Emerald Performance Materials
Emerald Kalama Chemical, LLC
1296 Third Street NW
Kalama, WA 98625-9799
360-673-2550

**VIA ELECTRONIC MAIL**

April 23, 2018

Dave Bartus
USEPA Region 10
1200 Sixth Avenue
Mail Code: AWT-150
Seattle, WA 98101

Greg Gould
Washington Department of Ecology
PO Box 47600
Olympia, WA 98504-7600

**RE: Delisting Petition for Mixed Material Stored at Fire Mountain Farms Burnt Ridge Facility**

Dear Messrs. Bartus and Gould:

In accordance with 40 Code of Federal Regulations (CFR) §260.22 and Washington Administrative Code (WAC) 173-303-910(3), Emerald Kalama Chemical, LLC (Emerald) and Fire Mountain Farms, Inc. (FMF) jointly petition the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology) to exclude the mixture of industrial wastewater biological solids (IWBS) generated by Emerald at its Kalama facility, municipal wastewater treatment plant biosolids (biosolids) accepted by FMF, secondary wastewater treatment solids (SWTS) accepted by FMF, and cow manure barn lot runoff currently stored at FMF's Burnt Ridge facility, located at 856 Burnt Ridge Road, Onalaska, Washington, from designation as a Resource Conservation and Recovery Act (RCRA) hazardous waste.

This petition establishes that the mixture of IWBS, biosolids, SWTS, and barn lot runoff, collectively known as mixed material, accepted by FMF, does not meet any of the criteria under which the waste carries the hazardous waste listings, that that there are no factors other than those for which the waste was listed that could cause the waste to be a hazardous waste, that such factors do not warrant retaining the waste as a hazardous waste, and that the mixed material is not a hazardous waste by operation of Subpart C of 40 CFR Part 261 or a dangerous waste by Chapter 173-303 WAC. In addition, the mixed material does not designate as a dangerous waste based on the criteria in WAC 173-303-100 (see Section 1.7, Evaluation of Dangerous Waste Criteria of the Waste Characterization Plan dated July 27, 2017; the Waste Characterization Plan is included in Appendix C of this petition).

The parties request EPA and Ecology approval to send the mixed material to a Subtitle D landfill. In accordance with the treatment variance, submitted concurrently, the mixed material meets applicable Land Disposal Restriction (LDR) treatment standards, based on the waste characterization sampling analytical results.

**Name and address of petitioners (40 CFR 260.20(b)(1); WAC 173-303-910(1)(b)(i))**

The joint petitioners for this matter are:

Emerald Kalama Chemical, LLC
1296 NW 3rd Street
Kalama, WA 98625

Fire Mountain Farms, Inc.
856 Burnt Ridge Road
Onalaska, WA 98570

**Statement of petitioners' interest in the proposed action (40 CFR 260.20(b)(2); WAC 173-303-910(1)(b)(ii)).**

Ecology has issued Administrative Order No. 10938 (Sept. 11, 2014) (Order) alleging that Emerald and FMF are co-generators of dangerous (i.e., hazardous)[1] waste at three FMF facilities. The alleged dangerous waste is comprised of a mixture of IWBS, barn lot runoff, SWTS, and biosolids accepted from various sources by FMF (mixed material). The IWBS carry two listed hazardous waste codes – U019 (benzene) and U220 (toluene). The Emerald IWBS carry these two codes because material entering Emerald's wastewater treatment plant carries those two codes and, although the resulting sludge does not contain hazardous waste constituents for either benzene or toluene, the sludge retains the listing due to RCRA's derived-from rule. Further, because the IWBS are considered listed hazardous waste and, because as described below, Ecology alleges that the IWBS are not eligible for the so-called fertilizer exemption under Ecology regulations, Ecology has alleged that the mixed material is considered a listed hazardous waste. The Order requires Emerald and FMF to undertake four different corrective actions, the first three of which have been completed to Ecology's satisfaction. The fourth – cleanup and closure of the three units in which the mixed material is being stored – will generate wastes requiring disposal that are the subject of and reason for this delisting petition.

Emerald provided its IWBS to FMF pursuant to a long-standing recycling agreement between the two parties, under which FMF would recycle Emerald's material as a fertilizer. It was the parties' intent and understanding that this recycling arrangement was consistent with an Ecology regulation that exempts such waste-derived fertilizer from regulation as a hazardous waste. Although the practice continued for many years and with Ecology's knowledge, Ecology

[1] Ecology uses the term "dangerous waste" to refer to "hazardous waste" under RCRA. Although there are some state-only dangerous wastes, those state-only wastes are not at issue here. For purposes of this delisting petition, the terms mean the same thing and may be used interchangeably.

concluded in 2014 that the material is not eligible for the "fertilizer exemption," that the practice does not constitute legitimate recycling, that the Emerald material is a solid and hazardous waste and, therefore, that the mixed material is a solid and hazardous waste. Emerald immediately complied with an Ecology request to stop sending the IWBS to FMF for recycling and the mixed material is currently being stored at FMF's Burnt Ridge, Newaukum Prairie and Big Hanaford facilities. On September 11, 2014, Ecology issued the Order to both Emerald and FMF.

Emerald and FMF appealed Ecology's Order to the Washington State Pollution Control Hearings Board (PCHB) but on September 28, 2015, the PCHB ruled in favor of Ecology. Emerald and FMF filed separate appeals with Washington State Superior Court. Those appeals have been consolidated and are currently stayed by agreement of all parties. The parties have since negotiated an Agreement[2], dated June 3, 2016, which sets forth specific steps that Emerald and FMF agree to undertake to satisfy the remaining corrective action obligation in the Order. Among other things, the Agreement states that Emerald and FMF will file three separate delisting petitions covering the material currently stored in the three different FMF units. If the delisting petitions are granted, the parties intend to close the three units in accordance with an approved closure plan under the terms of the Agreement, and dispose of the mixed material in a Subtitle D landfill.

**A description of the proposed action, including (where appropriate) suggested regulatory language (40 CFR 260.20(b)(3); WAC 173-303-910(1)(b)(iii)).**

Emerald and FMF are seeking EPA and Ecology approval to delist the mixed material currently being stored at FMF's Burnt Ridge facility with the following two conditions: (1) Disposal in a Subtitle D landfill, and (2) Compliance with the concentration-based LDRs for the following dangerous waste codes: U019, U154, U220, and F003 and obtaining a variance for the combustion LDR treatment standard for U001 wastes.[3]

**A statement of the need and justification for the proposed action, including any supporting tests, studies, or other information (40 CFR 260.20(b)(4); WAC 173-303-910(1)(b)(iv)).**

Emerald and FMF request the delisting of the RCRA waste codes attached to the mixed material, so that the material can be disposed of in a Subtitle D landfill rather than requiring that this benign material be sent to a RCRA Subtitle C landfill.

According to information provided by FMF, approximately 83 percent of the material in the Burnt Ridge storage unit is municipal biosolids that would have been applied to the land if not for the fact that the material was mixed with Emerald IWBS. Federal and Washington State regulations allow, and even encourage the use of biosolids as a soil amendment. FMF indicates that less than 10 tons of IWBS were added to the storage unit in 2013. The IWBS comprise less

[2] Ecology. 2016a. Agreement for Conditional Compliance with Ecology Administrative Order No. 10938 During Judicial Review, Washington State Department of Ecology. June 3.
[3] By seeking a treatment variance for U001 listed wastes, the parties are not waiving any argument they have made or may make in the future regarding the applicability of the LDR treatment standard for U001.

than eight percent of the total mass of material in the storage unit. FMF stated that they had ceased adding any material to the storage unit prior to the winter of 2013-2014 because of Ecology's concern that the liner might be leaking. FMF was preparing to replace the liner; however, it has since been determined that the elevated nitrate concentrations measured in the groundwater are the result of surface infiltration, not storage unit leakage. A list of sources and approximate quantities are provided in Table 1 below. This information was provided to Emerald by FMF.

Emerald's biological wastewater treatment plant treats process wastewater as well as groundwater containing contamination from historical spills. As part of that treatment process, the plant generates IWBS. Emerald's IWBS are basically the same material as municipal wastewater treatment plant (WWTP) biosolids. That is essentially the dead and decaying microorganisms used to digest and thereby chemically transform the undesirable components present in the wastewater into benign, and in many cases useful, compounds. IWBS are superior to biosolids in many ways because the processes that generate this material are consistent and the microorganisms are selected and conditioned by the nature of the wastewater. Therefore, the industrial WWTP can operate with exceptional efficiency to chemically transform the target chemicals into benign compounds.

**Table 1**
**Sources of Material Stored in the Burnt Ridge Storage Unit**

| Source | Tons (approximate) |
|---|---|
| Emerald Kalama Chemical, LLC IWBS | 9.8 |
| Kitsap Municipal Wastewater Treatment Plant | 26.5 |
| Castle Rock Municipal Wastewater Treatment Plant | 0.8 |
| West Sound Utility District Wastewater Treatment Plant | 17.0 |
| Camas Municipal Wastewater Treatment Plant | 8.1 |
| McCleary Municipal Wastewater Treatment Plant | 1.2 |
| Aberdeen Municipal Wastewater Treatment Plant | 19.7 |
| Kalama Municipal Wastewater Treatment Plant | 0.8 |
| Gig Harbor Municipal Wastewater Treatment Plant | 13.8 |
| Grand Mound Municipal Wastewater Treatment Plant | 3.2 |
| Darigold - Industrial Wastewater Treatment Plant Solids (SWTS) | 8.4 |
| Ocean Shores Municipal Wastewater Treatment Plant | 12.3 |
| Lewis County Water Sewer District 6 Municipal Wastewater Treatment Plant | 0.5 |
| Cow Manure (Fire Mountain Farms water runoff from barn lot) | 3.8 |
| **Total** | 125.9 |

**The waste produced by a particular generating facility does not meet any of the criteria under which the waste was listed as a hazardous waste (40 CFR 260.22(a)(1), 260.22(b)) and there are no factors (including additional constituents) other than those for which the waste was listed that could cause the waste to be a hazardous waste (40 CFR 260.22(a)(2), 260.22(b); WAC 173-303-072(4)).**

The majority of the mixed material (approximately 83 percent) is comprised of biosolids generated by municipal WWTPs. Municipal biosolids do not meet any of the criteria under which the mixed material is listed as a hazardous waste and there are no constituents (or other factors) that could cause the waste to be a hazardous waste. Biosolids are approved by EPA and Ecology for land application.

The mixed material contains approximately 3.8 tons of runoff from the livestock barn lot. The runoff material is cow manure produced by livestock, diluted with rain water. Cow manure does not meet any of the criteria under which the mixed material is listed as a hazardous waste and there are no constituents (or other factors) that could cause the waste to be a hazardous waste. Cow manure has long been applied to farm fields to replenish nitrogen and other nutrients that are required by crops.

The mixed material contains approximately 8.4 tons of SWTS from the Darigold Chehalis facility. The Chehalis plant produces dry milk products. The SWTS do not meet any of the criteria under which the mixed material is listed as a hazardous waste and there are no constituents (or other factors) that could cause the waste to be a hazardous waste. Ecology granted the SWTS a beneficial use determination (BUD-SA-15-08) for application to agricultural fields as a nitrogen supplement.

The mixed material contains approximately 9.8 tons of IWBS. The IWBS are produced in Emerald's biological WWTP. The WWTP treats process wastewater as well as groundwater containing contamination from historical spills. As part of that treatment process, the plant generates IWBS. Emerald's IWBS are basically the same material as municipal biosolids. The Emerald IWBS do not meet any of the criteria for which the waste was listed as hazardous and there are no constituents (or other factors) that could cause the waste to be a hazardous waste.

The Kalama facility regularly sampled the IWBS and had the material analyzed for various chemical constituents on a monthly, quarterly, or annual basis. The data are provided in Table A-1, Routine Analytical Data, in Appendix A. Toluene was detected in one sample of the IWBS between 1998 and 2014 at a concentration of 69 micrograms per kilogram (parts per billion; ppb), reported on a dry weight basis[4], which, as shown in Table A-1 in Appendix A, is significantly below the preliminary delisting levels developed by Ecology for the IWBS based on maximum allowable total concentrations (PDLs) and, for toluene,[5] maximum allowable toxicity

[4] Contaminant concentrations reported on a dry weight basis are higher than they would be if they were reported on an as-received basis. Therefore, consideration of dry weight results in delisting decisions is conservative. The percent solids for this sample is 8.6 percent.
[5] For other analytes listed on Table A-1 with identified TCLP-PDLs, TCLP analysis results provided on Table A-2 are compared to TCLP-PDLs.

characteristic leaching procedure (TCLP) concentrations (TCLP-PDLs) using EPA's Hazardous Waste Delisting Risk Assessment Software and provided to Emerald[6], and the RCRA LDR treatment standard of 10 milligrams per kilogram (parts per million; ppm). Benzene was not detected during this time period. The detection limits for benzene and toluene are in the microgram per kilogram range (ppb). In contrast, the preliminary delisting levels and RCRA land disposal treatment standard for benzene and toluene are many orders of magnitude greater than the detection limits. Therefore, if present below the detection limit; the concentrations of benzene and toluene in the IWBS are likely at least three orders of magnitude below the relevant preliminary delisting levels and RCRA land disposal treatment standard.

Emerald had TCLP analyses performed on the IWBS in 2000 and in 2014. The results were consistent and all chemicals were below the TCLP-PDLs and the LDR treatment standards. The data are presented in Table A-2, TCLP (EPA Method 1311), in Appendix A. Emerald had fish bioassays performed on the IWBS in 2000 and 2014. The percent mortality of the rainbow trout was zero for both tests. Refer to Table A-3, Bioassay (Rainbow Trout), in Appendix A.

The IWBS likely do not contain any other chemical constituent that would cause it to be hazardous. The IWBS were analyzed for pH, cyanide, sulfide, flashpoint, methanol, and acetone. All of the results were either negative or non-detect. The results are presented in Table A-4, Miscellaneous Analyses, in Appendix A.

The mixed material should be acceptable for disposal in a Subtitle D landfill given that the IWBS likely do not contain any of the chemicals or exhibit any of the characteristics of the associated waste codes, and comprise less than eight percent of the total mass of material in the Burnt Ridge storage unit.

**The waste does not exhibit the characteristic of ignitability and does not contain constituents for which the waste was listed (40 CFR 260.22(c), (d)).[7]**

The majority of the mixed material (approximately 83 percent) is comprised of biosolids generated by municipal waste water treatment plants. Municipal biosolids do not do not exhibit the characteristic of ignitability as defined in 40 CFR 261.21(a)(i) and WAC 173-303-090(5)(a), nor do they carry any RCRA waste codes, and are approved by EPA and Ecology for land application.

The mixed material contains approximately 3.8 tons of runoff from the livestock barn lot. The runoff material is cow manure produced by livestock, diluted with rain water. Cow manure does not exhibit the characteristic of ignitability as defined in 40 CFR 261.21(a)(i) and WAC 173-303-090(5)(a), nor does it carry any RCRA waste codes, and has long been applied to farm fields to replenish nitrogen and other nutrients that are required by crops.

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[6] Ecology. 2016b. Letter: EPA and Ecology Comments to Waste Characterization Plan. From Laurie G. Davies, Waste 2 Resources Program, Washington State Department of Ecology, to Jarrod Kocin, Emerald Kalama Chemical, LLC. September 23.

[7] For some of the remaining EPA delisting petition requirements discussed in this petition, there is no corresponding WAC regulatory citation.

The mixed material contains approximately 8.4 tons of SWTS from the Darigold Chehalis facility. The Chehalis plant produces dry milk products. The SWTS do not exhibit the characteristic of ignitability as defined in 40 CFR 261.21(a)(i) and WAC 173-303-090(5)(a), nor do they carry any RCRA waste codes, and are approved for application to agricultural fields as a nitrogen supplement (BUD-SA-15-08).

The mixed material contains approximately 9.8 tons of IWBS. The IWBS are produced in Emerald's biological WWTP. The WWTP treats process wastewater as well as groundwater containing contamination from historical spills. As part of that treatment process, the plant generates IWBS. Emerald's IWBS are basically the same material as municipal biosolids. The IWBS do not exhibit the characteristic of ignitability as defined in 40 CFR 261.21(a)(i) and WAC 173-303-090(5)(a), nor contain constituents for which the waste was listed (40 CFR 260.22(c), (d)).

Emerald performed a waste designation on the IWBS in 2000 and again in 2014. Emerald identified all hazardous waste streams that enter, or potentially enter, the wastewater treatment plant. Waste codes U001, U019, U154, U220, F003, and D018 apply to the wastewater treated in the WWTP. According to 40 CFR 261.3(g)(2)(ii); WAC 173-303-070(2)(c)(i), any waste that is listed on the basis of ignitability, corrosivity, or reactivity is not governed by the derived-from rule and so the listing code does not apply to the IWBS because the IWBS do not exhibit the characteristic. Therefore, F003 (spent non-halogenated solvents) does not apply because the IWBS are not ignitable (refer to Table A-4 in Appendix A). D018 (benzene) does not apply because that characteristic is not present in the IWBS (refer to Tables A-1 and A-2, in Appendix A).

Waste code U001 (acetaldehyde) applies to the wastewater entering Emerald's wastewater treatment plant; however, this code is listed solely on the basis of ignitability, the resulting IWBS do not exhibit the ignitability characteristic, and therefore the code does not carry through. Although Ecology agrees that the code does not carry through; Ecology has alleged that the WWTP must meet the combustion LDR treatment standard for U001, and has requested that Emerald file a treatment variance request for this waste code, separate from the delisting petition. The treatment variance request is being submitted concurrently.

40 CFR 268.40(j)[8] unambiguously provides an alternate concentration-based LDR treatment standard for U154 (methanol). Therefore, as long as the concentration of methanol in the IWBS is below the standard, U154 does not apply. Methanol has not been detected in the IWBS (refer to Table A-4 in Appendix A).

Waste codes U019 (benzene) and U220 (toluene) apply to the IWBS because material entering Emerald's wastewater treatment plant carries those two codes and, although the resulting IWBS do not contain either benzene or toluene, the IWBS retain the listing due to RCRA's derived-from rule.

[8] There is no specific corresponding Washington regulation.

Approximately eighty three percent of the material in the Burnt Ridge storage unit is municipal biosolids, approximately seven percent is SWTS from Darigold, and approximately three percent is barn runoff, which do not carry any RCRA waste codes or exhibit any hazardous characteristics; and the remaining approximately eight percent is Emerald IWBS.[9] None of the individual components of the mixed material exhibit the characteristic of ignitability as defined in 40 CFR 261.21(a)(i) and WAC 173-303-090(5)(a), nor contain constituents per 40 CFR 260.22(c), (d). Since none of the components of the mixed material is ignitable; the mixture of these materials is not likely to be ignitable, and is not likely to contain constituents for which the material was listed above either the PDLs or LDR treatment standards.

**Demonstration samples must consist of enough representative samples, but in no case less than four samples, taken over a period of time sufficient to represent the variability or the uniformity of the waste (40 CFR 260.22(h); WAC 173-303-072(3)).**

The mixed material has been sampled and analyzed during two separate campaigns. In 2014, Pacific Groundwater Group (PGG) was contracted by FMF to sample and analyze the mixed material. Landau Associates Inc. (LAI) collected and analyzed samples in 2017, in accordance with the Waste Characterization Plan which was approved by EPA and Ecology (Appendix C).

FMF contracted with PGG to sample the mixed material in the Burnt Ridge storage unit in July 2014. PGG collected 27 samples which were combined into three composite samples for analysis. The mixed material was tested for the following parameters/methods:

- Volatile Organic Compounds, Method 8260C
- Metals, Methods 6010C/7471A
- Semi-volatile Organic Compounds, Method 8270D
- Polychlorinated biphenyls, Method 8082A
- Pesticides, Method 8081B
- Dioxins/Furans, Method 1613B
- N-Nitrate, calculated
- N-Ammonia, Method 350.1M
- Total Kjeldahl Nitrogen, Method 351.2
- Nitrate and Nitrite, Method 353.2
- Nitrite, Method 353.2
- Total Solids, Method SM2540G
- Total Cyanide, Method 335.4
- pH, Method 9045

Ecology developed preliminary delisting levels for the Burnt Ridge storage unit based on PDLs and TCLP-PDLs using EPA's Hazardous Waste Delisting Risk Assessment Software and

[9] Note that percentages add up to more than 100 due to rounding.

provided them to Emerald[10]. All analytes and parameters were non-detect or present at concentrations below the PDLs or TCLP-PDLs, multiplied by 20 in accordance with the rule of 20, except cobalt. The data from the PGG study are presented, on a dry weight basis[11], in Table B-1 in Appendix B.

Emerald contracted with LAI in 2017 to collect three core samples, which were analyzed for total cobalt on a dry weight basis[12], and composited and analyzed for TCLP cobalt. The total cobalt concentrations were consistent with the results from the PGG results and the TCLP cobalt concentration was below the TCLP-PDL. The data from the LAI cobalt investigation are presented in Table B-3 in Appendix B.

As described in the Waste Characterization Plan, the analytical data from the 2014 PGG investigation and the 2017 LAI analysis of total and TCLP cobalt demonstrate that concentrations in the mixed material in the Burnt Ridge storage unit are likely below the PDLs and TCLP-PDLs.

A comparison of the PGG data for benzene and toluene with the LDR levels for non-wastewater indicates that the concentration of benzene and toluene in the mixed material likely complies with the LDR treatment standards; however, the samples were not analyzed for acetone or methanol. In order to ensure that there are no data gaps, Emerald and FMF submitted a Waste Characterization Plan, which was approved by EPA and Ecology, which proposed the following analyses:

- Volatile Organic Compounds, Method EPA SW8260C
    - toluene
    - benzene
    - acetone
- Volatile Organic Compounds, Method EPA SW8015C
    - methanol
- Total solids, EPA Method SM2540G-97
- pH, EPA Method 9045D

LAI collected and analyzed 11 grab samples of the mixed material. The data from the waste characterization are presented, on an as-received basis[13], in Table B-4 in Appendix B. The concentrations of acetone, benzene, toluene, and methanol indicate that the concentrations in the mixed material are likely below the LDR treatment standards.

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[10] Ecology. 2016b. Letter: EPA and Ecology Comments to Waste Characterization Plan. From Laurie G. Davies, Waste 2 Resources Program, Washington State Department of Ecology, to Jarrod Kocin, Emerald Kalama Chemical, LLC. September 23.
[11] Contaminant concentrations reported on a dry weight basis are higher than they would be if they were reported on an as-received basis. Therefore, consideration of dry weight results in delisting decisions is conservative.
[12] Contaminant concentrations reported on a dry weight basis are higher than they would be if they were reported on an as-received basis. Therefore, consideration of dry weight results in delisting decisions is conservative.
[13] EPA delisting guidance (EPA. 1993. Petitions to Delist Hazardous Wastes: A Guidance Manual. US Environmental Protection Agency. March) specifies that samples should be analyzed on an as-received basis.

