RPDs for the field QA/QC duplicate samples were within the acceptance criteria of 30% for all duplicate analyses except for aluminum (55.4%), barium (62.3%), calcium (66.4%), copper (44.6%), iron (33.5%), magnesium (48.2%), manganese (41.2%), silicon (37.6%), TPH diesel range (75.9%), TPH diesel range extended (72.4%), acenaphthene (81.8%), anthracene (108.4%), benzo(a)anthracene (45.2%), benzo(a)fluoranthene (40.7%), benzo(ghi)perylene (66.7%), benzo(k)fluoranthene (34.8%), chrysene (47.2%), fluoranthene (62.5%), fluorene (77.8%), indeno(1,2,3-cd)pyrene (66.7%), phenanthrene (94.1%), and pyrene (66.7%). All RPD values for the split analyses were within the acceptance criteria of 35% except

for barium (42.2%), calcium (75.5%), zinc (40.6%), acenaphthene (154.0%), anthracene (66.7%), benzo(a)anthracene (69.7%), benzo(a)pyrene (43.5%), benzo(a)fluoranthene (57.5%), benzo(ghi)perylene (71.2%), benzo(k)fluoranthene (53.3%), chrysene (56.6%), fluoranthene (58.8%), phenanthrene (70.0%), and pyrene (47.2%). A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than five times the TDL, including undetected analytes. In these cases, a control limit of ±2 times the TDL is used (Appendix B) to indicate that a visual check of the data is required by the reviewer. In the duplicate samples analyses, dibenz(a,h)anthracene required this check. No analytes in the split sample analyses required this check. All of these results are attributed to heterogeneities in the sample matrix from which the samples were collected. A visual inspection of all of the data is also performed. No additional major or minor deficiencies are noted. The data are usable for decision-making purposes.

**Summary**

Limited, random, or sample matrix-specific influenced batch QC issues such as those discussed above are a potential for any analysis. The number and types seen in these data sets are within expectations for the matrix types and analyses performed. The DQA review of the 124-N-2 waste site verification sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for the 124-N-2 waste site concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. The analytical data were found acceptable for decision-making purposes. The verification sample analytical data are stored in the Environmental Restoration project-specific database prior to being submitted for inclusion in the Hanford Environmental Information System database. The verification sample analytical data are also summarized in Appendix B.

## REFERENCES

BHI, 2000, *Data Validation Procedure for Chemical Analysis*, BHI-01435, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

DOE-RL, 2006, *100-N Area Sampling and Analysis Plan for CERCLA Waste Sites,* DOE/RL-2005-92, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

EPA, 2004, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540-R-04-004, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.

EPA, 2006, *Guidance on Systematic Planning using the Data Quality Objectives Process*, EPA QA/G-4, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.

WCH, 2013a, *100-N Field Remediation Sampling*, Logbook EL-1652-09, pp. 46-47, Washington Closure Hanford, Richland, Washington.

WCH, 2013b, *Work Instruction for Verification Sampling of the 124-N-2; 124-N-2 Septic Tank; 100-N Sanitary Sewer System No. 2 Waste Site,* 0100N-WI-G0039, Rev. 2, Washington Closure Hanford, Richland, Washington.