The IWBS are the only component of the mixed material that is alleged to carry RCRA waste codes, although these chemicals are not present above the detection limits in the IWBS. Emerald regularly collected and analyzed 323 samples of the IWBS for various constituents on a monthly, quarterly, or annual basis from January 1998 through April 2015. All of this data is summarized in Table A-1 (Appendix A) and illustrates the uniformity of the waste. Ecology developed preliminary delisting levels for the IWBS based on PDLs and TCLP-PDLs using EPA's Hazardous Waste Delisting Risk Assessment Software and provided them to Emerald[14]. As noted above, toluene was detected in one sample of IWBS between 1998 and 2014 at a concentration of 69 micrograms per kilogram (ppb), which is below the Burnt Ridge PDL of 6.64E+10 ppb, the TCLP-PDL, multiplied by 20 in accordance with the rule of 20, of 5.44E+06 ppb, and the RCRA LDR treatment standard of 10 milligrams per kilogram (ppm). Benzene was not detected during this time period.

Emerald had TCLP analyses performed on the IWBS in 2000 and in 2014. The results were consistent and all chemicals were below the TCLP-PDLs and the LDR treatment standards. The data are presented in Table A-2, TCLP (EPA Method 1311), in Appendix A. Emerald had fish bioassays performed on the IWBS in 2000 and 2014. The percent mortality of the rainbow trout was zero for both tests. Refer to Table A-3, Bioassay (Rainbow Trout), in Appendix A.

**Name and address of the laboratory facility performing the sampling or tests of the waste (40 CFR 260.22(i)(1); WAC 173-303-910(3)(c)(i)).**

Emerald Kalama Chemical, LLC
1296 Third Street NW
Kalama, WA 98625

Pacific Groundwater Group
Seattle, Washington 98102

Landau Associates, Inc.
130 2nd Avenue South
Edmonds, WA 98020

Analytical Resources, Inc.
4611 S. 134th Place
Suite 100
Tukwila, WA 98168-3240

[14] Ecology. 2016b. Letter: EPA and Ecology Comments to Waste Characterization Plan. From Laurie G. Davies, Waste 2 Resources Program, Washington State Department of Ecology, to Jarrod Kocin, Emerald Kalama Chemical, LLC. September 23.

ALS Environmental
ALS Group USA, Corp.
1317 South 13th Avenue
Kelso, WA 98626

CH2MHILL
100 NE Circle Boulevard, Suite 300
Corvallis, OR 97330

Laucks Testing Laboratories, Inc. (now part of Pace Analytical)
940 South Harney Street
Seattle, WA 98108

Parametrix, Inc.
5808 Lake Washington Blvd NE, Suite 200
Kirkland, WA 98033

PIXIS Labs (formerly Coffey Laboratories, Inc.)
12423 NE Whitaker Way
Portland, OR 97230

**Names and qualifications of the persons sampling and testing the waste (40 CFR 260.22(i)(2);WAC 173-303-910(3)(c)(ii)).**

Persons sampling the waste:

Emerald Kalama Chemical, LLC:
A company that employs scientists, engineers, and other individuals with baccalaureate or post-graduate degrees in the natural sciences or engineering, and has sufficient training and experience to enable that individual to make sound professional judgements regarding the sampling of IWBS and other environmental media.

Pacific Groundwater Group
A consulting firm that specializes in water resources and environmental services. The staff includes Washington State licensed geologists and hydrogeologists. Sampling was conducted under the supervision of a state licensed geologist. State licensure indicates that the professional is able to make sound judgements and determinations in regards to environmental media sampling.

Landau Associates, Inc.
A consulting firm specializing in environmental investigation and remediation. The staff include Washington State licensed geologists, hydrogeologists, and engineers. Sampling was conducted under the supervision of a professional engineer experienced with environmental investigation and remediation. State licensure indicates that the professional is able to make sound judgements and determinations in regards to environmental media sampling.

Persons testing the waste:

Analytical Resources, Inc.
Analytical Resources, Inc. is accredited by Ecology to analyze solids and water for the methods and analytes associated with this work. Ecology provides accreditation through an application process that involves a review of a detailed procedure manual, quality assurance manual, proficiency testing study reports, and third-party certification documents. This accreditation has been updated annually as required by Ecology and was current during each year that analysis associated with this project was performed.

ALS Environmental
ALS Environmental is accredited by Ecology to analyze solids and water for the methods and analytes associated with this work. Ecology provides accreditation through an application process that involves review of a detailed procedure manual, quality assurance manual, proficiency testing study reports, and third-party certification documents. This accreditation has been updated annually as required by Ecology and was current during each year that analysis associated with this project was performed.

CH2MHILL
CH2MHILL was accredited by Ecology to analyze the analytes associated with this work. Ecology provided accreditation through an application process that involves a review of a detailed procedure manual, quality assurance manual, proficiency testing study reports, and third-party certification documents. This accreditation was updated annually as required by Ecology and was current during each year that analysis associated with this project was performed.

Laucks Testing Laboratories, Inc. (now part of Pace Analytical)
Laucks Testing Laboratories was accredited in accordance with the applicable requirements at the time the analyses were performed.

Parametrix, Inc.
Parametrix, Inc. was accredited in accordance with the applicable requirements in place at the time the analyses were performed.

PIXIS Labs (formerly Coffey Laboratories, Inc.)
PIXIS Labs was accredited in accordance with the applicable requirements in place at the time the analyses were performed.

**The dates of sampling and testing (40 CFR 260.22(i)(3); WAC 173-303-910(3)(c)(iii)).**

Refer to Tables A-1 through A-4 in Appendix A and Tables B-1 through B-4 in Appendix B.

**The location of the generating facility (40 CFR 260.22(i)(4); WAC 173-303-910(3)(c)(iv))**.

Emerald Kalama Chemical, LLC
1296 Third Street NW
Kalama, WA 98625

Fire Mountain Farms
856 Burnt Ridge Road
Onalaska, WA 98570

**A description of the manufacturing processes or other operations and feed materials producing the waste and an assessment of whether such processes, operations, or feed materials can or might produce a waste that is not covered by the demonstration (40 CFR 260.22(i)(5); WAC 173-303-910(3)(c)(v)).**

There is approximately 125.9 tons of material in the Burnt Ridge storage unit. No new material has been added since Ecology mandated the cessation of activities in April 2014. Approximately 83 percent of the material in the storage unit is municipal biosolids, approximately three percent is runoff from FMF's livestock barn lot, and approximately seven percent is SWTS from a Darigold wastewater treatment plant. The remaining approximately eight percent is Emerald IWBS.[15]

*Biosolids*
Biosolids are created during the treatment of household wastewater/sewage. The WWTP uses physical, chemical, and biological means to treat the wastewater, control pathogens, and ultimately generate clean water and solid material. The water is discharged to an existing natural body of water and the solid portion undergoes further treatment. Additional water is removed from the solids and calcium oxide or calcium hydroxide is often added to neutralize the pH and to eliminate odors. The resulting solids, known as biosolids, are approved by the EPA and Ecology for beneficial land application.

According to the Ecology website, "Biosolids are a valuable resource because they contain important nutrients for plant growth and soil fertility such as nitrogen, phosphorous, and organic matter as well as essential nutrients such as copper, iron, molybdenum, and zinc. Biosolids are a great soil conditioner. They contain slow-releasing nutrients that are more eco-friendly than chemical fertilizers because they add organic matter to enrich depleted soils and fibrous matter to improve the soil's ability to hold water. This important recycled product can be used as a fertilizer and soil amendment on agricultural land, forests, mine and land reclamation sites. Treated biosolids come in various forms such as, rich moist soil, dried pellets, liquid, or compost."

[15] Percentages add up to greater than 100 due to rounding.

*Runoff from Livestock Barn Lot*

The mixed material contains approximately 3.8 tons of runoff from the livestock barn lot. The runoff material is cow manure produced by livestock, diluted with rain water. Cow manure has long been applied to farm fields to replenish nitrogen and other nutrients that are required by crops. Cow manure does not contain constituents (or other factors) that could cause it to be a hazardous waste.

*Darigold SWTS*

The Chehalis plant produces dry milk products. The facility's wastewater is biologically treated and the water is discharged in accordance with an Ecology-issued NPDES permit. The SWTS are the solid portion of the treated wastewater, which have historically been applied to agricultural fields as a nitrogen supplement. Ecology approved the SWTS for beneficial use (BUD-SA-15-08). Based on a review of the Darigold products and the Ecology-issued NPDES permit; there are likely no chemicals of concern associated with the SWTS (or other factors) that could cause it to be a hazardous waste.

*Emerald Wastewater Treatment Plant Operation*

The IWBS are produced by the Kalama facility's biological WWTP. The WWTP treats process wastewater as well as groundwater containing toluene contamination from historical spills. As part of that treatment process, the plant generates IWBS. Emerald's IWBS are basically the same material as municipal wastewater treatment plant biosolids. That is essentially the dead and decaying microorganisms used to digest and thereby chemically transform the undesirable components present in the wastewater into benign, and in many cases useful, compounds. IWBS are more consistent in composition than biosolids in many ways because the processes that generate this material are consistent and the microorganisms are selected and conditioned by the nature of the wastewater. Therefore, the industrial WWTP can operate with exceptional efficiency to chemically transform the target chemicals into benign compounds. Emerald's wastewater does not contain pathogens, hormones, prescription drugs, narcotics, or any other persistent and difficult to destroy chemicals.

The IWBS carry the waste codes for toluene (U220) and benzene (U019). The U220 code carries through from the treatment of contaminated groundwater. The Kalama facility periodically treats trace amounts of pure product benzene from de minimis spills that are captured by the treatment system; therefore, the IWBS carry the listed dangerous waste code U019.

Although the IWBS carry these two codes, the concentrations of these chemicals measured in the IWBS have consistently been below detection limits or detected at concentrations many times below the preliminary delisting levels and land disposal treatment standards. The IWBS do not exhibit any dangerous waste characteristics. The IWBS also meet all land disposal treatment standards, which are intended to ensure that constituents present in dangerous waste are properly treated before the material can be disposed in a RCRA Subtitle C landfill. The Kalama facility regularly samples the IWBS for various constituents as previously discussed.

**A description of the waste and an estimate of the average and maximum monthly and annual quantities of waste covered by the demonstration (40 CFR 260.22(i)(6); WAC 173-303-910(3)(c )(vi)).**

The waste is a mixture comprised of approximately 83 percent municipal wastewater treatment plant biosolids, three percent runoff from FMF's cow barn lot, seven percent SWTS from a Darigold wastewater treatment plant, and eight percent Emerald IWBS.[16] There is approximately 125.9 tons of material in the storage unit. No new material has been added since April 2014.

The majority of the mixed material (approximately 83 percent) is comprised of biosolids generated by municipal WWTPs. Municipal biosolids do not do not exhibit the characteristic of ignitability as defined in 40 CFR 261.21(a)(i) and WAC 173-303-090(5)(a), nor do they carry any RCRA waste codes, and are approved by EPA and Ecology for land application.

The mixed material contains approximately 3.8 tons of runoff from the livestock barn lot. The runoff material is cow manure produced by livestock, diluted with rain water. Cow manure does not exhibit the characteristic of ignitability as defined in 40 CFR 261.21(a)(i) and WAC 173-303-090(5)(a), nor does it carry any RCRA waste codes, and has long been applied to farm fields to replenish nitrogen and other nutrients that are required by crops.

The mixed material contains approximately 8.4 tons of SWTS from the Darigold Chehalis facility. The Chehalis plant produces dry milk products. The SWTS do not exhibit the characteristic of ignitability as defined in 40 CFR 261.21(a)(i) and WAC 173-303-090(5)(a), nor do they carry any RCRA waste codes, and are approved for application to agricultural fields as a nitrogen supplement (BUD-SA-15-08).

The mixed material contains approximately 9.8 tons of IWBS. The IWBS are produced in Emerald's biological WWTP. The WWTP treats process wastewater as well as groundwater containing contamination from historical spills. As part of that treatment process, the plant generates IWBS. Emerald's IWBS are basically the same material as municipal biosolids. The IWBS do not exhibit the characteristic of ignitability as defined in 40 CFR 261.21(a)(i) and WAC 173-303-090(5)(a), nor contain constituents for which the waste was listed (40 CFR 260.22(c), (d)).

**Pertinent data on and discussion of the factors delineated in the respective criterion for listing a hazardous waste, where the demonstration is based on the factors in §261.11(a)(3) (40 CFR 260.22(i)(7); WAC 173-303-910(3)(c)(vii)).**

These factors are:

(i) The nature of the toxicity presented by the constituent.
(ii) The concentration of the constituent in the waste.

[16] Percentages add up to greater than 100 due to rounding.

(iii) The potential of the constituent or any toxic degradation product of the constituent to migrate from the waste into the environment under the types of improper management considered in paragraph (a)(3)(vii) of this section.
(iv) The persistence of the constituent or any toxic degradation product of the constituent.
(v) The potential for the constituent or any toxic degradation product of the constituent to degrade into non-harmful constituents and the rate of degradation.
(vi) The degree to which the constituent or any degradation product of the constituent bioaccumulates in ecosystems.
(vii) The plausible types of improper management to which the waste could be subjected.
(viii) The quantities of the waste generated at individual generation sites or on a regional or national basis.
(ix) The nature and severity of the human health and environmental damage that has occurred as a result of the improper management of wastes containing the constituent.
(x) Action taken by other governmental agencies or regulatory programs based on the health or environmental hazard posed by the waste or waste constituent.
(xi) Such other factors as may be appropriate.

Substances will be listed on appendix VIII only if they have been shown in scientific studies to have toxic, carcinogenic, mutagenic or teratogenic effects on humans or other life forms.

(Wastes listed in accordance with these criteria will be designated Toxic wastes.)

The mixed material is not expected to contain any toxic constituents listed in Appendix VIII to Part 261 — Hazardous Constituents — or WAC 173-303-9905, other than those chemicals already listed in Appendices A and B, and shown to be well below the PDLs, TCLP-PDLs, and land disposal treatment standards. The action taken by EPA and Ecology is based on the regulatory interpretation that the IWBS carry RCRA waste codes, and even though said material does not contain those chemicals at concentrations anywhere approaching the PDLs, TCLP-PDLs, or LDRs, the action of commingling said material with biosolids has created the mixed material which now carries those waste codes. The mixed material has been determined not to exhibit the characteristics of ignitability, corrosivity, or reactivity. The mixed material does not exhibit the characteristic of toxicity, either by the federal or WA state definitions. The mixed material is not a persistent dangerous waste. There has been no damage to human health or the environment from the management of the mixed material.

**A description of the methodologies and equipment used to obtain the representative samples (40 CFR 260.22(i)(8); WAC 173-303-910(3)(c)(viii)).**

Mixed material samples collected from the Burnt Ridge storage unit by LAI were handled in accordance with the Waste Characterization Plan. Samples from the Burnt Ridge storage unit were collected using a 2-inch-diameter clear sludge sampler with a flapper valve attached. They were placed in a shipping cooler and stored at less than 6 degrees Celsius (ºC). Samples were transported to the laboratory within 48 hours of sample collection, and stored at the laboratory at less than 6°C. A complete description of the methodology and equipment that was used to sample the mixed material is presented in the Waste Characterization Report included in Appendix C.

The methodologies and equipment used by PGG to collect and analyze the mixed material are fully described in the Sludge Investigation Report which is included in Appendix C of this delisting petition.

The IWBS samples were collected from the chute that comes from the solids dewatering unit prior to entering the dewatering bin. Laboratory quality glass jars with Teflon lids were used to collect the samples. The samples were taken to the QA laboratory and immediately cooled to 6 °C. The samples were sent to the laboratory within 48 hours of collection.

**A description of the sample handling and preparation techniques, including techniques used for extraction, containerization and preservation of the samples (40 CFR 260.22(i)(9); WAC 173-303-910(3)(c)(ix)).**

Mixed material samples collected from the Burnt Ridge storage unit by LAI were handled in accordance with the Waste Characterization Plan. Samples from the Burnt Ridge storage unit were collected using a 2-inch-diameter clear sludge sampler with a flapper valve attached. They were placed in a shipping cooler and stored at less than 6°C. Samples were transported to the laboratory within 48 hours of sample collection, and stored at the laboratory at less than 6°C. A complete description of the methodology and equipment that was used to sample the mixed material is presented in the Waste Characterization Report included in Appendix C.

The methodologies and equipment used by PGG to collect and analyze the mixed material are fully described in the Sludge Investigation Report which is included in Appendix C of this delisting petition.

The IWBS samples were collected from the chute that comes from the solids dewatering unit prior to entering the dewatering bin. Laboratory quality glass jars with Teflon lids were used to collect the samples. The samples were taken to the QA laboratory and immediately cooled to 6 °C. The samples were sent to the laboratory within 48 hours of collection.

**A description of the tests performed (including results) (40 CFR 260.22(i)(10); WAC 173-303-910(3)(c)(x))**.

The mixed material has been sampled and analyzed during two separate campaigns. In 2014, PGG was contracted by FMF to sample and analyze the mixed material. LAI collected and analyzed samples in 2017, in accordance with the Waste Characterization Plan which was approved by EPA and Ecology (Appendix C).

FMF contracted with PGG to sample the mixed material in the Burnt Ridge storage unit in July 2014. PGG collected 27 samples which were combined into three composite samples for analysis. The mixed material was tested for the following parameters/methods:

- Volatile Organic Compounds, Method 8260C
- Metals, Methods 6010C/7471A
- Semi-volatile Organic Compounds, Method 8270D
- Polychlorinated biphenyls, Method 8082A
- Pesticides, Method 8081B
- Dioxins/Furans, Method 1613B
- N-Nitrate, calculated
- N-Ammonia, Method 350.1M
- Total Kjeldahl Nitrogen, Method 351.2
- Nitrate and Nitrite, Method 353.2
- Nitrite, Method 353.2
- Total Solids, Method SM2540G
- Total Cyanide, Method 335.4
- pH, Method 9045

Ecology developed preliminary delisting levels for the Burnt Ridge storage unit based on PDLs and TCLP-PDLs using EPA's Hazardous Waste Delisting Risk Assessment Software and provided them to Emerald[17]. All analytes and parameters were non-detect or present at concentrations below the PDLs or TCLP-PDLs except cobalt. The data from the PGG study are presented, on a dry weight basis[18], in Table B-1 in Appendix B.

Emerald contracted with LAI in 2017 to collect three core samples, which were analyzed for total cobalt, reported on a dry weight basis, and composited and analyzed for TCLP cobalt. The total cobalt concentrations were consistent with the results from the PGG results and the TCLP cobalt concentration was below the TCLP-PDL. The data from the LAI cobalt investigation are presented in Table B-3 in Appendix B.

As described in the Waste Characterization Plan, the analytical data from the 2014 PGG investigation and the 2017 LAI analysis of total and TCLP cobalt demonstrate that concentrations in the mixed material in the Burnt Ridge storage unit are likely below the PDLs and TCLP-PDLs.

A comparison of the PGG data for benzene and toluene with the LDR levels for non-wastewater indicates that the concentration of benzene and toluene in the mixed material likely complies with the LDR treatment standards; however, the samples were not analyzed for acetone or methanol. In order to ensure that there are no data gaps, Emerald and FMF submitted a Waste Characterization Plan, which was approved by EPA and Ecology, which proposed the following analyses:

[17] Ecology. 2016b. Letter: EPA and Ecology Comments to Waste Characterization Plan. From Laurie G. Davies, Waste 2 Resources Program, Washington State Department of Ecology, to Jarrod Kocin, Emerald Kalama Chemical, LLC. September 23.
[18] Contaminant concentrations reported on a dry weight basis are higher than they would be if they were reported on an as-received basis. Therefore, consideration of dry weight results in delisting decisions is conservative.

- Volatile Organic Compounds, Method EPA SW8260C
    - toluene
    - benzene
    - acetone
- Volatile Organic Compounds, Method EPA SW8015C
    - methanol
- Total solids, EPA Method SM2540G-97
- pH, EPA Method 9045D

LAI collected and analyzed 11 grab samples of the mixed material. The data from the waste characterization are presented, on an as-received basis[19], in Table B-4 in Appendix B. The concentrations of acetone, benzene, toluene, and methanol indicate that the concentrations in the mixed material are likely below the PDLs and LDR treatment standards.

The IWBS are the only component of the mixed material that is alleged to carry RCRA waste codes, although these chemicals are not present above the detection limits in the IWBS. Emerald regularly collected and analyzed 323 samples of the IWBS for various constituents on a monthly, quarterly, or annual basis from January 1998 through April 2015. All of this data is summarized in Table A-1 (Appendix A) and illustrates the uniformity of the waste. Ecology developed preliminary delisting levels for the IWBS based on PDLs and TCLP-PDLs using EPA's Hazardous Waste Delisting Risk Assessment Software and provided them to Emerald[20]. As noted above, toluene was detected in one sample of IWBS between 1998 and 2014 at a concentration of 69 micrograms per kilogram (ppb), which is below the Burnt Ridge PDL of 6.64E+10 ppb, the TCLP-PDL, multiplied by 20 in accordance with the rule of 20, of 5.44E+06 ppb, and the RCRA land disposal treatment standard of 10 milligrams per kilogram (ppm). Benzene was not detected during this time period.

Emerald had TCLP analyses performed on the IWBS in 2000 and in 2014. The results were consistent and all chemicals were below the TCLP-PDLs and the LDR treatment standards. The data are presented in Table A-2, TCLP (EPA Method 1311), in Appendix A. Emerald had fish bioassays performed on the IWBS in 2000 and 2014. The percent mortality of the rainbow trout was zero for both tests. Refer to Table A-3, Bioassay (Rainbow Trout), in Appendix A.

**The names and model numbers of the instruments used in performing the tests (40 CFR 260.22(i))(11); WAC 173-303-910(3)(c)(xi)).**

This information is not currently available to Emerald. However, all laboratories were accredited in accordance with the applicable requirements in place at the time the analyses were performed.

[19] EPA delisting guidance (EPA. 1993. Petitions to Delist Hazardous Wastes: A Guidance Manual. US Environmental Protection Agency. March) specifies that samples should be analyzed on an as-received basis.
[20] [20] Ecology. 2016b. Letter: EPA and Ecology Comments to Waste Characterization Plan. From Laurie G. Davies, Waste 2 Resources Program, Washington State Department of Ecology, to Jarrod Kocin, Emerald Kalama Chemical, LLC. September 23.

**The following statement signed by the generator of the waste or his authorized representative: (40 CFR 260.22(i)(12); WAC 173-303-910(3)(c)(xii)).**

**Certification**

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this demonstration and all attached documents, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

_______________________ Date: April 25 2018

Robert Thode Without Prejudice With reservation of rights
Fire Mountain Farms, Inc.
President

Edward 2. Gotch
_______________________ Date: April 24th 2018

Edward Gotch
Emerald Kalama Chemical, LLC
Chief Executive Officer



62998-0001/131520531.1

# Appendix A
# Emerald IWBS Analytical Data

## Table A-1
## Routine Analytical Data

| | Total Solids % | pH | Benzene ppb As-received | Benzene ppb Dry Weight Basis | Toluene ppb As-received | Toluene ppb Dry Weight Basis | NH3, Nitrogen % Dry Weight Basis | Total Nitrogen Calc. % Dry Weight Basis | Organic Nitrogen % Dry Weight Basis | Nitrate Nitrogen % Dry Weight Basis | NO2+NO3 Nitrogen % Dry Weight Basis | Total Potassium % Dry Weight Basis | Total Sodium % Dry Weight Basis | Total Phosphorus % Dry Weight Basis | Copper ppm Dry Weight Basis | Nickel ppm Dry Weight Basis | Zinc ppm Dry Weight Basis | Cobalt ppm Dry Weight Basis | Lead ppm Dry Weight Basis | Cadmium ppm Dry Weight Basis | Arsenic ppm Dry Weight Basis | Selenium ppm Dry Weight Basis | Chromium ppm Dry Weight Basis | Molybdenum ppm Dry Weight Basis | Mercury ppm Dry Weight Basis | Barium ppm Dry Weight Basis |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **LDR Treatment Std** | | | **10,000** | | **10,000** | | | | | | | | | | | **(a)** | **(a)** | | **(a)** | **(a)** | **(a)** | **(a)** | **(a)** | | **(a)** | **(a)** |
| **PDL** | | | **40,600,000** | | **6,030,000,000** | | | | | | | | | | | | | | | | | | | | | |
| **TCLP-PDL X 20** | | | **(b)** | | **340,000** | | | | | | | | | | **(b)** | **(b)** | **(b)** | | **(b)** | **(b)** | **(b)** | **(b)** | **(b)** | | **(b)** | **(b)** |
| **Sample Date** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1/6/1998 | 9.2 | 7.7 | <30 | <1700 | | | 0.0061 | 9.6 | 8.8 | 0.72 | 0.73 | 0.72 | 2.4 | 1.8 | 1,600 | 150 | 250 | 340 | <33 | <3.0 | <3.0 | <1.0 | 13 | 11 | <0.8 | 91 |
| 1/14/1998 | 9.2 | | | | | | | | | | | | | | 1,800 | | | | | | | | | | | |
| 1/20/1998 | 8.2 | | | | | | | | | | | | | | 2,000 | | | | | | | | | | | |
| 1/27/1998 | 9.2 | | | | | | | | | | | | | | 2,000 | | | | | | | | | | | |
| 2/3/1998 | 9.3 | | | | | | | | | | | | | | 2,100 | 160 | 310 | 360 | | | | | | | | |
| 2/10/1998 | 9.4 | | | | | | | | | | | | | | 1,900 | | | | | | | | | | | |
| 2/17/1998 | 9.2 | | | | | | | | | | | | | | 1,900 | | | | | | | | | | | |
| 2/24/1998 | 9.8 | | | | | | | | | | | | | | 1,500 | | | | | | | | | | | |
| 3/3/1998 | 11.2 | | | | | | | | | | | | | | 1,300 | | | | | | | | | | | |
| 3/10/1998 | 8.5 | | | | | | | | | | | | | | 1,500 | 150 | 300 | 350 | | | | | | | | |
| 3/17/1998 | 9 | | | | | | | | | | | | | | 1,400 | | | | | | | | | | | |
| 3/24/1998 | 7.9 | | | | | | | | | | | | | | 1,400 | | | | | | | | | | | |
| 3/31/1998 | 8 | | | | | | | | | | | | | | 1,400 | | | | | | | | | | | |
| 4/7/1998 | 8.6 | 7.5 | | | | | 0.26 | 8.2 | 7.9 | 0.0012 | 7.9 | 0.45 | 0.51 | 0.72 | 1,400 | 160 | 300 | 330 | <82 | <8 | 6 | <5 | 13 | 12 | <0.4 | 130 |
| 4/13/1998 | 8.8 | | | | | | | | | | | | | | 1,200 | | | | | | | | | | | |
| 4/21/1998 | 8.9 | | | | | | | | | | | | | | 1,300 | | | | | | | | | | | |
| 4/29/1998 | 8.4 | | | | | | | | | | | | | | 1,200 | | | | | | | | | | | |
| 5/5/1998 | 7.7 | | | | | | | | | | | | | | 1,200 | | | | | | | | | | | |
| 5/12/1998 | 8 | | | | | | | | | | | | | | 1,600 | 160 | 300 | 790 | | | | | | | | |
| 5/16/1998 | 8.7 | | | | | | | | | | | | | | 1,600 | | | | | | | | | | | |
| 6/2/1998 | 8.1 | | | | | | | | | | | | | | 2,300 | 130 | 280 | 550 | | | | | | | | |
| 6/9/1998 | 7.7 | | | | | | | | | | | | | | 2,200 | | | | | | | | | | | |
| 6/16/1998 | 8.3 | | | | | | | | | | | | | | 2,600 | | | | | | | | | | | |
| 6/23/1998 | 9.1 | | | | | | | | | | | | | | 2,200 | | | | | | | | | | | |
| 6/30/1998 | 9 | | | | | | | | | | | | | | 2,600 | | | | | | | | | | | |
| 7/8/1998 | 8.8 | 6.6 | | | | | 0.29 | 9.2 | 8.8 | 0.0087 | | 0.36 | 0.47 | 1.9 | 2,300 | 110 | 250 | 460 | <110 | <11 | <5.4 | <5.4 | 17 | <11 | 1.8 | 110 |
| 7/14/1998 | 8.7 | | | | | | | | | | | | | | 2,200 | | | | | | | | | | | |
| 7/21/1998 | 9 | | | | | | | | | | | | | | 2,200 | | | | | | | | | | | |
| 8/5/1998 | 6.4 | | | | | | | | | | | | | | 2,000 | | | | | | | | | | | |
| 8/12/1998 | 7.5 | | | | | | | | | | | | | | 2,000 | | | | | | | | | | | |
| 8/18/1998 | 7.4 | | | | | | | | | | | | | | 2,000 | | | | | | | | | | | |
| 8/25/1998 | 6.7 | | | | | | | | | | | | | | 2,500 | | | | | | | | | | | |
| 9/1/1998 | 8.3 | | | | | | | | | | | | | | 2,600 | | | | | | | | | | | |
| 9/8/1998 | 8.1 | | | | | | | | | | | | | | 2,700 | | | | | | | | | | | |
| 9/15/1998 | 7.5 | | | | | | | | | | | | | | 2,900 | | | | | | | | | | | |
| 9/22/1998 | 7.5 | | | | | | | | | | | | | | 3,100 | | | | | | | | | | | |
| 9/29/1998 | 7.7 | | | | | | | | | | | | | | 3,700 | | | | | | | | | | | |
| 10/5/1998 | 7.3 | | | | | | | | | | | | | | 3,400 | | | | | | | | | | | |
| 10/12/1998 | 6.3 | 8.1 | | | | | 0.42 | 11 | 10 | <0.003 | 0.006 | 0.55 | 0.84 | 1.3 | 3,600 | 280 | 300 | 600 | 24 | <13 | <7 | <35 | 21 | 19 | 0.56 | 87 |
| 10/20/1998 | 9.4 | | | | | | | | | | | | | | 3,500 | | | | | | | | | | | |
| 10/27/1998 | 7.9 | | | | | | | | | | | | | | 2,800 | | | | | | | | | | | |
| 11/3/1998 | 8 | | | | | | | | | | | | | | 3,000 | | | | | | | | | | | |
| 11/10/1998 | 8.4 | | | | | | | | | | | | | | 3,000 | | | | | | | | | | | |
| 11/17/1998 | 8.4 | | | | | | | | | | | | | | 2,900 | | | | | | | | | | | |
| 11/24/1998 | 7.7 | | | | | | | | | | | | | | 2,400 | | | | | | | | | | | |
| 12/2/1998 | 7 | | | | | | | | | | | | | | 2,600 | | | | | | | | | | | |
| 12/8/1998 | 7.3 | | | | | | | | | | | | | | 2,700 | | | | | | | | | | | |
| 12/14/1998 | 7.5 | | | | | | | | | | | | | | 2,700 | | | | | | | | | | | |
| 12/23/1998 | 7.8 | | | | | | | | | | | | | | 3,100 | | | | | | | | | | | |
| 12/29/1998 | 7.2 | | | | | | | | | | | | | | 3,200 | | | | | | | | | | | |
| 1/5/1999 | 7.6 | 7.4 | <300 | <3800 | <300 | <3800 | 0.23 | 9.8 | 9.6 | 0.01 | 0.012 | 0.47 | 0.79 | 1.4 | 3,400 | 250 | 560 | 470 | <58 | <12 | <5.7 | <5.7 | 22 | 30 | <0.5 | 120 |
| 1/13/1999 | 7.9 | | | | | | | | | | | | | | 2,400 | | | | | | | | | | | |
| 1/19/1999 | 7.2 | | | | | | | | | | | | | | 2,800 | | | | | | | | | | | |
| 1/26/1999 | 7.4 | | | | | | | | | | | | | | 2,600 | | | | | | | | | | | |
| 2/1/1999 | 7.4 | | | | | | | | | | | | | | 2,500 | | | | | | | | | | | |
| 2/8/1999 | 7.6 | | | | | | | | | | | | | | 2,400 | | | | | | | | | | | |
| 2/16/1999 | 7.5 | | | | | | | | | | | | | | 2,400 | | | | | | | | | | | |
| 2/24/1999 | 9.1 | | | | | | | | | | | | | | 1,900 | | | | | | | | | | | |
| 3/3/1999 | 9 | | | | | | | | | | | | | | 2,000 | | | | | | | | | | | |
| 3/10/1999 | 8.8 | | | | | | | | | | | | | | 2,600 | | | | | | | | | | | |
| 3/16/1999 | 10.4 | | | | | | | | | | | | | | 2,100 | | | | | | | | | | | |
| 3/25/1999 | 9.6 | | | | | | | | | | | | | | 2,200 | | | | | | | | | | | |
| 3/30/1999 | 10.2 | | | | | | | | | | | | | | 2,000 | | | | | | | | | | | |
| 4/5/1999 | 10 | 7.1 | | | | | 0.22 | 8.7 | 8.3 | 0.17 | | 0.44 | 0.61 | 1.4 | 2,100 | 180 | 380 | 370 | 25 | <16 | <4.9 | <20 | 11 | 12 | <0.1 | 93 |
| 4/13/1999 | 9.1 | | | | | | | | | | | | | | 2,000 | | | | | | | | | | | |
| 4/20/1999 | 8 | | | | | | | | | | | | | | 2,100 | | | | | | | | | | | |
| 4/27/1999 | 7.8 | | | | | | | | | | | | | | 2,000 | | | | | | | | | | | |
| 5/5/1999 | 7.3 | | | | | | | | | | | | | | 1,800 | | | | | | | | | | | |
| 5/11/1999 | 7.4 | | | | | | | | | | | | | | 1,800 | | | | | | | | | | | |

## Table A-1
## Routine Analytical Data

| | Total Solids % | pH | Benzene ppb As-received | Benzene ppb Dry Weight Basis | Toluene ppb As-received | Toluene ppb Dry Weight Basis | NH3, Nitrogen % Dry Weight Basis | Total Nitrogen Calc. % Dry Weight Basis | Organic Nitrogen % Dry Weight Basis | Nitrate Nitrogen % Dry Weight Basis | NO2+NO3 Nitrogen % Dry Weight Basis | Total Potassium % Dry Weight Basis | Total Sodium % Dry Weight Basis | Total Phosphorus % Dry Weight Basis | Copper ppm Dry Weight Basis | Nickel ppm Dry Weight Basis | Zinc ppm Dry Weight Basis | Cobalt ppm Dry Weight Basis | Lead ppm Dry Weight Basis | Cadmium ppm Dry Weight Basis | Arsenic ppm Dry Weight Basis | Selenium ppm Dry Weight Basis | Chromium ppm Dry Weight Basis | Molybdenum ppm Dry Weight Basis | Mercury ppm Dry Weight Basis | Barium ppm Dry Weight Basis |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **LDR Treatment Std** | | | **10,000** | | **10,000** | | | | | | | | | | | **(a)** | **(a)** | | **(a)** | **(a)** | **(a)** | **(a)** | **(a)** | | **(a)** | **(a)** |
| **PDL** | | | **40,600,000** | | **6,030,000,000** | | | | | | | | | | | | | | | | | | | | | |
| **TCLP-PDL X 20** | | | **(b)** | | **340,000** | | | | | | | | | | **(b)** | **(b)** | **(b)** | | **(b)** | **(b)** | **(b)** | **(b)** | **(b)** | | **(b)** | **(b)** |
| **Sample Date** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5/18/1999 | 9.4 | | | | | | | | | | | | | | 2,000 | | | | | | | | | | | |
| 5/25/1999 | 9.9 | | | | | | | | | | | | | | 2,000 | | | | | | | | | | | |
| 6/1/1999 | 10 | | | | | | | | | | | | | | 1,900 | | | | | | | | | | | |
| 6/7/1999 | 8.6 | | | | | | | | | | | | | | 1,900 | | | | | | | | | | | |
| 6/15/1999 | 10 | | | | | | | | | | | | | | 2,100 | | | | | | | | | | | |
| 6/23/1999 | 9 | | | | | | | | | | | | | | 2,000 | | | | | | | | | | | |
| 6/29/1999 | 9.5 | | | | | | | | | | | | | | 1,800 | | | | | | | | | | | |
| 7/6/1999 | 8.2 | | | | | | | | | | | | | | 1,900 | | | | | | | | | | | |
| 7/14/1999 | 9.5 | 7.4 | | | | | 0.12 | 8.9 | 8.8 | <0.0001 | | 0.3 | 0.46 | 1.7 | 1,700 | 170 | 270 | 370 | <95 | <9.5 | 5.8 | <4.9 | 17 | 29 | <0.1 | 110 |
| 7/21/1999 | 9.1 | | | | | | | | | | | | | | 1,900 | | | | | | | | | | | |
| 7/27/1999 | 8.6 | | | | | | | | | | | | | | 1,800 | | | | | | | | | | | |
| 8/3/1999 | 8.1 | | | | | | | | | | | | | | 1,700 | | | | | | | | | | | |
| 8/10/1999 | 6.3 | | | | | | | | | | | | | | 1,600 | 180 | 250 | 360 | | | | | | | | |
| 8/17/1999 | 8 | | | | | | | | | | | | | | 1,700 | | | | | | | | | | | |
| 8/24/1999 | 7.8 | | | | | | | | | | | | | | 2,100 | | | | | | | | | | | |
| 9/2/1999 | 8.4 | | | | | | | | | | | | | | 1,700 | | | | | | | | | | | |
| 9/7/1999 | 8.4 | | | | | | | | | | | | | | 1,600 | 230 | 250 | 490 | | | | | | | | |
| 9/14/1999 | 7.5 | | | | | | | | | | | | | | 1,500 | | | | | | | | | | | |
| 9/21/1999 | 8.6 | | | | | | | | | | | | | | 1,400 | | | | | | | | | | | |
| 9/28/1999 | 8.3 | | | | | | | | | | | | | | 1,400 | | | | | | | | | | | |
| 10/5/1999 | 6.6 | 7.4 | | | | | 0.23 | 10 | 9.8 | 0.25 | 0.25 | 0.37 | 0.64 | 1.6 | 1,200 | 210 | 220 | 500 | 7.4 | <12 | 9.8 | 7.1 | 21 | 22 | 0.31 | 100 |
| 10/12/1999 | 8.6 | | | | | | | | | | | | | | 1,800 | | | | | | | | | | | |
| 10/20/1999 | 8 | | | | | | | | | | | | | | 2,400 | | | | | | | | | | | |
| 10/26/1999 | 7.8 | | | | | | | | | | | | | | 2,700 | | | | | | | | | | | |
| 11/2/1999 | 7.8 | | | | | | | | | | | | | | 2,600 | 180 | 240 | 410 | | | | | | | | |
| 11/10/1999 | 8.1 | | | | | | | | | | | | | | 2,200 | | | | | | | | | | | |
| 11/16/1999 | 8.1 | | | | | | | | | | | | | | 2,900 | | | | | | | | | | | |
| 11/27/1999 | 7.6 | | | | | | | | | | | | | | 3,100 | | | | | | | | | | | |
| 11/30/1999 | 7.8 | | | | | | | | | | | | | | 2,700 | | | | | | | | | | | |
| 12/4/1999 | 6.8 | | | | | | | | | | | | | | 3,100 | 150 | 470 | 680 | | | | | | | | |
| 12/14/1999 | 5.7 | | | | | | | | | | | | | | 2,600 | | | | | | | | | | | |
| 12/20/1999 | 6 | | | | | | | | | | | | | | 2,400 | | | | | | | | | | | |
| 12/28/1999 | 5.8 | | | | | | | | | | | | | | 2,200 | | | | | | | | | | | |
| 1/4/2000 | 6.7 | | | | | | | | | | | | | | 1,600 | | | | | | | | | | | |
| 1/10/2000 | 6.8 | 7.7 | <6 | <100 | <6 | <100 | 0.22 | 10 | 9.8 | 0.00086 | 0.00088 | 0.47 | 0.56 | 0.14 | 1,700 | 140 | 390 | 410 | <11 | <11 | <11 | 6.4 | 16 | <11 | 0.2 | 89 |
| 1/19/2000 | 6.7 | | | | | | | | | | | | | | 1,600 | | | | | | | | | | | |
| 1/24/2000 | 5.2 | | | | | | | | | | | | | | 2,400 | | | | | | | | | | | |
| 2/1/2000 | 8.1 | | | | | | | | | | | | | | 1,900 | | | | | | | | | | | |
| 2/8/2000 | 7.3 | | | | | | | | | | | | | | 1,800 | 150 | 360 | 340 | | | | | | | | |
| 2/15/2000 | 8.1 | | | | | | | | | | | | | | 1,800 | | | | | | | | | | | |
| 2/23/2000 | 8.6 | | | | | | | | | | | | | | 1,500 | | | | | | | | | | | |
| 3/1/2000 | 8.9 | | | | | | | | | | | | | | 1,300 | | | | | | | | | | | |
| 3/7/2000 | 9.4 | | | | | | | | | | | | | | 1,200 | | | | | | | | | | | |
| 3/13/2000 | 10.1 | | | | | | | | | | | | | | 1,100 | 140 | 300 | 410 | | | | | | | | |
| 3/21/2000 | 8.8 | | | | | | | | | | | | | | 1,300 | | | | | | | | | | | |
| 3/27/2000 | 8.9 | | | | | | | | | | | | | | 1,400 | | | | | | | | | | | |
| 4/4/2000 | 9.5 | 7.1 | | | | | 0.15 | 8.4 | 8.2 | <0.0002 | <0.0002 | 0.4 | 0.44 | 0.2 | 1,500 | 150 | 360 | 480 | 11 | <7.4 | 16 | <7.4 | 26 | 7.9 | <0.1 | 120 |
| 4/12/2000 | 9.1 | | | | | | | | | | | | | | 1,200 | | | | | | | | | | | |
| 4/19/2000 | 8.9 | | | | | | | | | | | | | | 1,100 | | | | | | | | | | | |
| 4/24/2000 | 8.9 | | | | | | | | | | | | | | 1,200 | | | | | | | | | | | |
| 5/3/2000 | 8.4 | | | | | | | | | | | | | | 980 | 130 | 130 | 260 | | | | | | | | |
| 5/9/2000 | 7.6 | | | | | | | | | | | | | | 1,100 | | | | | | | | | | | |
| 5/16/2000 | 7.1 | | | | | | | | | | | | | | 1,300 | | | | | | | | | | | |
| 5/23/2000 | 6.9 | | | | | | | | | | | | | | 1,300 | | | | | | | | | | | |
| 5/30/2000 | 5.9 | | | | | | | | | | | | | | 1,300 | | | | | | | | | | | |
| 6/7/2000 | 6.4 | | | | | | | | | | | | | | 1,400 | 140 | 350 | 1400 | | | | | | | | |
| 6/12/2000 | 7 | | | | | | | | | | | | | | 1,400 | | | | | | | | | | | |
| 6/20/2000 | 6.9 | | | | | | | | | | | | | | 1,500 | | | | | | | | | | | |
| 6/27/2000 | 7.3 | | | | | | | | | | | | | | 1,400 | | | | | | | | | | | |
| 7/4/2000 | 7 | | | | | | | | | | | | | | 1,300 | | | | | | | | | | | |
| 7/11/2000 | 8.2 | 7.7 | | | | | 0.36 | 7.8 | 7.4 | <0.00061 | <0.00061 | 0.36 | 0.55 | 1.8 | 1,200 | 180 | 260 | 910 | <13 | 4.3 | <14 | <25 | 24 | 30 | 0.12 | 98 |
| 7/19/2000 | 7.1 | | | | | | | | | | | | | | 1,300 | | | | | | | | | | | |
| 7/25/2000 | 6.2 | | | | | | | | | | | | | | 1,200 | | | | | | | | | | | |
| 8/9/2000 | 4.6 | | | | | | | | | | | | | | 1,100 | | | 590 | | | | | | | | |
| 8/15/2000 | 5.1 | | | | | | | | | | | | | | 920 | | | | | | | | | | | |
| 8/24/2000 | 5.5 | | | | | | | | | | | | | | 600 | | | | | | | | | | | |
| 8/29/2000 | 5.5 | | | | | | | | | | | | | | 730 | | | | | | | | | | | |
| 9/5/2000 | 6.5 | | | | | | | | | | | | | | 690 | | | | | | | | | | | |
| 9/12/2000 | 7 | | | | | | | | | | | | | | 910 | | | 390 | | | | | | | | |

## Table A-1
## Routine Analytical Data

| | Total Solids % | pH | Benzene ppb As-received | Benzene ppb Dry Weight Basis | Toluene ppb As-received | Toluene ppb Dry Weight Basis | NH3, Nitrogen % Dry Weight Basis | Total Nitrogen Calc. % Dry Weight Basis | Organic Nitrogen % Dry Weight Basis | Nitrate Nitrogen % Dry Weight Basis | NO2+NO3 Nitrogen % Dry Weight Basis | Total Potassium % Dry Weight Basis | Total Sodium % Dry Weight Basis | Total Phosphorus % Dry Weight Basis | Copper ppm Dry Weight Basis | Nickel ppm Dry Weight Basis | Zinc ppm Dry Weight Basis | Cobalt ppm Dry Weight Basis | Lead ppm Dry Weight Basis | Cadmium ppm Dry Weight Basis | Arsenic ppm Dry Weight Basis | Selenium ppm Dry Weight Basis | Chromium ppm Dry Weight Basis | Molybdenum ppm Dry Weight Basis | Mercury ppm Dry Weight Basis | Barium ppm Dry Weight Basis |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **LDR Treatment Std** | | | **10,000** | | **10,000** | | | | | | | | | | | **(a)** | **(a)** | | **(a)** | **(a)** | **(a)** | **(a)** | **(a)** | | **(a)** | **(a)** |
| **PDL** | | | **40,600,000** | | **6,030,000,000** | | | | | | | | | | | | | | | | | | | | | |
| **TCLP-PDL X 20** | | | **(b)** | | **340,000** | | | | | | | | | | **(b)** | **(b)** | **(b)** | | **(b)** | **(b)** | **(b)** | **(b)** | **(b)** | | **(b)** | **(b)** |
| **Sample Date** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9/19/2000 | 8.5 | | | | | | | | | | | | | | 2,000 | | | | | | | | | | | |
| 9/27/2000 | 7.7 | | | | | | | | | | | | | | 820 | | | 360 | | | | | | | | |
| 10/2/2000 | 7.3 | 7.8 | | | | | 0.11 | 9.9 | 9.8 | 0.00055 | 0.00062 | 0.27 | 0.49 | 1.4 | 860 | 190 | 220 | 390 | 13 | <11 | <11 | <15 | 18 | <11 | <1.4 | 93 |
| 10/11/2000 | 8 | | | | | | | | | | | | | | 820 | | | | | | | | | | | |
| 10/17/2000 | 8.5 | | | | | | | | | | | | | | 890 | | | | | | | | | | | |
| 10/24/2000 | 9 | | | | | | | | | | | | | | 800 | | | | | | | | | | | |
| 10/30/2000 | 8 | | | | | | | | | | | | | | 810 | | | | | | | | | | | |
| 11/8/2000 | 7.7 | | | | | | | | | | | | | | 920 | | | 510 | | | | | | | | |
| 11/14/2000 | 8.1 | | | | | | | | | | | | | | 800 | | | | | | | | | | | |
| 11/21/2000 | 7.1 | | | | | | | | | | | | | | 1,100 | | | | | | | | | | | |
| 11/28/2000 | 7.1 | | | | | | | | | | | | | | 890 | | | | | | | | | | | |
| 12/5/2000 | 6 | | | | | | | | | | | | | | 1,000 | | | | | | | | | | | |
| 12/12/2000 | 6.5 | | | | | | | | | | | | | | 840 | | | | | | | | | | | |
| 12/19/2000 | 6.9 | | | | | | | | | | | | | | 990 | | | | | | | | | | | |
| 12/26/2000 | 6.8 | | | | | | | | | | | | | | 810 | | | | | | | | | | | |
| 1/2/2001 | 6.5 | 8.1 | <6 | <97 | <6 | <97 | 0.17 | 9.9 | 9.7 | 0.0038 | 0.0038 | 0.34 | 0.55 | 1.4 | 950 | 150 | 290 | 230 | 10 | <12 | <12 | <12 | 16 | <12 | <1.5 | 68 |
| 2/6/2001 | 4.6 | | | | | | | | | | | | | | 910 | 170 | 280 | 280 | | | | | | | | |
| 3/7/2001 | 7.2 | | | | | | | | | | | | | | 600 | 84 | 220 | 160 | | | | | | | | |
| 4/17/2001 | 8.2 | | | | | | | | | | | | | | 830 | 140 | 960 | 210 | | | | | | | | |
| 5/8/2001 | 7.8 | | | | | | | | | | | | | | 3,100 | 180 | 870 | 470 | | | | | | | | |
| 6/5/2001 | 6.9 | 7 | | | | | 0.54 | 11 | 10 | <0.0028 | <0.0028 | 0.42 | <0.1 | 1.7 | 3,700 | 190 | 760 | 550 | 37 | <10 | <10 | 12 | 19 | <10 | <1.4 | 70 |
| 7/11/2001 | 7.4 | 7.3 | | | | | 0.58 | 11 | 10 | <0.013 | 0.0079 | 0.45 | 0.88 | 0.94 | 1,500 | 200 | 840 | 580 | <8.3 | <10 | <10 | <10 | 16 | 17 | <1.4 | 980 |
| 8/3/2001 | 8.6 | | | | | | | | | | | | | | 1,670 | 162 | 227 | 425 | | | | | | | | |
| 9/4/2001 | 8 | | | | | | | | | | | | | | 1,000 | 125 | 221 | 288 | | | | | | | | |
| 10/10/2001 | 5.4 | 6.9 | | | | | 0.12 | 8.1 | 8.1 | 0.0042 | <0.0019 | 0.61 | 1.2 | 0.84 | 978 | 168 | 267 | 329 | <40 | <2 | <2 | <2 | 14 | <4 | <0.2 | 61 |
| 11/6/2001 | 4.1 | | | | | | | | | | | | | | 1,370 | 197 | 328 | 405 | | | | | | | | |
| 12/6/2001 | 4.7 | | | | | | | | | | | | | | 1,820 | 137 | 385 | 513 | | | | | | | | |
| 1/8/2002 | 7.3 | 7.3 | | <340 | | <340 | 0.12 | 8.5 | 8.5 | <0.0014 | <0.0014 | 0.47 | 0.52 | 0.8 | 1,300 | 112 | 304 | 304 | <27 | <1.4 | <3.4 | <3.4 | 9.5 | 3.3 | <0.05 | 59.6 |
| 2/12/2002 | 8.2 | | | | | | | | | | | | | | 1,320 | 140 | 374 | 512 | | | | | | | | |
| 3/6/2002 | 8.7 | | | | | | | | | | | | | | 1,340 | 134 | 406 | 570 | | | | | | | | |
| 4/9/2002 | 10.2 | 7.5 | | | | | 0.02 | 7 | 6.7 | <0.0010 | <0.0010 | 0.32 | 0.49 | 0.08 | 1,440 | 203 | 464 | 573 | <78 | <3.9 | 5.2 | <3.9 | 18.2 | <7.8 | 0.18 | 106 |
| 5/1/2002 | 10.6 | | | | | | | | | | | | | | 1,190 | 172 | 510 | 424 | | | | | | | | |
| 6/3/2002 | 8.1 | | | | | | | | | | | | | | 1,510 | 145 | 549 | 412 | | | | | | | | |
| 7/9/2002 | 8.8 | 7.4 | | | | | 0.42 | 7.95 | 7.5 | <0.0011 | <0.0011 | 0.37 | 0.6 | 0.91 | 1,060 | 128 | 369 | 516 | <76 | <3.8 | <3.8 | <3.8 | 14 | <7.6 | 0.09 | 90 |
| 8/3/2002 | 8.7 | | | | | | | | | | | | | | 838 | 158 | 389 | 469 | | | | | | | | |
| 9/3/2002 | 9.6 | | | | | | | | | | | | | | 834 | 157 | 300 | 359 | | | | | | | | |
| 10/8/2002 | 8.9 | 7.4 | | | | | 0.13 | 2.03 | 1.9 | <0.0034 | <0.0034 | 0.11 | 0.19 | 0.21 | 689 | 80 | 101 | 94 | <12 | <1.2 | <2.9 | <1.2 | 9.1 | <2.3 | 0.04 | 23 |
| 11/6/2002 | 11.3 | | | | | | | | | | | | | | 2,230 | 422 | 282 | 366 | | | | | | | | |
| 12/3/2002 | 7.1 | | | | | | | | | | | | | | 3,750 | 361 | 325 | 405 | | | | | | | | |
| 1/14/2003 | 9.4 | 6.7 | | <54 | | <54 | 0.22 | 9.03 | 8.82 | 0.14 | 0.14 | 0.25 | 0.45 | 0.76 | 2,550 | 253 | 475 | 385 | <71 | <3.5 | 5.4 | <3.5 | 24.1 | 11.1 | 0.13 | 112 |
| 2/4/2003 | 8.7 | | | | | | | | | | | | | | 2,060 | 218 | 467 | 579 | | | | | | | | |
| 3/4/2003 | 8.65 | | | | | | | | | | | | | | 1,320 | 140 | 405 | 350 | | | | | | | | |
| 4/8/2003 | 8.74 | 7.54 | | | | | 0.18 | 8.71 | 8.53 | 0.0069 | 0.0069 | 0.41 | 0.51 | 0.62 | 1,250 | 92 | 101 | 306 | <80 | <4 | 5.4 | <4 | 12.6 | <8 | 0.14 | 93 |
| 5/6/2003 | 9.2 | | | | | | | | | | | | | | 1,670 | 122 | 366 | 412 | | | | | | | | |
| 6/3/2003 | 7.4 | | | | | | | | | | | | | | 1,380 | 152 | 231 | 277 | | | | | | | | |
| 7/9/2003 | 6.9 | 7.21 | | | | | 0.38 | 8.38 | 7.86 | 0.0091 | 0.0091 | 0.46 | 1.06 | 0.75 | 1,060 | 131 | 261 | 287 | <100 | <5 | <10 | <10 | 16 | 16 | 0.3 | 105 |
| 8/5/2003 | 8.2 | | | | | | | | | | | | | | 764 | 118 | 172 | 170 | | | | | | | | |
| 9/9/2003 | 9.86 | | | | | | | | | | | | | | 455 | 72 | 133 | 202 | | | | | | | | |
| 10/21/2003 | 8.61 | | | | | | | | | | | | | | 605 | 87 | 323 | 329 | | | | | | | | |
| 11/4/2003 | 9.91 | 7.29 | | | | | 0.29 | 9.32 | 9.04 | <0.0006 | <0.0006 | 0.44 | 0.8 | 0.76 | 741 | 100 | 386 | 748 | <70 | <3.4 | <8.4 | <1.3 | 8 | <6.7 | <0.04 | 69 |
| 12/4/2003 | 6.24 | | | | | | | | | | | | | | 1,000 | 100 | 526 | 420 | | | | | | | | |
| 1/14/2004 | 9.49 | 7.03 | | <110 | | <110 | 0.22 | 8.05 | 7.74 | 0.0981 | 0.0981 | 0.37 | 0.35 | 0.76 | 1,110 | 84 | 617 | 744 | <70 | <3.5 | <20 | <8.8 | 12.2 | <7.1 | <0.04 | 78 |
| 2/3/2004 | 10.9 | | | | | | | | | | | | | | 1,090 | 96 | 590 | 533 | | | | | | | | |
| 3/2/2004 | 10.9 | | | | | | | | | | | | | | 1,090 | 100 | 630 | 536 | | | | | | | | |
| 4/5/2004 | 8.8 | 7.3 | | | | | 0.27 | 8.21 | 7.94 | <0.0012 | <0.0012 | 0.5 | 0.42 | 0.98 | 994 | 188 | 888 | 791 | <80 | <4 | <9 | <9 | 10 | <8 | 0.02 | 100 |
| 5/5/2004 | 11.2 | | | | | | | | | | | | | | 967 | 110 | 749 | 746 | | | | | | | | |
| 6/8/2004 | 10.3 | | | | | | | | | | | | | | 1,320 | 103 | 1,050 | 1,300 | | | | | | | | |
| 7/6/2004 | 10.2 | 7.4 | | | | | 0.093 | 8.08 | 7.94 | 0.0342 | 0.0342 | 0.52 | 0.64 | 0.81 | 940 | 108 | 853 | 1,220 | <70 | <3.3 | <3.3 | <3.3 | 15.5 | <6.5 | 0.04 | 89.4 |
| 8/3/2004 | 9.53 | | | | | | | | | | | | | | 2,080 | 134 | 855 | 712 | | | | | | | | |
| 9/8/2004 | 8.2 | | | | | | | | | | | | | | 1,140 | 118 | 769 | 780 | | | | | | | | |
| 10/5/2004 | 9.7 | 8.2 | | | | | 0.27 | 9.9 | 9.63 | 0.0096 | 0.0096 | 0.42 | 0.69 | 1.07 | 1,210 | 155 | 844 | 735 | <60 | 3.2 | <4 | <3 | 19.4 | 6 | <0.07 | 90.8 |
| 11/2/2004 | 9.3 | | | | | | | | | | | | | | 2,220 | 145 | 881 | 1,170 | | | | | | | | |
| 12/7/2004 | 8.79 | | | | | | | | | | | | | | 1,500 | 93 | 909 | 1,100 | | | | | | | | |
| 1/11/2005 | 7.73 | 7.34 | | <64 | | <64 | 0.21 | 9.64 | 9.43 | 0.0016 | 0.0016 | 0.43 | 0.41 | 0.83 | 958 | 82.1 | 970 | 517 | <43 | <2.1 | <4.3 | <4.3 | 11.3 | <4.3 | <0.05 | 86.7 |
| 2/1/2005 | 6.07 | | | | | | | | | | | | | | 1,120 | 74.5 | 883 | 451 | | | | | | | | |
| 3/1/2005 | 4.87 | | | | | | | | | | | | | | 1,360 | 81.2 | 809 | 486 | | | | | | | | |
| 4/6/2005 | 4.91 | 7.67 | | | | | 0.52 | 9.05 | 8.77 | <0.0005 | <0.0019 | 0.42 | 0.78 | 0.97 | 931 | 72.9 | 648 | 478 | <138 | <6.9 | <6.9 | <6.9 | <13.8 | <13.8 | 0.1 | 61.6 |
| 5/2/2005 | 11 | | | | | | | | | | | | | | 1,670 | 87.1 | 658 | 580 | | | | | | | | |
| 6/6/2005 | 9.38 | | | | | | | | | | | | | | 1,270 | 158 | 838 | 728 | | | | | | | | |

## Table A-1
## Routine Analytical Data

| | Total Solids % | pH | Benzene ppb As-received | Benzene ppb Dry Weight Basis | Toluene ppb As-received | Toluene ppb Dry Weight Basis | NH3, Nitrogen % Dry Weight Basis | Total Nitrogen Calc. % Dry Weight Basis | Organic Nitrogen % Dry Weight Basis | Nitrate Nitrogen % Dry Weight Basis | NO2+NO3 Nitrogen % Dry Weight Basis | Total Potassium % Dry Weight Basis | Total Sodium % Dry Weight Basis | Total Phosphorus % Dry Weight Basis | Copper ppm Dry Weight Basis | Nickel ppm Dry Weight Basis | Zinc ppm Dry Weight Basis | Cobalt ppm Dry Weight Basis | Lead ppm Dry Weight Basis | Cadmium ppm Dry Weight Basis | Arsenic ppm Dry Weight Basis | Selenium ppm Dry Weight Basis | Chromium ppm Dry Weight Basis | Molybdenum ppm Dry Weight Basis | Mercury ppm Dry Weight Basis | Barium ppm Dry Weight Basis |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **LDR Treatment Std** | | | **10,000** | | **10,000** | | | | | | | | | | | **(a)** | **(a)** | | **(a)** | **(a)** | **(a)** | **(a)** | **(a)** | | **(a)** | **(a)** |
| **PDL** | | | **40,600,000** | | **6,030,000,000** | | | | | | | | | | | | | | | | | | | | | |
| **TCLP-PDL X 20** | | | **(b)** | | **340,000** | | | | | | | | | | **(b)** | **(b)** | **(b)** | | **(b)** | **(b)** | **(b)** | **(b)** | **(b)** | | **(b)** | **(b)** |
| **Sample Date** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7/6/2005 | 8.92 | 7.44 | | | | | 0.48 | | | <0.0012 | <0.0012 | 0.36 | 0.34 | 1.03 | 1,120 | 164 | 867 | 909 | <75 | <3.7 | <3.7 | <3.7 | 11.5 | <7.5 | 0.05 | 95.5 |
| 8/2/2005 | 8.07 | | | | | | | | | | | | | | 7,520 | 398 | 912 | 1,140 | | | | | | | | |
| 9/7/2005 | 9.8 | | | | | | 0.19 | 9.46 | 9.27 | 0.166 | 0.166 | | | | 7,170 | 319 | 1,020 | 1,100 | | | | | | | | |
| 10/5/2005 | 9.57 | 6.89 | | | | | 0.09 | 8.13 | 8.04 | 0.11 | 0.11 | 0.57 | 0.56 | 0.97 | 3,270 | 235 | 821 | 751 | <70 | <3.5 | 3.7 | <3.5 | 13.8 | <6.9 | 0.3 | 70.1 |
| 11/8/2005 | 8.49 | | | | | | | | | | | | | | 1,700 | 189 | 668 | 1,100 | | | | | | | | |
| 12/6/2005 | 7.89 | | | | | | | | | | | | | | 1,240 | 124 | 1,040 | 540 | | | | | | | | |
| 1/10/2006 | 11.4 | 7.36 | <5 | <44 | <5 | <44 | 0.15 | 10.3 | 9.95 | <0.0002 | <0.0002 | 0.33 | 0.3 | 0.68 | 1,110 | 137 | 1,080 | 643 | <60 | <3 | 6.4 | <3 | 11 | <6 | 0.03 | 77 |
| 2/14/2006 | 11.5 | | | | | | | | | | | | | | 1,940 | 215 | 1,350 | 910 | | | | | | | | |
| 3/7/2006 | 12 | | | | | | | | | | | | | | 1,900 | 182 | 1,020 | 719 | | | | | | | | |
| 4/4/2006 | 11.7 | 7.23 | | | | | 0.27 | 8.33 | 8.06 | <0.0002 | <0.0002 | 0.41 | 0.35 | 0.63 | 1,710 | 145 | 791 | 657 | <57 | <2.9 | 6.1 | <2.9 | 11.4 | <5.7 | 0.06 | 91.5 |
| 5/9/2006 | 10.2 | | | | | | | | | | | | | | 973 | 110 | 768 | 1,170 | | | | | | | | |
| 6/7/2006 | 9.5 | | | | | | | | | | | | | | 1,200 | 134 | 990 | 984 | | | | | | | | |
| 7/5/2006 | 9.15 | 7.22 | | | | | 0.06 | 8.95 | 9.16 | 0.003 | 0.003 | 0.5 | 0.39 | 0.99 | 1,020 | 99 | 816 | 895 | <70 | <4 | 6.3 | <4 | 9.9 | <7.0 | 0.05 | 93 |
| 8/9/2006 | 9.98 | | | | | | | | | | | | | | 717 | 91 | 681 | 744 | | | | | | | | |
| 9/12/2006 | 10.7 | | | | | | | | | | | | | | 616 | 100 | 680 | 710 | | | | | | | | |
| 10/3/2006 | 10.1 | 6.93 | | | | | 0.13 | 7.47 | 6.95 | <0.0002 | <0.0002 | 0.35 | 0.41 | 0.75 | 440 | 111 | 744 | 645 | <66 | <3.3 | <8.3 | <8.3 | 9.4 | 7.2 | 0.03 | 61.7 |
| 11/8/2006 | 7.6 | | | | | | | | | | | | | | 1,570 | 154 | 624 | 599 | | | | | | | | |
| 12/1/2006 | 10 | | | | | | | | | | | | | | 1,210 | 139 | 712 | 595 | | | | | | | | |
| 1/9/2007 | 6.62 | 6.77 | <8.1 | <130 | <8.1 | <130 | 0.22 | 6.99 | 7.28 | <0.0004 | <0.0004 | 0.43 | 0.28 | 0.84 | 1,780 | 106 | 719 | 883 | <100 | <5.0 | 6.6 | <5.0 | 12 | <10 | 0.04 | 94.1 |
| 2/6/2007 | 10.1 | | | | | | | | | | | | | | 1,710 | 145 | 743 | 2,060 | | | | | | | | |
| 3/6/2007 | 10.3 | | | | | | | | | | | | | | 2,320 | 89 | 636 | 1,190 | | | | | | | | |
| 4/3/2007 | 9.62 | 6.98 | | | | | 0.09 | 7.83 | 7.81 | 0.002 | 0.03 | 0.43 | 0.028 | 0.72 | 1,540 | 107 | 684 | 1,180 | <70 | <3 | 7 | <3 | 10 | <7 | 0.03 | 72 |
| 5/9/2007 | 9 | | | | | | | | | | | | | | 1,230 | 129 | 844 | 1,760 | | | | | | | | |
| 6/20/2007 | 9.01 | | | | | | | | | | | | | | 670 | 87 | 853 | 1,190 | | | | | | | | |
| 7/11/2007 | 8 | 7.34 | | | | | 0.17 | 9.18 | 8.7 | 0.06 | 0.1 | 0.69 | 0.52 | 12.2 | 913 | 111 | 899 | 1,150 | <87 | <4.4 | 5 | <4.1 | <8.7 | <8.7 | 0.05 | 76.8 |
| 8/7/2007 | 8.94 | | | | | | | | | | | | | | 892 | 126 | 860 | 956 | | | | | | | | |
| 9/24/2007 | 7.96 | | | | | | | | | | | | | | 397 | 143 | 1,000 | 2,110 | | | | | | | | |
| 10/9/2007 | 7.54 | 7.32 | | | | | 0.18 | 11.4 | 9.6 | 0.0049 | 0.0049 | 0.58 | 0.67 | 1.1 | 467 | 143 | 1,070 | 1,780 | <4.4 | <4.4 | <4.4 | <4.4 | 19 | <8.7 | <0.02 | 55.3 |
| 11/6/2007 | 7.96 | | | | | | | | | | | | | | 442 | 116 | 802 | 1,150 | | | | | | | | |
| 12/13/2007 | 8.61 | | | | | | | | | | | | | | 626 | 128 | 964 | 947 | | | | | | | | |
| 1/9/2008 | 8.58 | 6.91 | <5.5 | <64 | <5.5 | <64 | 0.41 | 6.67 | 6.25 | <0.0003 | <0.0003 | 0.44 | 0.37 | 1.12 | 756 | 145 | 1,240 | 1,200 | <76 | <3.8 | <3.9 | <3.9 | 22.9 | <7.6 | 0.03 | 84.8 |
| 2/6/2008 | 9.56 | | | | | | | | | | | | | | 626 | 183 | 1,110 | 940 | | | | | | | | |
| 3/5/2008 | 8.46 | | | | | | | | | | | | | | 560 | 201 | 931 | 839 | | | | | | | | |
| 4/15/2008 | 10.8 | 7.3 | | | | | 0.24 | 7.61 | 8.21 | <0.0005 | <0.0005 | 0.7 | 0.4 | 0.92 | 423 | 179 | 706 | 686 | <62 | <3.1 | <3.1 | <3.1 | 15.4 | 6.2 | 0.05 | 71.6 |
| 5/6/2008 | 9.54 | | | | | | | | | | | | | | 358 | 201 | 744 | 614 | | | | | | | | |
| 6/11/2008 | 9.4 | | | | | | | | | | | | | | 490 | 213 | 724 | 710 | | | | | | | | |
| 7/17/2008 | 9.67 | 7.36 | | | | | 0.2 | 8.57 | 8.37 | 0.00052 | 0.00052 | 0.36 | 0.29 | 0.8 | 397 | 147 | 697 | 553 | <70 | <3.5 | 5 | <3.5 | 14.2 | <7.0 | 0.03 | 69.6 |
| 8/5/2008 | 8.3 | | | | | | | | | | | | | | 289 | 119 | 471 | 438 | | | | | | | | |
| 9/9/2008 | 8.6 | | | | | | | | | | | | | | 1,450 | 103 | 476 | 506 | | | | | | | | |
| 10/10/2008 | 8.64 | 7.71 | | | | | 0.17 | 6.33 | 6.17 | <0.00057 | <0.00057 | 1.08 | 0.56 | 0.004 | 869 | 227 | 701 | 674 | <15 | <3.8 | 4.9 | <3.7 | 13.1 | <7.5 | 0.04 | 50.8 |
| 11/5/2008 | 8.64 | | | | | | | | | | | | | | 491 | 176 | 595 | 495 | | | | | | | | |
| 12/2/2008 | 8.35 | | | | | | | | | | | | | | 594 | 150 | 622 | 471 | | | | | | | | |
| 1/6/2009 | 8.17 | 7.52 | <5.0 | | <5.0 | | 0.051 | 7.45 | 7.4 | 0.00325 | 0.00325 | 0.67 | 0.3 | 2.65 | 614 | 174 | 699 | 472 | <81 | <4.1 | <4.1 | <4.1 | 12.8 | <8.1 | <0.03 | 72.2 |
| 2/6/2009 | 8.73 | | | | | | | | | | | | | | 516 | 225 | 679 | 449 | | | | | | | | |
| 3/5/2009 | 11 | | | | | | | | | | | | | | 470 | 273 | 755 | 660 | | | | | | | | |
| 4/14/2009 | 11.7 | 7.5 | | | | | 0.0175 | 6.59 | 6.25 | <0.00043 | <0.00043 | 4.36 | 0.24 | 4.64 | 356 | 301 | 673 | 567 | <60 | <2.8 | 3.4 | <2.8 | 15.4 | <5.7 | <0.02 | 61.6 |
| 5/8/2009 | 11.4 | | | | | | | | | | | | | | 396 | 272 | 638 | 627 | | | | | | | | |
| 6/11/2009 | 11.4 | | | | | | | | | | | | | | 451 | 359 | 709 | 786 | | | | | | | | |
| 7/9/2009 | 10.6 | 7.79 | | | | | 0.1 | 6.65 | 6.55 | <0.00048 | <0.00048 | 0.498 | 0.275 | 4.11 | 620 | 415 | 868 | 1,060 | <60 | <3.1 | <20 | <7.7 | 19.9 | <6.2 | 0.05 | 95.1 |
| 8/4/2009 | 9.8 | | | | | | | | | | | | | | 465 | 316 | 688 | 830 | | | | | | | | |
| 9/9/2009 | 8.63 | | | | | | | | | | | | | | 305 | 267 | 604 | 543 | | | | | | | | |
| 10/6/2009 | 8.6 | 7.01 | | | | | 0.128 | 5.52 | 5.39 | <0.00057 | <0.00057 | 0.81 | 0.403 | 2.2 | 295 | 256 | 625 | 512 | <80 | <3.8 | 7.1 | <3.7 | 11.7 | <7.6 | 0.03 | 54.1 |
| 11/4/2009 | 8.42 | | | | | | | | | | | | | | 223 | 164 | 448 | 439 | | | | | | | | |
| 12/8/2009 | 8.34 | | | | | | | | | | | | | | 240 | 114 | 378 | 263 | | | | | | | | |
| 1/11/2010 | 8.01 | 7.16 | <5 | <63 | <5 | <63 | 0.127 | 15.7 | 15.6 | <0.00063 | <0.00063 | 0.83 | 0.361 | 11.2 | 243 | 121 | 449 | 257 | <83.6 | <4.2 | <4.2 | <4.2 | <8.4 | <8.4 | <0.025 | 55.6 |
| 2/5/2010 | 8.87 | | | | | | | | | | | | | | 236 | 113 | 883 | 248 | | | | | | | | |
| 3/9/2010 | 8.69 | | | | | | | | | | | | | | 312 | 148 | 900 | 361 | | | | | | | | |
| 4/15/2010 | 9.5 | 7.41 | | | | | 0.226 | 7.81 | 7.59 | 0.00068 | 0.00109 | 0.602 | 0.411 | 16.9 | 775 | 161 | 676 | 368 | <70 | <4 | <4 | <4 | 15.6 | <7 | 0.04 | 69.3 |
| 5/5/2010 | 10.4 | | | | | | | | | | | | | | 500 | 171 | 574 | 364 | | | | | | | | |
| 6/17/2010 | 10.7 | | | | | | | | | | | | | | 401 | 127 | 539 | 398 | | | | | | | | |
| 7/3/2010 | 9.16 | 7.26 | | | | | 0.182 | 8.47 | 8.29 | 0.00069 | 0.0008 | 0.78 | 0.986 | 3.42 | 352 | 137 | 598 | 441 | <72.6 | <3.6 | 5.2 | <3.6 | 12.7 | 11.2 | <0.02 | 77.5 |
| 8/9/2010 | 9.93 | | | | | | | | | | | | | | 249 | 142 | 607 | 718 | | | | | | | | |
| 9/21/2010 | 9.5 | | | | | | | | | | | | | | 1,350 | 165 | 511 | 532 | | | | | | | | |
| 10/22/2010 | 9.98 | 7.4 | | | | | 0.312 | 7.4 | 7.09 | <0.0005 | <0.0005 | 0.877 | 0.462 | 2.68 | 588 | 110 | 425 | 436 | <67 | <3.3 | <3.3 | <3.3 | 10.4 | <6.7 | 0.17 | 63.2 |
| 11/17/2010 | 8.56 | | | | | | | | | | | | | | 339 | 97.8 | 489 | 377 | | | | | | | | |
| 12/14/2010 | 7.72 | | | | | | | | | | | | | | 342 | 95 | 546 | 398 | | | | | | | | |
| 1/13/2011 | 7.46 | 7.31 | <8 | <110 | <8 | <110 | 0.141 | 9.15 | 9.01 | <0.00066 | <0.00066 | 0.684 | 0.486 | 1.91 | 421 | 71.5 | 520 | 364 | <88.1 | <4.4 | <4.4 | <4.4 | 11.7 | <8.8 | 0.04 | 61.6 |
| 2/15/2011 | 8.31 | | | | | | | | | | | | | | 321 | 84 | 568 | 415 | | | | | | | | |
| 3/8/2011 | 7.05 | | | | | | | | | | | | | | 356 | 92 | 605 | 435 | | | | | | | | |

## Table A-1
## Routine Analytical Data

| | Total Solids % | pH | Benzene ppb As-received | Benzene ppb Dry Weight Basis | Toluene ppb As-received | Toluene ppb Dry Weight Basis | NH3, Nitrogen % Dry Weight Basis | Total Nitrogen Calc. % Dry Weight Basis | Organic Nitrogen % Dry Weight Basis | Nitrate Nitrogen % Dry Weight Basis | NO2+NO3 Nitrogen % Dry Weight Basis | Total Potassium % Dry Weight Basis | Total Sodium % Dry Weight Basis | Total Phosphorus % Dry Weight Basis | Copper ppm Dry Weight Basis | Nickel ppm Dry Weight Basis | Zinc ppm Dry Weight Basis | Cobalt ppm Dry Weight Basis | Lead ppm Dry Weight Basis | Cadmium ppm Dry Weight Basis | Arsenic ppm Dry Weight Basis | Selenium ppm Dry Weight Basis | Chromium ppm Dry Weight Basis | Molybdenum ppm Dry Weight Basis | Mercury ppm Dry Weight Basis | Barium ppm Dry Weight Basis |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **LDR Treatment Std** | | | **10,000** | | **10,000** | | | | | | | | | | | **(a)** | **(a)** | | **(a)** | **(a)** | **(a)** | **(a)** | **(a)** | | **(a)** | **(a)** |
| **PDL** | | | **40,600,000** | | **6,030,000,000** | | | | | | | | | | | | | | | | | | | | | |
| **TCLP-PDL X 20** | | | **(b)** | | **340,000** | | | | | | | | | | **(b)** | **(b)** | **(b)** | | **(b)** | **(b)** | **(b)** | **(b)** | **(b)** | | **(b)** | **(b)** |
| **Sample Date** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4/21/2011 | 8.9 | 7.39 | | | | | 0.174 | 8.02 | 7.85 | 0.00049 | 0.00077 | 0.678 | 0.27 | 2.46 | 380 | 95.8 | 689 | 578 | 4 | 0.72 | 3.2 | 3 | 14.1 | 3.64 | 0.039 | 101 |
| 5/31/2011 | 8.93 | | | | | | | | | | | | | | 304 | 69 | 529 | 453 | | | | | | | | |
| 6/14/2011 | 9.07 | | | | | | | | | | | | | | 400 | 95 | 764 | 633 | | | | | | | | |
| 7/21/2011 | 10.6 | 7.54 | | | | | 0.143 | 9.62 | 9.48 | <0.00047 | <0.00047 | 0.513 | 0.205 | 1.77 | 472 | 100 | 605 | 835 | <61 | <3.1 | 4.6 | <3.2 | 15 | <6.1 | <0.09 | 92.1 |
| 8/24/2011 | 9.99 | | | | | | | | | | | | | | 488 | 79 | 440 | 649 | | | | | | | | |
| 9/21/2011 | 9.6 | | | | | | | | | | | | | | 314 | 77 | 324 | 485 | | | | | | | | |
| 10/12/2011 | 9.55 | 7.58 | | | | | 0.107 | 9.86 | 9.75 | <0.00052 | <0.00052 | 0.536 | 0.337 | 1.33 | 278 | 69.4 | 312 | 624 | <68.9 | <3.5 | 3.5 | <3.5 | 9.3 | <6.89 | <0.04 | 92.2 |
| 11/18/2011 | 9.64 | | | | | | | | | | | | | | 264 | 58.9 | 351 | 546 | | | | | | | | |
| 12/15/2011 | 11.9 | | | | | | | | | | | | | | 279 | 177 | 461 | 619 | | | | | | | | |
| 1/12/2012 | 9.29 | 7.44 | | | | | 0.377 | 9.17 | 8.79 | 0.00004 | 0.00009 | 0.601 | 0.321 | 1.58 | 264 | 74.8 | 401 | 708 | <4.6 | 0.63 | 3.9 | <0.5 | 8.2 | 4.72 | 0.027 | 102 |
| 2/16/2012 | 9.1 | | | | | | | | | | | | | | 246 | 97.2 | 386 | 838 | | | | | | | | |
| 4/4/2012 | 8.9 | 7.36 | | | | | 0.151 | 9.8 | 9.65 | <0.00056 | 0.00199 | 0.549 | 0.22 | 2.49 | 243 | 102 | 424 | 506 | <4.5 | <0.2 | 3.3 | <0.5 | 13.1 | 3.8 | 0.022 | 88.3 |
| 5/24/2012 | 8.97 | | | | | | | | | | | | | | 200 | 80 | 285 | 1,750 | | | | | | | | |
| 6/20/2012 | 8.81 | | | | | | | | | | | | | | 200 | 90 | 393 | 1,310 | | | | | | | | |
| 7/18/2012 | 7.7 | 7.51 | | | | | 1.77 | 8.36 | 8.18 | <0.00065 | <0.00065 | 0.91 | 0.474 | 3.34 | 630 | 63 | 331 | 1,030 | <87 | <4.3 | 4.4 | <4.3 | 21.3 | <8.7 | <0.02 | 116 |
| 8/1/2012 | 7.7 | | | | | | | | | | | | | | 335 | 80 | 300 | 715 | | | | | | | | |
| 9/28/2012 | 9.07 | | | | | | | | | | | | | | 408 | 50 | 210 | 618 | | | | | | | | |
| 10/21/2012 | 7.86 | 7.31 | | | | | 0.86 | 15 | 14.9 | <0.00063 | <0.00063 | 0.86 | 0.397 | 1.97 | 530 | 55 | 294 | 938 | <84 | <4.2 | <17 | <17 | 11.8 | <8.4 | <0.1 | 95.1 |
| 11/30/2012 | 9.15 | | | | | | | | | | | | | | 591 | 81.7 | 558 | 1,230 | | | | | | | | |
| 12/27/2012 | 8.46 | | | | | | | | | | | | | | 428 | 70.3 | 554 | 827 | | | | | | | | |
| 1/16/2013 | 8.6 | 7.53 | | <58 | | 69 | 0.218 | 11.5 | 11.28 | <0.00058 | <0.00058 | 0.903 | 0.247 | 1.71 | 388 | 82.8 | 652 | 759 | <81.3 | <4.1 | <4.0 | <4.0 | 15.5 | <8.13 | <0.11 | 99.5 |
| 2/27/2013 | 7.98 | | | | | | | | | | | | | | 358 | 99.9 | 841 | 840 | | | | | | | | |
| 3/27/2013 | 9.68 | | | | | | | | | | | | | | 284 | 79 | 880 | 837 | | | | | | | | |
| 4/22/2013 | 5.49 | 9.43 | | | | | 0.22 | 9.37 | 9.15 | <0.00091 | <0.00091 | 1.12 | 0.52 | 3.56 | 244 | 66.6 | 801 | 626 | <12 | <1.2 | <6.0 | <18 | 14.8 | <4.8 | <0.09 | 91.1 |
| 5/22/2013 | 8.17 | | | | | | | | | | | | | | 222 | 48.6 | 629 | 486 | | | | | | | | |
| 6/26/2013 | 9.82 | | | | | | | | | | | | | | 1,600 | 175 | 975 | 997 | | | | | | | | |
| 7/17/2013 | 8.27 | 7.34 | | | | | 0.293 | 7.87 | 7.84 | <0.0006 | <0.0006 | 1.09 | 0.297 | 2.05 | 1,520 | 146 | 834 | 814 | <10.8 | <0.8 | <4.0 | <4.0 | 20.2 | 7.3 | <0.17 | 104 |
| 8/15/2013 | 8.39 | | | | | | | | | | | | | | 665 | 70.3 | 473 | 466 | | | | | | | | |
| 9/11/2013 | 8.56 | | | | | | | | | | | | | | 536 | 65.2 | 469 | 436 | | | | | | | | |
| 10/14/2013 | 9.03 | 7.28 | | | | | 0.392 | 7.96 | 7.92 | <0.00055 | <0.00055 | 0.8 | 0.227 | 4.8 | 501 | 78.2 | 615 | 553 | <7.8 | <0.7 | 1.9 | <3.7 | 12.6 | 3.8 | <0.05 | 83.9 |
| 11/20/2013 | 9.32 | | | | | | | | | | | | | | 448 | 91.1 | 671 | 3,660 | | | | | | | | |
| 12/5/2013 | 9.02 | | | | | | | | | | | | | | 392 | 87.1 | 615 | 2,580 | | | | | | | | |
| 1/8/2014 | 8.58 | 7.45 | | <58 | | <58 | 0.149 | 8.7 | 8.55 | <0.00058 | <0.00058 | 0.848 | 0.444 | 3.19 | 308 | 147 | 584 | 1,410 | <7.8 | <0.78 | 2.7 | <3.9 | 13.6 | 5.2 | <0.19 | 97.5 |
| 2/21/2014 | 3.87 | | | | | | | | | | | | | | 245 | 122 | 504 | 738 | | | | | | | | |
| 3/21/2014 | 11.0 | | | | | | | | | | | | | | 214 | 121 | 514 | 513 | | | | | | | | |
| 4/23/2014 | 9.32 | | | | | | | | | | | | | | 192 | 126 | 589 | 730 | | | | | | | | |
| 5/22/2014 | 9.28 | | | | | | | | | | | | | | 202 | 118 | 578 | 646 | | | | | | | | |
| 7/28/2014 | 10.4 | 6.55 | | | | | 0.183 | 5.41 | 5.23 | <4.8 | <4.8 | 0.571 | 0.201 | 1.52 | 171 | 115 | 480 | 615 | <6.2 | <0.6 | 2.4 | <3.1 | 11.3 | 3.6 | <0.08 | 77.9 |
| 8/26/2014 | 9.7 | | | | | | | | | | | | | | 586 | 171 | 586 | 973 | | | | | | | | |
| 9/22/2014 | 10 | | | | | | | | | | | | | | 482 | 162 | 611 | 937 | | | | | | | | |
| 10/16/2014 | 7.24 | 7.46 | | | | | 0.444 | 7.13 | 6.69 | <0.5 | <6.9 | 1.03 | 0.404 | 1.73 | 402 | 145 | 610 | 846 | <7.6 | <0.8 | 3.9 | <3.8 | 17 | 5.2 | <0.13 | 95.1 |
| 11/24/2017 | 6.7 | | | | | | | | | | | | | | 277 | 129 | 595 | 726 | | | | | | | | |
| 12/5/2014 | 7.2 | | | | | | | | | | | | | | 222 | 113 | 540 | 576 | | | | | | | | |
| 1/6/2015 | 7.19 | 7.19 | <290 | | <290 | | 0.177 | 7.15 | 6.98 | 0.00681 | 0.00787 | 0.77 | 0.34 | 2.11 | 211 | 128 | 668 | 619 | <8.9 | <0.9 | 2.9 | <4.4 | 17 | 3.6 | <0.2 | 73.5 |
| 2/23/2015 | 8.71 | | | | | | | | | | | | | | 306 | 142 | 658 | 645 | | | | | | | | |
| 3/4/2015 | 7.41 | | | | | | | | | | | | | | 508 | 137 | 644 | 743 | | | | | | | | |
| 4/9/2015 | 6.28 | 7.2 | | | | | 0.15 | 6.82 | 6.67 | <0.25 | <8.0 | 1.2 | 0.495 | 0.163 | 617 | 142 | 667 | 765 | <10.1 | <1.0 | 3.3 | <5.0 | 21.8 | 4.8 | <0.21 | 87.6 |

**Notes:**

(a) LDR treatment standard is a TCLP value, and is identified on Table A-2.

(b) Sample concentrations using TCLP analysis are compared to TCLP-PDL as shown on Table A-2.

| Table A-2<br>TCLP (EPA Method 1311) | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | LDR | Sample Date | | |
| Analyte | Method | Units | TCLP-PDL | Treatment Standard | 10/2/2000 | 5/9/2014 | 7/21/2014 |
| | | | | | | | |
| | | | | | Analysis Date | | |
| | | | | | 10/13-10/26/00 | 5/15/2014 | 7/29/2014 |
| Silver | 6010C | mg/L | 3.29 | 0.14 | <0.10 | <0.1 | <0.1 |
| Barium | 6010C | mg/L | 50.5 | 21 | 0.77 | <1.0 | <1.0 |
| Cadmium | 6010C | mg/L | 0.128 | 0.11 | <0.010 | <0.05 | <0.05 |
| Lead | 6010C | mg/L | 2.32 | 0.75 | <0.10 | <0.05 | <0.05 |
| Chromium | 6010C | mg/L | 1.21 | 0.6 | <0.10 | <0.05 | <0.05 |
| Selenium | 6010C | mg/L | 1.26 | 5.7 | <0.20 | <0.1 | <0.1 |
| Arsenic | 6010C | mg/L | 0.00321 | 5 | <0.20 | <0.05 | <0.05 |
| Mercury | 7470A | mg/L | 0.0254 | 0.025 | <0.005 | <0.001 | <0.001 |
| Copper | 6010C | mg/L | 11.8 | -- | 0.29 | Not Analyzed | Not Analyzed |
| Nickel | 6010C | mg/L | 5.07 | 11 | 0.26 | 0.35 | Not Analyzed |
| Zinc | 6010C | mg/L | 74.3 | 4.3 | 0.64 | Not Analyzed | Not Analyzed |
| | | | | | | | |
| | | | | | Prep/Analysis Date | | |
| | | | | | 10/12/2000 | Not Applicable | 8/6/2014 |
| 2,4-D | 8081 | mg/L | 2.16 | -- | <0.0030 | Not Analyzed | <0.1 |
| 2,4,5-TP | 8081 | mg/L | 1.73 | -- | <0.0010 | Not Analyzed | <0.02 |
| | | | | | | | |
| | | | | | Analysis Date | | |
| | | | | | 10/17/2000 | Not Applicable | 8/8/2014 |
| Chlordane | 8081 | mg/L | 6.06E+03 | -- | <0.0010 | Not Analyzed | <0.0050 |
| Endrin | 8081 | mg/L | 2.88E+10 | -- | <0.00010 | Not Analyzed | <0.00050 |
| Heptachlor | 8081 | mg/L | 4.89E+24 | -- | <0.00005 | Not Analyzed | <0.00050 |
| Lindane | 8081 | mg/L | 3.83E+17 | -- | <0.00005 | Not Analyzed | <0.00050 |
| Methoxychlor | 8081 | mg/L | 1.17E+28 | -- | <0.00050 | Not Analyzed | <0.0010 |
| Toxaphene | 8081 | mg/L | 1.24E+05 | -- | <0.0020 | Not Analyzed | <0.010 |
| Heptachlor epoxide | 8081 | mg/L | 2.1E+25 | -- | <0.00005 | Not Analyzed | <0.00050 |
| | | | | | | | |
| | | | | | Analysis Date | | |
| | | | | | 10/13/2000 | Not Applicable | 8/2/2014 |
| m,p-Cresol | 8270 | mg/L | 1.08 (a) | -- | <0.0040 | Not Analyzed | <0.10 |
| o-Cresol | 8270 | mg/L | 10.8 | -- | <0.0040 | Not Analyzed | <0.10 |
| 1,4-Dichlorobenzene | 8270 | mg/L | 0.178 | -- | <0.0040 | Not Analyzed | See 8260 |
| 2,4-Dinitrotoluene | 8270 | mg/L | 0.00619 | -- | <0.0080 | Not Analyzed | <0.10 |
| Hexachlorobenzene | 8270 | mg/L | 0.0336 | -- | <0.0080 | Not Analyzed | <0.10 |
| Hexachloro-1,3-butadiene | 8270 | mg/L | 0.0306 | -- | <0.0040 | Not Analyzed | <0.10 |
| Hexachloroethane | 8270 | mg/L | 0.102 | -- | <0.0080 | Not Analyzed | <0.10 |
| Nitrobenzene | 8270 | mg/L | 0.108 | -- | <0.0040 | Not Analyzed | <0.10 |
| Pentachlorophenol | 8270 | mg/L | 0.00903 | -- | <0.0400 | Not Analyzed | <0.25 |
| 2,4,5-Trichlorophenol | 8270 | mg/L | 8.56 | -- | <0.0120 | Not Analyzed | <0.10 |
| 2,4,6-Trichlorophenol | 8270 | mg/L | 0.119 | -- | <0.0080 | Not Analyzed | <0.10 |
| Pyridine | 8270 | mg/L | 0.216 | -- | <0.110 | Not Analyzed | <0.50 |
| | | | | | | | |
| | | | | | Analysis Date | | |
| | | | | | 10/10/2000 | Not Applicable | 7/25/2014 |
| Benzene | 8260 | mg/L | 0.0765 | -- | <0.15 | Not Analyzed | <0.20 |
| Carbon Tetrachloride | 8260 | mg/L | 0.0528 | -- | <0.15 | Not Analyzed | <0.20 |
| Chlorobenzene | 8260 | mg/L | 1.72 | -- | <0.15 | Not Analyzed | <0.20 |
| Chloroform | 8260 | mg/L | 0.0299 | -- | <0.15 | Not Analyzed | <0.20 |
| 1,2-Dichloroethane | 8260 | mg/L | 0.0394 | -- | <0.15 | Not Analyzed | <0.20 |
| 1,4-Dichlorobenzene | 8260 | mg/L | 0.178 | -- | See 8270 | Not Analyzed | <0.20 |
| 1,1-Dichloroethylene | 8260 | mg/L | 0.403 | -- | <0.15 | Not Analyzed | <0.20 |
| Methyl Ethyl Ketone | 8260 | mg/L | 130 | -- | <0.25 | Not Analyzed | <8.0 |
| Tetrachloroethylene | 8260 | mg/L | 0.00764 | -- | <0.15 | Not Analyzed | <0.20 |
| Trichloroethylene | 8260 | mg/L | 0.0423 | -- | <0.15 | Not Analyzed | <0.20 |
| Vinyl Chloride | 8260 | mg/L | 0.00301 | -- | <0.15 | Not Analyzed | <0.080 |

**Notes:**

(a) TCLP-PDL shown is the lower of the TCLP-PDL values for m-Cresol and p-Cresol.

**Table A-3**
**Bioassay (Rainbow Trout)**

| Method DOE 80-12 | Sample Collection Date: 10/3/2000<br>Test Initiation Date: 10/5/2000 | Sample Collection Date: 7/21/2014<br>Test Initiation Date: 8/1/2014 |
|---|---|---|
| **Sludge Concentration, mg/L** | **Percent Mortality** | **Percent Mortality** |
| 0 | 0 | 0 |
| 10 | 0 | 0 |
| 100 | 0 | 0 |

**Table A-4**
**Miscellaneous Analyses**

| Analysis | PDL | TCLP-PDLX20 | Sample ID | Sample Date | Analysis Date | Method | Result |
|---|---|---|---|---|---|---|---|
| Flashpoint (Degrees Celcius) | -- | -- | SOMAT #1-4 | 7/21/2014 | 8/6/2014 | 1020A | > 110 |
| Sulfide, reactive (mg/kg) | -- | -- | SOMAT #1-4 | 7/21/2014 | 7/25/2014 | 9034 | <330 |
| pH | -- | -- | SOMAT #1-4 | 7/21/2014 | 7/23/2014 | 9045D | 5.32 |
| Cyanide, weak acid dissociable (mg/kg) | 167,000 | 86.4 | SOMAT #1-4 | 7/21/2014 | 7/30/2014 | SM 4500-CN-E | <2.0 |
| Solids, total (percent) | -- | -- | SOMAT #1-4 | 7/21/2014 | 7/29/2014 | 160.3 | 9.71 |
| | | | | | | | |
| Methanol (mg/kg) | 1,070,000,000 | 2,160 | Waste Activated Sludge | 8/1/2001 | 8/8/2001 | CLI SolventScan | <0.75 |
| Acetone (µg/kg) | 23,500,000,000 | 3,900,000 | SOMAT | 7/19/2001 | 7/24/2001 | 8260 | <50 |

µg/kg = microgram per kilogram
mg/kg = milligram per kilogram

# Appendix B
# Mixed Material Analytical Results

**Table B-1**
**Comparison of 2014 Sampling Results to Preliminary Delisting Levels**
**Fire Mountain Farms Burnt Ridge Mixed Material Storage Unit**
**Lewis County, Washington**

| Analyte | CAS No. | Analysis Date | Preliminary Delisting Level (a) | TCLP-PDL X 20 (b) | Sample ID and Sample Date | | |
|---|---|---|---|---|---|---|---|
| | | | | | BR-Comp-1 7/9/2014 | BR-Comp-2 7/9/2014 | BR-Comp-3 7/9/2014 |
| **Volatiles (ug/kg dry weight; EPA Method 8260C)** | | | | | | | |
| 1,1,1-Trichloroethane | 71-55-6 | 7/15/2014 | 2.45E+11 | 1.40E+10 | 2.3U | 2U | 1.8U |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 7/15/2014 | 1.88E+08 | 5.54E+06 | 2.3U | 2U | 1.8U |
| 1,1,2-Trichloroethane | 79-00-5 | 7/15/2014 | 5.25E+08 | 2.32E+04 | 2.3U | 2U | 1.8U |
| 1,1-Dichloroethane | 75-34-3 | 7/15/2014 | 1.88E+10 | 6.36E+06 | 2.3U | 2U | 1.8U |
| 1,1-Dichloroethene | 75-35-4 | 7/15/2014 | 2.88E+09 | 1.29E+05 | 2.3U | 2U | 1.8U |
| 1,2,4-Trichlorobenzene | 120-82-1 | 7/15/2014 | 2.49E+10 | 1.19E+05 | 12U | 10U | 9U |
| 1,2-Dichlorobenzene | 95-50-1 | 7/15/2014 | 2.19E+10 | 2.76E+06 | 2.3U | 2U | 1.8U |
| 1,2-Dichloroethane | 107-06-2 | 7/15/2014 | 8.25E+07 | 1.26E+04 | 2.3U | 2U | 1.8U |
| 1,2-Dichloropropane | 78-87-5 | 7/15/2014 | 7.06E+08 | 4.06E+04 | 2.3U | 2U | 1.8U |
| 1,3-Dichlorobenzene | 541-73-1 | 7/15/2014 | --- | --- | 2.3U | 2U | 1.8U |
| 1,4-Dichlorobenzene | 106-46-7 | 7/15/2014 | 2.50E+08 | 5.70E+04 | **48** | **26** | **32** |
| 2-Chloroethylvinylether | 110-75-8 | 7/15/2014 | --- | --- | 12U | 10U | 9U |
| Acrolein | 107-02-8 | 7/15/2014 | 7.68E+05 | 6.04E+31 | 120U | 100U | 90U |
| Acrylonitrile | 107-13-1 | 7/15/2014 | 2.75E+07 | 2.74E+03 | 12U | 10U | 9U |
| Benzene | 71-43-2 | 7/15/2014 | 2.51E+08 | 2.46E+04 | 2.3U | 2U | 1.8U |
| Bromodichloromethane | 75-27-4 | 7/15/2014 | 2.51E+08 | 1.63E+04 | 2.3U | 2U | 1.8U |
| Bromoform | 75-25-2 | 7/15/2014 | 4.68E+09 | 1.82E+05 | 2.3U | 2U | 1.8U |
| Bromomethane | 74-83-9 | 7/15/2014 | 2.78E+07 | 1.32E+27 | 2.3U | 2U | 1.8U |
| Carbon Tetrachloride | 56-23-5 | 7/15/2014 | 1.37E+08 | 1.70E+04 | 2.3U | 2U | 1.8U |
| Chlorobenzene | 108-90-7 | 7/15/2014 | 1.37E+10 | 5.54E+05 | 2.3U | 2U | 1.8U |
| Chloroethane | 75-00-3 | 7/15/2014 | 6.33E+08 | 2.78E+07 | 2.3U | 2U | 1.8U |
| Chloroform | 67-66-3 | 7/15/2014 | 4.35E+07 | 9.62E+03 | 2.3U | 2U | 1.8U |
| Chloromethane | 74-87-3 | 7/15/2014 | 2.02E+08 | 7.28E+05 | 2.3U | 2U | 1.8U |
| cis-1,3-Dichloropropene | 10061-01-5 | 7/15/2014 | 6.70E+08 | 8.78E+32 | 2.3U | 2U | 1.8U |
| Dibromochloromethane | 124-48-1 | 7/15/2014 | 6.70E+08 | 1.67E+04 | 2.3U | 2U | 1.8U |
| Ethylbenzene | 100-41-4 | 7/15/2014 | 3.98E+10 | 5.10E+06 | 2.3U | 2U | 1.8U |
| Hexachlorobutadiene | 87-68-3 | 7/15/2014 | 3.11E+06 | 9.82E+03 | 12U | 10U | 9U |
| Methylene Chloride | 75-09-2 | 7/15/2014 | 9.90E+08 | 9.48E+04 | 4.6U | 4U | 3.6U |
| Naphthalene | 91-20-3 | 7/15/2014 | 1.43E+09 | 3.92E+03 | 12U | 10U | 9U |
| Tetrachloroethene | 127-18-4 | 7/15/2014 | 1.19E+07 | 2.46E+03 | 2.3U | 2U | 1.8U |
| Toluene | 108-88-3 | 7/15/2014 | 6.64E+10 | 5.44E+06 | **20** | **35** | **19** |
| trans-1,2-Dichloroethene | 156-60-5 | 7/15/2014 | 1.36E+09 | 3.08E+05 | 2.3U | 2U | 1.8U |
| trans-1,3-Dichloropropene | 10061-02-6 | 7/15/2014 | 7.06E+08 | 8.78E+32 | 2.3U | 2U | 1.8U |
| Trichloroethene | 79-01-6 | 7/15/2014 | 4.28E+08 | 1.36E+04 | 2.3U | 2U | 1.8U |
| Vinyl Chloride | 75-01-4 | 7/15/2014 | 7.44E+06 | 9.66E+02 | 2.3U | 2U | 1.8U |
| **Metals (mg/kg dry weight; EPA Method 6010C/7471A)** | | | | | | | |
| Antimony | 7440-36-0 | 7/15/2014 | 5.80E+05 | 3.24E+01 | 40U | 30U | 30U |
| Arsenic | 7440-38-2 | 7/15/2014 | 8.48E+03 | 1.01E+00 | 40U | 30U | 30U |
| Beryllium | 7440-41-7 | 7/15/2014 | 5.94E+04 | 9.14E+01 | 0.7U | 0.7U | 0.6U |
| Cadmium | 7440-43-9 | 7/15/2014 | 3.20E+04 | 4.12E+01 | **3** | **3** | **3** |
| Chromium | 7440-47-3 | 7/15/2014 | 1.19E+04 | 2.54E+02 | **31** | **45** | **35** |
| Cobalt | 7440-48-4 | 7/15/2014 | 1.59E+04 | 2.54E+01 | **43** | **48** | **37** |
| Copper | 7440-50-8 | 7/15/2014 | 3.27E+06 | 3.34E+03 | **379** | **417** | **358** |
| Lead | 7439-92-1 | 7/15/2014 | 1.36E+07 | 6.24E+02 | **40** | **30** | **30** |
| Molybdenum | 7439-98-7 | 7/15/2014 | 1.93E+07 | 3.94E+02 | **14** | **16** | **16** |
| Nickel | 7440-02-0 | 7/15/2014 | 5.94E+05 | 1.60E+03 | **28** | **45** | **31** |
| Selenium | 7782-49-2 | 7/15/2014 | 2.25E+06 | 3.96E+02 | 40U | 30U | 30U |
| Silver | 7440-22-4 | 7/15/2014 | 3.31E+06 | 9.24E+02 | **5** | **5** | **6** |
| Thallium | 7440-28-0 | 7/15/2014 | 3.83E+02 | 5.44E+00 | 40U | 30U | 30U |
| Zinc | 7440-66-6 | 7/15/2014 | 8.46E+06 | 2.40E+04 | **886** | **969** | **876** |
| Mercury | 7439-97-6 | 7/15/2014 | 1.16E+06 | 8.16E+00 | **1** | **1.9** | **1.8** |
| **Semivolatiles (ug/kg dry weight; EPA Method 8270D)** | | | | | | | |
| 1,2,4-Trichlorobenzene | 120-82-1 | 7/17/2014 | 2.49E+10 | 1.19E+05 | 260U | 310U | 260U |
| 1,2-Dichlorobenzene | 95-50-1 | 7/17/2014 | 2.19E+10 | 2.76E+06 | 260U | 310U | 260U |
| 1,2-Diphenylhydrazine | 122-66-7 | 7/17/2014 | 1.80E+07 | 1.67E+03 | 260U | 310U | 260U |
| 1,3-Dichlorobenzene | 541-73-1 | 7/17/2014 | --- | --- | 260U | 310U | 260U |
| 1,4-Dichlorobenzene | 106-46-7 | 7/17/2014 | 2.50E+08 | 5.70E+04 | **480** | **540** | 260U |
| 2,2'-Oxybis(1-Chloropropane) | 108-60-1 | 7/17/2014 | --- | --- | 260U | 310U | 260U |
| 2,4,6-Trichlorophenol | 88-06-2 | 7/17/2014 | 1.55E+08 | 3.82E+04 | 1,300U | 1,500U | 1,300U |
| 2,4-Dichlorophenol | 120-83-2 | 7/17/2014 | 1.40E+09 | 2.04E+05 | 1,300U | 1,500U | 1,300U |
| 2,4-Dimethylphenol | 105-67-9 | 7/17/2014 | 3.52E+10 | 1.36E+06 | 260U | 310U | 260U |
| 2,4-Dinitrophenol | 51-28-5 | 7/17/2014 | 7.72E+09 | 1.39E+05 | 2,600U | 3,100U | 2,600U |
| 2,4-Dinitrotoluene | 121-14-2 | 7/17/2014 | 3.60E+08 | 1.99E+03 | 1,300U | 1,500U | 1,300U |
| 2,6-Dinitrotoluene | 606-20-2 | 7/17/2014 | 3.60E+08 | 1.99E+03 | 1,300U | 1,500U | 1,300U |
| 2-Chloronaphthalene | 91-58-7 | 7/17/2014 | 4.08E+09 | 1.23E+06 | 260U | 310U | 260U |
| 2-Chlorophenol | 95-57-8 | 7/17/2014 | 1.14E+10 | 3.48E+05 | 260U | 310U | 260U |
| 2-Nitrophenol | 88-75-5 | 7/17/2014 | --- | --- | 260U | 310U | 260U |
| 3,3'-Dichlorobenzidine | 91-94-1 | 7/17/2014 | 1.18E+07 | 3.04E+03 | 1,300U | 1,500U | 1,300U |
| 4,6-Dinitro-2-Methylphenol | 534-52-1 | 7/17/2014 | 3.86E+08 | 6.98E+03 | 2,600U | 3,100U | 2,600U |
| 4-Bromophenyl-phenylether | 101-55-3 | 7/17/2014 | --- | --- | 260U | 310U | 260U |
| 4-Chlorophenyl-phenylether | 7005-72-3 | 7/17/2014 | --- | --- | 260U | 310U | 260U |
| 4-Methylphenol | 106-44-5 | 7/17/2014 | 1.65E+10 | 3.48E+05 | **1,100** | **450** | **460** |
| 4-Nitrophenol | 100-02-7 | 7/17/2014 | --- | --- | 1,300U | 1,500U | 1,300U |
| Acenaphthene | 83-32-9 | 7/17/2014 | 6.23E+09 | 1.28E+06 | 260U | 310U | 260U |
| Acenaphthylene | 208-96-8 | 7/17/2014 | --- | --- | 260U | 310U | 260U |
| Anthracene | 120-12-7 | 7/17/2014 | 7.06E+09 | 3.12E+06 | 260U | 310U | 260U |
| Azobenzene | 103-33-3 | 7/17/2014 | --- | --- | 260U | 310U | 260U |
| Benzo(a)anthracene | 56-55-3 | 7/17/2014 | 4.65E+05 | 8.42E+03 | 260U | 310U | 260U |
| Benzo(a)pyrene | 50-32-8 | 7/17/2014 | 3.45E+04 | 3.16E+06 | 260U | 310U | 260U |
| Benzo(b)fluoranthene | 205-99-2 | 7/17/2014 | 2.72E+05 | 2.70E+07 | **330M** | 310U | **380M** |
| Benzo(g,h,i)perylene | 191-24-2 | 7/17/2014 | --- | --- | 260U | 310U | 260U |
| Benzo(k)fluoranthene | 207-08-9 | 7/17/2014 | 3.22E+06 | 8.02E+22 | **330M** | 310U | **360M** |
| bis(2-Chloroethoxy) Methane | 111-91-1 | 7/17/2014 | 1.16E+10 | 2.04E+05 | 260U | 310U | 260U |
| Bis-(2-Chloroethyl) Ether | 111-44-4 | 7/17/2014 | 2.34E+08 | 1.33E+04 | 260U | 310U | 260U |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | 7/17/2014 | 2.44E+10 | 3.86E+33 | **10,000** | **12,000** | **9,100** |
| Butylbenzylphthalate | 85-68-7 | 7/17/2014 | 2.06E+09 | 4.80E+06 | 260U | 310U | 260U |
| Chrysene | 218-01-9 | 7/17/2014 | 4.57E+07 | 8.42E+05 | 260U | 310U | 260U |
| Dibenz(a,h)anthracene | 53-70-3 | 7/17/2014 | 3.63E+04 | 4.44E+16 | 260U | 310U | 260U |
| Diethylphthalate | 84-66-2 | 7/17/2014 | 1.14E+12 | 1.20E+08 | 260U | 310U | 260U |
| Dimethylphthalate | 131-11-3 | 7/17/2014 | 3.86E+13 | 6.94E+08 | 260U | 310U | 260U |

**Table B-1**
**Comparison of 2014 Sampling Results to Preliminary Delisting Levels**
**Fire Mountain Farms Burnt Ridge Mixed Material Storage Unit**
**Lewis County, Washington**

| Analyte | CAS No. | Analysis Date | Preliminary Delisting Level (a) | TCLP-PDL X 20 (b) | Sample ID and Sample Date | | |
|---|---|---|---|---|---|---|---|
| | | | | | BR-Comp-1 7/9/2014 | BR-Comp-2 7/9/2014 | BR-Comp-3 7/9/2014 |
| Di-n-Butylphthalate | 84-74-2 | 7/17/2014 | 2.12E+09 | 2.96E+06 | 260U | 310U | 260U |
| Di-n-Octyl phthalate | 117-84-0 | 7/17/2014 | 4.18E+10 | 3.12E+32 | 260U | 310U | 260U |
| Fluoranthene | 206-44-0 | 7/17/2014 | 1.17E+08 | 2.96E+05 | **360** | **390** | **450** |
| Fluorene | 86-73-7 | 7/17/2014 | 1.91E+09 | 5.90E+05 | 260U | 310U | 260U |
| Hexachlorobenzene | 118-74-1 | 7/17/2014 | 1.74E+04 | 1.08E+04 | 260U | 310U | 260U |
| Hexachlorobutadiene | 87-68-3 | 7/17/2014 | 3.11E+06 | 9.82E+03 | 260U | 310U | 260U |
| Hexachlorocyclopentadiene | 77-47-4 | 7/17/2014 | 7.08E+08 | 1.50E+32 | 1,300U | 1,500U | 1,300U |
| Hexachloroethane | 67-72-1 | 7/17/2014 | 5.10E+07 | 3.30E+04 | 260U | 310U | 260U |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 7/17/2014 | 8.57E+05 | 2.96E+14 | 260U | 310U | **400** |
| Isophorone | 78-59-1 | 7/17/2014 | 1.26E+11 | 1.35E+06 | 260U | 310U | 260U |
| Naphthalene | 91-20-3 | 7/17/2014 | 1.43E+09 | 3.92E+03 | 260U | 310U | 260U |
| Nitrobenzene | 98-95-3 | 7/17/2014 | 1.93E+09 | 3.48E+04 | 260U | 310U | 260U |
| N-Nitrosodimethylamine | 62-75-9 | 7/17/2014 | 2.83E+06 | 2.66E+01 | 1,300U | 1,500U | 1,300U |
| N-Nitroso-Di-N-Propylamine | 621-64-7 | 7/17/2014 | 3.26E+07 | 1.93E+02 | 260U | 310U | 260U |
| N-Nitrosodiphenylamine | 86-30-6 | 7/17/2014 | 2.10E+09 | 2.72E+05 | 260U | 310U | 260U |
| Pentachlorophenol | 87-86-5 | 7/17/2014 | 3.05E+07 | 2.90E+03 | 1,300U | 1,500U | 1,300U |
| Phenanthrene | 85-01-8 | 7/17/2014 | --- | --- | 260U | 310U | 260U |
| Phenol | 108-95-2 | 7/17/2014 | 1.16E+12 | 2.08E+07 | 260U | 310U | 260U |
| Pyrene | 129-00-0 | 7/17/2014 | 2.10E+08 | 5.34E+05 | **390** | **310** | **270** |
| Total Benzofluoranthenes | TOTBFA | 7/17/2014 | --- | --- | **350M** | 310U | **400M** |
| **PCBs (ug/kg dry weight; EPA Method 8082A)** | | | | | | | |
| Aroclor 1016 | 12674-11-2 | 7/20/2017 | --- | --- | 9.8U | NA | NA |
| Aroclor 1221 | 11104-28-2 | 7/20/2017 | --- | --- | 9.8U | NA | NA |
| Aroclor 1232 | 11141-16-5 | 7/20/2017 | --- | --- | 9.8U | NA | NA |
| Aroclor 1242 | 53469-21-9 | 7/20/2017 | --- | --- | 9.8U | NA | NA |
| Aroclor 1248 | 12672-29-6 | 7/20/2017 | --- | --- | 98U | NA | NA |
| Aroclor 1254 | 11097-69-1 | 7/20/2017 | --- | --- | 150U | NA | NA |
| Aroclor 1260 | 11096-82-5 | 7/20/2017 | --- | --- | **61** | NA | NA |
| Total PCBs (b) | 1336-36-3 | 7/20/2017 | 1.12E+02 | 2.40E+13 | **61** | NA | NA |
| **Pesticides (ug/kg dry weight; EPA Method 8081B)** | | | | | | | |
| 4,4'-DDD | 72-54-8 | 7/18-7/19/2014 | 1.59E+04 | 2.64E+31 | 16U | NA | NA |
| 4,4'-DDE | 72-55-9 | 7/18-7/19/2014 | 8.21E+03 | 1.95E+22 | 16U | NA | NA |
| 4,4'-DDT | 50-29-3 | 7/18-7/19/2014 | 2.33E+03 | 1.17E+31 | 16U | NA | NA |
| Aldrin | 309-00-2 | 7/18-7/19/2014 | 6.70E+01 | 5.98E+12 | 8.2U | NA | NA |
| alpha-BHC | 319-84-6 | 7/18-7/19/2014 | 5.07E+05 | 1.26E+25 | 8.2U | NA | NA |
| beta-BHC | 319-85-7 | 7/18-7/19/2014 | 7.09E+05 | 7.60E+02 | 8.2U | NA | NA |
| cis-Chlordane | 5103-71-9 | 7/18-7/19/2014 | --- | --- | 19U | NA | NA |
| delta-BHC | 319-86-8 | 7/18-7/19/2014 | --- | --- | 110U | NA | NA |
| Dieldrin | | 7/18-7/19/2014 | --- | --- | 57U | NA | NA |
| Endosulfan I | 959-98-8 | 7/18-7/19/2014 | --- | --- | 14U | NA | NA |
| Endosulfan II | 33213-65-9 | 7/18-7/19/2014 | --- | --- | 16U | NA | NA |
| Endosulfan Sulfate | 1031-07-8 | 7/18-7/19/2014 | --- | --- | 72U | NA | NA |
| Endrin | 72-20-8 | 7/18-7/19/2014 | 8.73E+06 | 9.26E+15 | 25U | NA | NA |
| Endrin Aldehyde | 7421-93-4 | 7/18-7/19/2014 | --- | --- | 16U | NA | NA |
| gamma BHC (Lindane) | 58-89-9 | 7/18-7/19/2014 | 2.83E+06 | 1.23E+23 | 8.2U | NA | NA |
| Heptachlor | 76-44-8 | 7/18-7/19/2014 | 6.40E+02 | 1.57E+30 | 8.2U | NA | NA |
| Heptachlor Epoxide | 1024-57-3 | 7/18-7/19/2014 | 2.22E+04 | 6.74E+30 | 8.2U | NA | NA |
| Toxaphene | 8001-35-2 | 7/18-7/19/2014 | 7.50E+02 | 3.98E+10 | 820U | NA | NA |
| trans-Chlordane | 5103-74-2 | 7/18-7/19/2014 | --- | --- | 1,100U | NA | NA |
| **Dioxins/Furans (pg/g dry weight; EPA Method 1613B)** | | | | | | | |
| 2,3,7,8-TCDD | 1746-01-6 | 9/4/2014 | 9.90E+00 | 4.84E+09 | 2.35UJ | NA | NA |
| **Inorganic Parameters** | | | | | | | |
| N-Nitrate (mg-N/kg dry weight; Calculated) | NITRATE | 7/10/2014 | --- | --- | 0.6U | NA | NA |
| N-Ammonia (mg-N/kg dry weight; EPA 350.1M) | AMMONIA | not available | --- | --- | **7,600** | NA | NA |
| Total Kjeldahl Nitrogen (mg-N/kg dry weight; EPA 351.2) | KJELDHAL-N | 7/10/2014 | --- | --- | **33,700** | NA | NA |
| Nitrate+Nitrite (NO3+NO2) (mg-N/kg dry weight; EPA 353.2) | NITRATE-NITRITE | 7/10/2014 | --- | --- | **0.60** | NA | NA |
| N-Nitrite (mg-N/kg dry weight; EPA 353.2) | NITRITE | 7/10/2014 | --- | --- | **0.72** | NA | NA |
| Total Solids (% dry weight; SM2540G) | TS104 | 7/14/2014 | --- | --- | **15.06** | **13.40** | **15.91** |
| Total Cyanide (mg/kg dry weight; EPA 335.4) | 57-12-5 | 7/21/2014 | 1.83E+06 | 1.39E+03 | **1.05** | **1.42** | **1.08** |
| pH (Std units dry weight; SM9045) | PH | 7/14/2014 | --- | --- | **7.43** | NA | NA |

(a) Preliminary Delisting Level calculated using EPA's Hazardous Waste Delisting Risk Assessment Software, as identified by the Washington State Department of Ecology (September 23, 2016 letter to Mr. Jarrod Kocin, Emerald Kalama Chemical, LLC, re: EPA and Ecology Comments to Waste Characterization Plan).
(b) TCLP-PDL x 20 represents the TCLP Preliminary Delisiting Level calculated using EPA's Hazardous Waste Delisting Risk Assessment Software, the resulting outputs were multiplied by 20 to be compared to the total analysis.
(c) Total PCBs is the sum of detected aroclors.
M = Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match.
U = Indicates the compound was not detected at the reported concentration.

| | |
|---|---|
| **Bold** | = Detected concentration. |
| Box | = Exceedance of Preliminary Delisting Level. |
| (green shading) | = Exceedance of TCLP-PDL X 20. |
| NA | = Not Applicable. |
| --- | = screening level not available |
| EPA | = US Environmental Protection Agency |
| ID | = identification |
| ug/kg | = micrograms per kilogram |
| mg-N/kg | = milligrams Nitrogen per kilogram |
| mg/kg | = milligrams per kilogram |
| pg/g | = picogram per gram |

**Table B-2**
**Comparison of 2014 Sampling Results to Land Disposal Restriction Levels**
**Fire Mountain Farms Burnt Ridge Mixed Material Storage Unit**
**Lewis County, Washington**

| Analyte | CAS No. | Analysis Date | Land Disposal Restriction Level (non-wastewater) | Units | Sample ID and Sample Date | | |
|---|---|---|---|---|---|---|---|
| | | | | | BR-Comp-1 7/9/2014 | BR-Comp-2 7/9/2014 | BR-Comp-3 7/9/2014 |
| Acetone | 67-64-1 | NA | 160,000 | ug/kg dry weight | NA | NA | NA |
| Benzene | 71-43-2 | 7/15/2014 | 10,000 | ug/kg dry weight | 2.3U | 2U | 1.8U |
| Methanol (a) | 67-56-1 | NA | 0.75 | mg/L | NA | NA | NA |
| Toluene | 108-88-3 | 7/15/2014 | 10,000 | ug/kg dry weight | **20** | **35** | **19** |

(a) This LDR is a TCLP level.

NA = Indicates no past anaylsis was performed.

U = Indicates the compound was not detected at the reported concentration.

**Bold** = Detected concentration

NA = not applicable

= Detected analyte with concentration greater than the LDR Level.

EPA = US Environmental Protection Agency

ID = identification

ug/kg = micrograms per kilogram

mg/L = milligrams per liter

# Table B-3
## Comparison of 2014 and 2017 Cobalt Results to Preliminary Delisting Levels
## Fire Mountain Farms Burnt Ridge Mixed Material Storage Unit
## Lewis County, Washington

| Analyte | CAS No. | 2014/2017 Analysis Date | Preliminary Delisting Level (a) | TCLP-Preliminary Delisting Level (a) | Sample ID and Sample Date | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | BR-Comp-1 7/9/2014 | BR-Comp-2 7/9/2014 | BR-Comp-3 7/9/2014 | FMF_Burntsed 5/1/2017 |
| **Metals (mg/kg dry weight; EPA Method 6010C)** | | | | | | | | |
| Cobalt | 7440-48-4 | 7/15/2014; 5/8/2017 | **15900** | -- | **43** | **48** | **37** | **28.3** |
| | | | | | | | | |
| **TCLP Metals (mg/L; EPA Method 6010C)** | | | | | | | | |
| Cobalt | 7440-48-4 | NA; 5/8/2017 | -- | **1.27** | NA | NA | NA | **0.108** |

(a) Preliminary Delisting Level calculated using EPA's Hazardous Waste Delisting Risk Assessment Software, as identified by the Washington State Department of Ecology (September 23, 2016 letter to Mr. Jarrod Kocin, Emerald Kalama Chemical, LLC, re: EPA and Ecology Comments to Waste Characterization Plan).
Analytical results indicate no exceedances of PDLs or TCLP-PDLs.

**Bold** = Detected concentration.
NA = Not Analyzed.
--- = screening level not available

EPA = US Environmental Protection Agency
ID = identification
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
TCLP = Toxicity Characteristic Leaching Procedure

**Table B-4**
**Comparison of 2017 Sampling Results to Preliminary Delisting Levels and Land Disposal Restriction Levels**
**Fire Mountain Farms Burnt Ridge Mixed Material Storage Unit**
**Lewis County, Washington**

| Analyte | CAS No. | Analysis Date | Land Disposal Restriction Level (non-wastewater) | Land Disposal Restriction Level x 20 | Grid Location, Sample Location, Laboratory Sample ID, and Sample Date | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Grid A1 | | Grid A2 | | | | Grid B1 | | Grid B3 | | Grid C2 | |
| | | | | | | | | | Dup of BR-G-A2 | | | | | | | |
| | | | | | BR-G-A1 | | BR-G-A2 | | BR-G-DUP1 | | BR-G-B1 | | BR-G-B3 | | BR-G-C2 | |
| | | | | | 17J0506-01 | | 17J0506-02 | | 17J0506-12 | | 17J0506-03 | | 17J0506-04 | | 17J0506-05 | |
| | | | | | 10/26/2017 | | 10/26/2017 | | 10/26/2017 | | 10/26/2017 | | 10/26/2017 | | 10/26/2017 | |
| **Volatile Organic Compounds (ug/kg as received; EPA Method 8260C)** | | | | | | | | | | | | | | | | |
| Acetone | 67-64-1 | 11/1-11/2/2017 | 160,000 | -- | **422** | | **284** | **J** | **166** | **J** | **278** | | **116** | | **288** | |
| Benzene | 71-43-2 | 11/1-11/2/2017 | 10,000 | -- | **1.01** | | 0.87 | U | 0.98 | U | 0.97 | U | 0.90 | U | 0.86 | U |
| Toluene | 108-88-3 | 11/1-11/2/2017 | 10,000 | -- | **8.93** | | **7.05** | | **9.11** | | **5.99** | | **8.47** | | **10.1** | |
| | | | | | | | | | | | | | | | | |
| **Volatile Organic Compounds (mg/kg as received; EPA Method 8015C)** | | | | | | | | | | | | | | | | |
| Methanol | 67-56-1 | 11/3/2017 | 0.75 mg/L (a) | 15 mg/kg | 9.6 | U | 9.5 | U | 9.5 | U | 10.0 | U | 9.9 | U | 9.9 | U |
| | | | | | | | | | | | | | | | | |
| **Conventionals** | | | | | | | | | | | | | | | | |
| pH (std units as received; EPA Method 9045D) | -- | 10/31/2017 | -- | -- | **7.26** | | **7.28** | | **7.17** | | **7.16** | | **6.89** | | **7.26** | |
| Total Solids (% as received; SM2540 G-97) | -- | 10/31/2017 | -- | -- | **16.76** | | **14.19** | | **14.20** | | **12.77** | | **8.34** | | **15.34** | |

**Table B-4**
**Comparison of 2017 Sampling Results to Preliminary Delisting Levels and Land Disposal Restriction Levels**
**Fire Mountain Farms Burnt Ridge Mixed Material Storage Unit**
**Lewis County, Washington**

| Analyte | CAS No. | Analysis Date | Land Disposal Restriction Level (non-wastewater) | Land Disposal Restriction Level x 20 | Grid Location, Sample Location, Laboratory Sample ID, and Sample Date | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Grid D4 | | Grid D5 | | Grid E2 | | Grid E4 | | Grid E5 | | Grid E6 | |
| | | | | | BR-G-D4<br>17J0506-06<br>10/26/2017 | | BR-G-D5<br>17J0506-07<br>10/26/2017 | | BR-G-E2<br>17J0506-08<br>10/26/2017 | | BR-G-E4<br>17J0506-09<br>10/26/2017 | | BR-G-E5<br>17J0506-10<br>10/26/2017 | | BR-G-E6<br>17J0506-11<br>10/26/2017 | |
| **Volatile Organic Compounds (ug/kg as received; EPA Method 8260C)** | | | | | | | | | | | | | | | | |
| Acetone | 67-64-1 | 11/1-11/2/2017 | 160,000 | -- | **380** | | **201** | | **232** | | **341** | | **251** | | **279** | |
| Benzene | 71-43-2 | 11/1-11/2/2017 | 10,000 | -- | 0.96 | U | 0.97 | U | 0.93 | U | 0.96 | U | 0.98 | U | 0.99 | U |
| Toluene | 108-88-3 | 11/1-11/2/2017 | 10,000 | -- | **10.3** | **J** | **5.75** | | **7.30** | | **10.1** | | **13.2** | | **6.42** | |
| | | | | | | | | | | | | | | | | |
| **Volatile Organic Compounds (mg/kg as received; EPA Method 8015C)** | | | | | | | | | | | | | | | | |
| Methanol | 67-56-1 | 11/3/2017 | 0.75 mg/L (a) | 15 mg/kg | 9.1 | U | 9.4 | U | 9.4 | U | 9.6 | U | 9.5 | U | 8.8 | U |
| | | | | | | | | | | | | | | | | |
| **Conventionals** | | | | | | | | | | | | | | | | |
| pH (std units as received; EPA Method 9045D) | -- | 10/31/2017 | -- | -- | **7.22** | | **7.26** | | **7.12** | | **7.22** | | **7.28** | | **7.23** | |
| Total Solids (% as received; SM2540 G-97) | -- | 10/31/2017 | -- | -- | **17.28** | | **17.53** | | **11.44** | | **15.56** | | **19.98** | | **10.58** | |

**Notes:**

(a) This LDR is a TCLP level; analytical limitations would produce a reporting limit greater than the LDR. The total methanol concentration is compared to the TCLP LDR using the rule of 20.

U = Indicates the compound was not detected at the reported concentration.

Analytical results indicate no exceedances of LDRs, PDLs, or TCLP-PDLsx20.

**Bold** = Detected concentration

-- = not applicable

**Abbreviations and Acronyms:**

EPA = US Environmental Protection Agency
ID = identification
ug/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
mg/L = milligrams per liter

# Appendix C
# Fire Mountain Farms, Inc. Results of Investigation of Sludge at Three Storage Sites (Pacific Groundwater Group 2014)
# and
# Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units, Lewis County, Washington (Landau Associates, Inc. July 2017)
# and
# Waste Characterization Report, Fire Mountain Farms Burnt Ridge Storage Unit, Lewis County, Washington (Landau Associates, Inc. November 2017)

Fire Mountain Farms, Inc. Results of Investigation of Sludge at Three Storage Sites
(Pacific Groundwater Group 2014)

# FIRE MOUNTAIN FARMS, INC.
# RESULTS OF INVESTIGATION OF SLUDGE
# AT THREE STORAGE SITES

**September 2014**

# FIRE MOUNTAIN FARMS, INC.
# RESULTS OF INVESTIGATION OF SLUDGE AT THREE STORAGE SITES

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*September 11, 2014*
*JW9901.01*
*FMF_SludgeReport_V4_rev091114_EcologyReview.docx*

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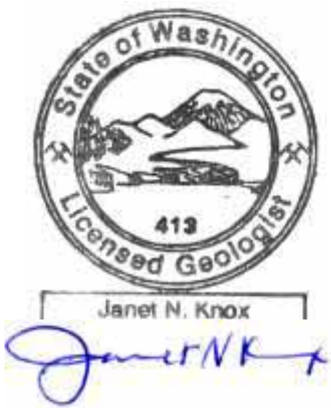
# SIGNATURE

This report, and Pacific Groundwater Group's work contributing to this report, were reviewed by the undersigned and approved for release.

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# 1.0 EXECUTIVE SUMMARY

This report documents the results of extensive sampling and analytical testing of biosolids (mixed sludge waste from various sources) currently being stored at three facilities operated by Fire Mountains Farms, Inc. (FMF) in Lewis County, Washington (Newaukum Prairie Impoundment, Burnt Ridge Lagoon, and Big Hanaford Bunker). Sludge samples were collected in July 2014 from each site and were analyzed for a comprehensive list of chemical compounds, including the full US Environmental Protection Agency (U.S. EPA) priority pollutant list for at least one composite sample at each site. A liquid sample was also collected from the water cap at the Burnt Ridge Lagoon.

Evaluation of the analytical results under the Washington State land disposal restriction for dangerous waste Chapter 173-303 of the Washington Administrative Code (WAC) indicate the sludge currently stored at all three facilities do not likely designate as wastes that would be restricted from land disposal (Section 6.1).

Evaluation of the analytical results under the Washington State Biosolids Management Rule (WAC 173-308) indicate the concentration of regulated pollutants in the FMF sludge are all below regulatory limits (WAC 173-308-160) and total fecal coliform concentrations meet the pathogen reduction requirements for Class B biosolids (WAC 173-308-170) (Section 6.3).

Comparison of the analytical results to mean sewage sludge concentrations from the U.S. EPA 1988 National Sewage Sludge Survey (NSSS) indicate chemical concentrations in the FMF sludge is either similar to or less than the mean concentrations calculated from the NSSS dataset except for the following chemicals (in order from highest to lowest exceedance of the NSSS dataset) (Section 6.2):

- Cobalt at all three sites
- 4-Methylphenol at Big Hanaford
- Toluene at Newaukum Prairie and Big Hanaford
- Phenol at Big Hanaford
- Molybdenum at all three sites

Although molybdenum concentrations exceeded the mean concentration in the NSSS dataset, they are below the ceiling limit for molybdenum in the State Biosolids Rule (WAC 173-308-160). Pollutant limits are not set for toluene, cobalt, 4-methylphenol, and phenol in the State Biosolids Rule.

Toluene was detected in four discrete liquid samples collected from each quadrant of the Burnt Ridge water cap at concentrations well below the Federal Maximum Contaminant Level (MCL) for drinking water. No other organic chemicals were detected in the water cap samples.

Seven metals were detected in the composite liquid sample from the Burnt Ridge water cap (all measured as totals): chromium, cobalt, copper, molybdenum, nickel, zinc, and mercury. The concentrations of chromium, copper, and mercury were all below the Federal MCL and the Washington State Standards for Groundwater (WAC 173-200). There is no state or federal standard for cobalt, molybdenum, or nickel.

## 2.0 INTRODUCTION

The purpose of this report is to document the investigation of biosolids (sludge waste) currently stored at three facilities operated by Fire Mountain Farms, Inc. in Lewis County, Washington. Pacific Groundwater Group (PGG) performed the investigation and prepared this report for Fire Mountain Farms, Inc. (FMF) to meet the requirements of an Administrative Order (Docket #10721) issued by the Washington Department of Ecology (Ecology) on June 2, 2014.

The purpose of the investigation was to conduct a rigorous characterization of the chemical composition of sludge waste being stored at the three facilities. The analytical results were then evaluated under the Land Disposal Restrictions under the Washington Dangerous Waste Regulations (Washington Administrative Code [WAC] 173-303-140) and Biosolids Management Code (WAC 173-308). Analytical results were also compared to the mean sewage sludge concentrations from the U.S. EPA 1988 National Sewage Sludge Survey (NSSS).

This work was performed, our findings obtained, and this report prepared, using generally accepted environmental investigation practices used at this time and in this vicinity, for exclusive application to the Fire Mountain Farm, Inc. sludge investigation, and for the exclusive use of Fire Mountain Farms, Inc. This is in lieu of other warranties, expressed or implied.

## 3.0 BACKGROUND

Fire Mountain Farms, Inc. (FMF) operates several facilities in Lewis County where biosolids are applied to fields as fertilizer under the Washington State General Permit for Biosolids Management. On June 2, 2014, FMF was issued an Administrative Order (AO), Docket #10721 by the Washington Department of Ecology (Ecology). Under the directive of the AO, Ecology required FMF to undergo a rigorous investigation to sample and characterize sludge currently stored at three of its facilities: Newaukum Prairie, Big Hanaford, and Burnt Ridge (Figure 1).

### 1. Newaukum Prairie Surface Impoundment

The Newaukum Prairie surface impoundment (Figure 2) was recently re-constructed and lined in 2013. The lagoon does not have a water cap. The dimensions of the sludge in July 2014 were estimated to be 8 to 9 feet thick, measuring roughly 100 feet by 100 feet at the bottom and 170 feet by 170 feet at the surface.

**2. Big Hanaford Bunker**

The Big Hanaford Bunker (Figure 3) is a covered concrete structure measuring approximately 100 feet by 60 feet in dimension and stores sludge estimated to be about 10 feet deep[1].

**3. Burnt Ridge Surface Lagoon**

The Burnt Ridge Lagoon (Figure 4) has a water cap approximately 14 feet deep above sludge and solids stored at the bottom. The surface water dimensions of the lagoon were measured by FMF personnel on June 25, 2014 to be 215 feet by 205 feet. The lagoon's sloped interior sides extend about 50 feet from the edge indicating the bottom area of the lagoon is about 115 feet by 105 feet. Limited sludge material is currently stored at the bottom of Burnt Ridge Lagoon. The sludge material is estimated to currently be 3 feet thick or less.

As stated in the AO, the investigative work was required to follow an Ecology-approved Quality Assurance Project Plan (QAPP) specifying a rigorous method of sampling (gridding, randomized sampling, compositing, etc.) to address the heterogeneity of the materials stored at the three sites. The QAPP was prepared by Pacific Groundwater Group in accordance with Ecology guidelines (Publication No. 04-03-030 July 2004) and was submitted to and approved by Ecology in July 2014 (PGG, 2014).

During conversations with Ecology while developing the QAPP, it was also agreed that the water cap at the Burnt Ridge Lagoon and groundwater monitoring wells downgradient of the Newaukum Prairie and Burnt Ridge storage site would also be sampled as part of this investigation.

## 4.0 INVESTIGATIVE WORK PERFORMED

This section summarizes the field investigative work performed to meet the requirements of the AO. Field investigative work included sampling of sludge wastes stored at three of the Fire Mountain Farms sites: Burnt Ridge, Newaukum Prairie, and Big Hanaford (Figure 1). The Burnt Ridge Lagoon water cap was also sampled as part of the investigation. Although not required by the AO, existing downgradient groundwater monitoring wells were sampled at the Newaukum Prairie and Big Hanaford sites; however, the results of the groundwater investigation will be summarized in a separate addendum to this report.

Results of this investigative work are summarized in Section 5 (Analytical Results).

## 4.1 FIELD INVESTIGATION

Samples were collected from the three storage sites (Burnt Ridge, Newaukum Prairie, and Big Hanaford) following the procedures outlined in the QAPP (PGG, 2014); field conditions required exceptions to the QAPP that were approved by Ecology and are described

[1] The concrete segments used to construct the bunker are 11.5 feet tall with a 6 inch thick poured concrete slab floor, making an effective depth of 11 feet. The top of the biosolids is 6 to 12 inches from the top of the bunker - for a total biosolids thickness of 10 to 10.5 feet.

below. At each site, several grab samples ("subsamples") were systematically collected by FMF personnel using various coring devices at prescribed horizontal spacing and random vertical depths. An x-y grid was staked out along the perimeter of each storage site to guide sample locations as specified in the QAPP (PGG, 2014). Sludge sample depths varied from near the surface to the bottom of the sludge material and were randomly selected in the field using a pre-generated table of random numbers in MS-Excel.

Three composited sludge samples from each storage site were submitted for laboratory analysis. Each composite consisted of up to nine discrete grab samples composited in the field (except for samples analyzed for volatile organic compounds (VOCs), which were composited by the lab in order to minimize volatilization to air). A composite liquid sample was also collected from the water cap at the Burnt Ridge Lagoon. Field compositing of grab samples was conducted by PGG personnel and followed the procedures documented in the QAPP (2014). Decontamination of sampling and compositing equipment also followed the procedures documented in the QAPP.

In accordance with the QAPP, the sludge samples were analyzed for a comprehensive list of chemical compounds, including the full US Environmental Protection Agency (USEPA) priority pollutants for at least one composited sludge sample collected from each site.

The water cap liquid sample collected at the Burnt Ridge site was analyzed for VOCs, Semi-VOCs, metals, nitrate, and total cyanide. The water cap sample was not analyzed for the full priority pollutants as stated in Section 4.7 of the QAPP (PGG, 2014). This deviation is due to Table 6 in the QAPP, which indicates sample parameters for the water cap were to be the same as the sample parameters for groundwater (VOCs, Semi-VOCs, metals, nitrate, and total cyanide).

Finally, in accordance with the pathogen reduction requirements in the State's Biosolids Management Rule (Chapter WAC 173-308-170) discrete grab samples of sludge from each site were submitted for Total Coliform analysis.

All samples were analyzed by Analytical Resources Inc. in Tukwila, Washington except for Total Coliform which was analyzed by Water Management Laboratories in Tacoma, Washington. The analytical methods were as specified in the QAPP and are shown with the analytical results in Tables 3, 4, 5, 6, and 7.

Details of the sampling conducted at each site are described below.

### 4.1.1 Newaukum Prairie Lagoon Field Investigation

Sludge grab samples at the Newaukum Prairie site were collected by FMF personnel on July 7, 2014 using a 1.5 inch sludge judge with a flapper valve. The location of each grab sample is shown in Figure 2. Depths are noted in Table 2. Three composited sludge samples were prepared by PGG personnel and submitted for laboratory analysis (NP-Comp-1, NP-Comp-2, and NP-Comp-3 in Table 1), except for VOC samples, which were composited by the lab to minimize volatilization. Nine individual grab samples comprised each composited sludge sample (Figure 2 and Table 2). In accordance with the QAPP, fourteen individual grab samples were submitted for Total Coliform analysis. All samples were placed in iced coolers and delivered to the lab on the same day (July 7, 2014).

### 4.1.2 Big Hanford Bunker Field Investigation

Sludge grab samples at the Big Hanaford site were collected by FMF personnel on July 8, 2014 using a 1.5 inch PVC casing pipe driven to the desired depth and samples collected from the final depth of casing using a 1 inch stainless steel, solid stem, hand auger. The PVC pipe was hand driven into the material allowing accessing for sample collection at depth with the hand auger. FMF personnel verified the sludge material was pushed to the outside of the PVC pipe by measuring depth inside the PVC pipe. If any sludge material were encountered inside the PVC pipe, FMF personnel used the hand auger to clean out materials to achieve sample depth, decontaminated the hand auger, and collected the sample. Sludge samples were obtained by “peeling” the material from the threads on the auger head.

The location of each grab sample is shown in Figure 3. Sample depths are noted in Table 2. Three composited sludge samples were prepared by PGG personnel and submitted for laboratory analysis (BH-Comp-1, BH-Comp-2, and BH-Comp-3 in Table 1), except for VOC samples, which were composited by the lab to minimize volatilization. Six individual grab samples comprised each composited sludge sample (Figure 3 and Table 2). In accordance with the QAPP, seven individual grab samples were submitted for Total Coliform analysis. All samples were placed in iced coolers and delivered to the lab on the same day (July 8, 2014).

### 4.1.3 Burnt Ridge Lagoon Field Investigation

Sludge grab samples at the Burnt Ridge Lagoon site were collected by FMF personnel on July 9, 2014 using a 1.5 inch sludge judge with a flapper valve. The location of each grab sample is shown in Figure 4. Sample depths are noted in Table 2. Three composited sludge samples were prepared by PGG personnel and submitted for laboratory analysis (BR-Comp-1, BR-Comp-2, and BR-Comp-3 in Table 1), except for VOC samples, which were composited by the lab to minimize volatilization. Nine individual grab samples comprised each composited sludge sample (Figure 4 and Table 2). In accordance with the QAPP, seven individual grab samples were submitted for Total Coliform analysis. All samples were placed in iced coolers and delivered to the lab on the same day (July 9, 2014).

The Burnt Ridge water cap was sampled on July 17, 2014. In accordance with the QAPP, water cap sample depths were not random as they were for the sludge samples, but instead targeted the lower part of the water column where chemical partitioning from the sludge and minimal volatilization to the atmosphere would likely results in the highest concentrations in the water. Except for the analysis of VOCs, one composited water sample was prepared in the field by PGG personnel from four individual grab samples collected at each quadrant of the lagoon (Figure 5 and Table 2). Four individual grab samples collected at each quadrant of the lagoon were submitted for VOC analysis. Samples collected for VOC analysis could not be filled directly from the sludge judge sampler into 40 mL laboratory vials as specified in the QAPP. Instead, water samples were emptied from the sludge judge into 32 oz glass jars and immediately provided to PGG personnel at the shoreline. PGG personnel then filled the 40 mL laboratory vials. The pouring of the water sample twice could result in some of the VOCs volatilizing to the air and thus the water cap VOC results could be biased low. The four grab samples for VOC analysis were requested to be composited by the lab, but were instead analyzed individually.

Water cap grab samples were collected by FMF personnel using a 1.5 inch sludge judge with a flapper valve in tandem with a measuring rod. FMF personnel would drop the measuring rod to identify the sludge water cap interface, then using the sludge judge collect the water sample from approximately six inches above the sludge surface. In coordination PGG and FMF personnel would determine if any water/sludge was to be discarded from the bottom of sampler prior to bottle filling. All samples were placed in iced coolers and delivered to the lab on the same day (July 17, 2014).

## 4.2 DATA VALIDATION

Analytical data collected for this investigation have been validated in accordance with the QAPP, including both laboratory and field quality assurance quality control procedures (PGG, 2014). Appendix A contains the data validation. Some analyses required sample dilution which resulted in elevated laboratory reporting limits; however, the QA/QC data are satisfactory and indicate that the data are acceptable for the project purposes.

The Dioxin results were flagged "JEMPC" by the analytical laboratory, indicating the concentrations are "Estimated Maximum Possible Concentrations", and are less than the analytical reporting limits (RL or Practical Quantitation Limit, PQL). The analysis was challenging due to the sludge matrix and high moisture content. These estimated and qualified analytical results are considered not sufficiently accurate to serve as a basis for regulatory decisions.

# 5.0 ANALYTICAL RESULTS

This section provides a summary of the analytical results. Section 6.0 provides an evaluation of the sludge analytical results within the context of regulatory requirements.

The analytical results for sludge samples collected at all three sites show detections of a few volatile organic compounds (VOCs) and semi-VOCs; metals; PCBs[2] (Aroclor 1260), and Total Cyanide. Elevated concentrations of N-ammonia and total Kjeldahl nitrogen (TKN) were also detected in the sludge. Pesticides were not detected in the sludge at all three sites.

The dominant organic chemicals (greater than 10 ppm[3]) detected in the sludge were:

- Bis(2-ethylhexyl)phthalate (at all three sites)
- 4-Methylphenol (Big Hanaford)
- Toluene (Newaukum Prairie and Big Hanaford)
- Phenol (Big Hanaford)

The dominant metals detected in the sludge at all three sites were:

- Zinc (~ 900 - 1100 ppm)
- Copper (~ 400 to 500 ppm)

[2] Polychlorinated Biphenyls
[3] Parts per million. One ppm (1 mg/kg) = 1000 ug/kg (1000 parts per billion or ppb)

As described in Section 6.1, the concentrations of chemicals in the sludge at all three sites do not trigger the land disposal restrictions set forth in Chapter WAC 173-303-140. Furthermore, as described in Section 6.2, except for the chemicals toluene, 4-methylphenol, phenol, molybdenum, and cobalt, the chemical concentrations detected in sludge at the Fire Mountain Farm sites are similar to or less than the national averages calculated by the U.S. EPA as part of their National Sewage Sludge Survey (NSSS) from Publically Owned Treatment Works (POTW).

Analytical results for the water cap samples collected from the bottom of the Burnt Ridge Lagoon showed detections of toluene (26 to 41 ug/L), some metals, and very low levels of nitrite and nitrite+nitrate (0.014 and 0.051 mg/L as N respectively). Except for toluene, no other VOCs or Semi-VOCs were detected in the water cap sample, suggesting minimal leaching of organic parameters from the sludge. As mentioned above, groundwater samples have been collected at the Burnt Ridge and Newaukum Prairie sludge storage sites to assess potential historical leaching of chemicals in the sludge with transport to the groundwater. The results of the groundwater sampling will be submitted as an addendum to this report.

The geometric means of total fecal coliform results at the three sites were 44 MPN[4] per gram (dw)[5] at Burnt Ridge; 145 MPN per gram (dw) at Big Hanaford; and 3,056 MPN per gram (dw) at Newaukum Prairie. All values are well below the required threshold of 2,000,000 MPN per gram (dw) for Class B biosolids (WAC 173-308-170(5))[6].

The analytical results for each storage site are described in more detail below. Section 6.0 provides describes the sludge analytical results within the context of regulatory requirements of land disposal restrictions under the State's Dangerous Waste Regulation (WAC 173-303-140), the State's Biosolids Management Rule (WAC 173-308), and comparison to the U.S. EPA National Sewage Sludge Survey (NSSS) dataset.

## 5.1 NEWAUKUM PRAIRIE ANALYTICAL RESULTS

Newaukum Prairie analytical results are shown in Table 3. Total Coliform Results are shown in Table 6. A summary is provided below.

### 5.1.1 Organic Results

The following organic chemicals were detected in the composite sludge samples collected at Newaukum Prairie (in order from highest concentrations to lowest concentrations):

- Toluene
- Bis(2-ethylhexyl)phthalate (BEHP)

[4] MPN = Most Probable Number
[5] dw = dry weight
[6] Total coliform results were reported by the lab as wet weight concentrations and were converted to dry weight concentrations using the average total solids results from the three composited sludge samples at each location (see Tables 3, 4, and 5). There was very little variability in percent total solids between the three composited samples, suggesting the use of an average is acceptable.

- Phenols (4-methylphenol & Phenol)
- 1,4-dichlorobenzene
- PAHs[7] (Fluoranthene; Indeno(1,2,3-cd)pyrene; Pyrene; Phenanthrene; Benzo(b)fluoranthene; Benzo(k)fluoranthene)
- PCBs (Aroclor 1260)
- Ethylbenzene

Toluene concentrations varied from 130 to 150 ppm, BEHP from 19 to 20 ppm, and 4-methylphenol from 2.4 to 2.6 ppm. The concentrations of all other detected organic chemicals were less than 1 ppm (Table 3).

### 5.1.2 Metals Results

The following metals were detected in sludge samples collected at Newaukum Prairie (in order from highest concentration to lowest concentration):

- Zinc (950 to 1060 ppm)
- Copper (440 to 503 ppm)
- Cobalt (76 to 89 ppm)
- Nickel (30 ppm)
- Chromium (24 to 27 ppm)
- Molybdenum (12 to 14 ppm)
- Mercury (0.9 to 1.2 ppm)

### 5.1.3 Inorganic Results

The following inorganics were detected in the sludge samples collected at Newaukum Prairie:

- N-Ammonia (21,400 mg/kg as N)
- TKN (71,400 mg/kg as N)
- Nitrate+Nitrite (4.01 mg/kg as N)
- Nitrite (6.09 mg/kg as N)
- Total Cyanide (1.73 mg/kg)

### 5.1.4 Total Coliform Results

Fourteen discrete sludge samples for Total Coliform analysis were collected from Newaukum Prairie (Table 6). Concentrations ranged from 504 MPN per grams (dw) to 14,060 MPN per grams (dw) with a geometric mean of 3,056 MPN per grams (dw).

## 5.2 BIG HANAFORD ANALYTICAL RESULTS

Big Hanaford analytical results are shown in Table 4. Total Coliform Results are shown in Table 6. A summary is provided below.

[7] Polycyclic Aromatic Hydrocarbons

### 5.2.1 Organic Results

The following organic chemicals were detected in the composite sludge samples collected at Big Hanaford site (in order from highest concentrations to lowest concentrations):

- Phenols (4-methylphenol and phenol)
- Toluene
- Bis(2-ethylhexyl)phthalate (BEHP)
- N-nitrosodiphenylamine
- 1,4-dichlorobenzene
- PAHs (Fluoranthene)
- PCBs (Aroclor 1260)

4-Methylphenol concentrations varied from 480 to 720 ppm, phenol from 14 to 23 ppm, toluene from 8.3 to 120 ppm, and BEHP from 24 to 25 ppm, N-nitrodiphenylamine from 1.1 to 1.4 ppm, and 1,4-dichlorobenzene from 1 to 1.3 ppm. The concentrations of PAHs and PCBs were all below 1 ppm (Table 4).

Although fluoranthene was the only PAH detected at the Big Hanaford site, the laboratory reporting limits were elevated for the samples analyzed at this site compared to the other two sites due to laboratory dilution requirements (see Appendix A). Therefore, the PAHs that were detected at relatively low levels at the Newaukum Prairie and Burnt Ridge site could also be present at the Big Hanaford site below the laboratory reporting limit.

### 5.2.2 Metals Results

The following metals were detected in sludge samples collected at Big Hanaford site (in order from highest concentration to lowest concentration):

- Zinc (1030 to 1100 ppm)
- Copper (473 to 521 ppm)
- Cobalt (15 to 165 ppm)
- Nickel (27 to 42 ppm)
- Lead (20 to 30 ppm)
- Chromium (25 to 29 ppm)
- Molybdenum (12 to 15 ppm)
- Silver (4 to 6 ppm)
- Mercury (1 to 3 ppm)
- Cadmium (2 ppm)

### 5.2.3 Inorganic Results

The following inorganics were detected in the sludge samples collected at Big Hanaford site:

- N-Ammonia (24,800 mg/kg as N)
- TKN (76,800 mg/kg as N)

- Nitrate+Nitrite (7.01 mg/kg as N)
- Nitrite (7.86 mg/kg as N)
- Total Cyanide (1.6 to 2.39 mg/kg)

### 5.2.4 Total Coliform Results

Seven discrete sludge samples for Total Coliform analysis were collected from Big Hanaford site (Table 6). Concentrations ranged from 5 MPN per grams (dw) to 6,800 MPN per grams (dw) with a geometric mean of 145 MPN per grams (dw).

## 5.3 BURNT RIDGE ANALYTICAL RESULTS

Burnt Ridge analytical results are shown in Table 5 (sludge results) and Table 7 (water cap results). Total Coliform Results for the sludge are shown in Table 6. A summary is provided below.

### 5.3.1 Organic Results (Sludge Samples)

The following organic chemicals were detected in the composite sludge samples collected at the Burnt Ridge site (in order from highest concentrations to lowest concentrations):

- Bis(2-ethylhexyl)phthalate (BEHP)
- 4-Methylphenol
- 1,4-Dichlorobenzene
- PAHs (Fluoranthene, Indeno(1,2,3-cd)pyrene, Pyrene, Benzo(b)fluoranthene, and Benzo(k)fluoranthene)
- PCBs (Aroclor 1260)
- Toluene

BEHP concentrations varied from 9.1 to 12 ppm and 4-methylphenol from 0.46 to 1.1 ppm. All other organics had concentrations below 1 ppm. Toluene concentrations in the Burnt Ridge sludge was noticeably lower than the concentrations of toluene at the other two sites.

### 5.3.2 Metals Results (Sludge Samples)

The following metals were detected in sludge samples collected at the Burnt Ridge site (in order from highest concentration to lowest concentration):

- Zinc (876 to 969 ppm)
- Copper (379 to 417 ppm)
- Cobalt (37 to 48 ppm)
- Chromium (31 to 45 ppm)
- Nickel (28 to 45 ppm)
- Lead (30 to 40 ppm)
- Molybdenum (14 to 16 ppm)
- Silver (5 to 6 ppm)
- Cadmium (3 ppm)

- Mercury (1 to 2 ppm)

### 5.3.3 Inorganic Results (Sludge Samples)

The following inorganics were detected in the sludge samples collected at the Burnt Ridge site:

- N-Ammonia (7,600 mg/kg as N)
- TKN (33,700 mg/kg as N)
- Nitrate+Nitrite (0.60 mg/kg as N)
- Nitrite (0.72 mg/kg as N)
- Total Cyanide (1.05 to 1.42 mg/kg)

The concentrations of N-Ammonia, TKN, Nitrate+Nitrite, and Nitrite were noticeably lower at the Burnt Ridge Site relative to the other two sites.

### 5.3.4 Burnt Ridge Water Cap Results

The only organic parameter detected in the water cap liquid sample was toluene with concentrations ranging from 26 ppb to 41 ppb (Table 7) – well below the Federal drinking water MCL (1000 ug/L) [8]. The following metals were detected in the water cap composite sample (from highest to lowest):

- Zinc (0.18 ppm)
- Copper (0.057 ppm)
- Nickel (0.02 ppm)
- Cobalt (0.017 ppm)
- Chromium (0.012 ppm)
- Molybdenum (0.006 ppm)
- Mercury (0.0003 ppm)

The concentration of chromium, copper, and mercury are all below the Federal MCL for drinking water (0.1, 1.3, and 0.002 ppm respectively) and the Washington State groundwater criteria in Chapter WAC 173-200 (0.05, 1.0, and 0.002 ppm respectively). There is no state or federal standard for cobalt, molybdenum, or nickel.

Low concentrations of nitrate+nitire (0.014 mg/L as N) and nitrite (0.051 mg/L as N) were also detected in the water cap sample - well below the federal drinking water MCL (10 and 1 mg/L as N respectively).

Except for the detection of toluene, no other VOCs or Semi-VOCs were detected in the liquid at the bottom of the Burnt Ridge lagoon, suggesting minimal leaching of organic parameters from the sludge. However, as explained above in Section 4.1.3, the water cap sample could not be poured directly into the 40 mL laboratory vials and instead were first emptied into 32 oz glass jars and then transferred to the 40 mL laboratory vials from the 32 oz jars. The pouring of the water sample twice could result in some VOCs volatilizing to the air and thus bias the results low.

[8] Maximum Contaminant Level (MCL) for toluene = 1000 micrograms per liter (ug/L)

As mentioned above, groundwater samples have been collected at the Burnt Ridge and Newaukum Prairie storage sites to assess potential historical leaching of chemicals in the sludge with transport to the groundwater. The results of the groundwater sampling will be submitted as an addendum to this report.

### 5.3.5 Total Coliform Results

Seven discrete sludge samples for Total Coliform analysis were collected from Burnt Ridge site (Table 6). Concentrations ranged from 16 MPN per grams (dw) to 156 MPN per grams (dw) with a geometric mean of 44 MPN per grams (dw).

# 6.0 EVALUATION OF SLUDGE ANALYTICAL RESULTS

The following sections provide an evaluation of the sludge analytical results under the Washington State land disposal restriction for dangerous waste (WAC 173-303-140); comparison of the analytical results to the U.S. EPA National Sewage Sludge Survey; and evaluation under the Washington State Biosolids Management Rule (WAC 173-308).

## 6.1 EVALUATION OF RESULTS - STATE LAND DISPOSAL RESTRICTIONS FOR DANGEROUS WASTE

The sludge analytical results from each storage site were evaluated against land disposal restrictions under the State's Dangerous Waste Regulation (WAC 173-303-140). Under the State's code, the following wastes are restricted from land disposal (WAC 173-303-140 (4)):

1. Disposal of extremely hazardous waste (EHW): Designated under WAC 173-303-100.
2. Disposal of Liquid Waste: Demonstrated using Method 9095 (Paint Filter Liquid Test)
3. Disposal of solid acid waste: pH ≤ 2 and pH ≥ 12.5 (WAC 173-303-90(6)(a)(iii).
4. Disposal of organic/carbonaceous Waste: wastes containing combined organics > 10% (WAC 173-303-140(3)(c)).

### 6.1.1 Liquid Waste Evaluation

Because biosolids are applied as solids at the land surface, it is considered a valid assumption that the waste would not likely designate as a liquid waste. We understand that this restriction applies to land disposal of liquid wastes at a landfill.

### 6.1.2 Solid Acid Waste Evaluation

The pH results for the sludge samples collected at all three sites (Tables 3, 4, and 5) were relatively similar (7.91 at Big Hanaford, 7.43 at Burnt Ridge, 7.38 at Newaukum Prairie) and do not designate as a solid acid.

### 6.1.3 Extremely Hazardous Waste Evaluation

Under WAC 173-303-100, a waste is evaluated as extremely hazardous under the Toxicity Criteria (WAC 173-303-100(5)) and the Persistence Criteria (WAC 173-303-100(6)). For this evaluation we considered the full list of organic chemicals, metals, and cyanide analyzed at each of the three storage sites.

For detected chemicals, we used the maximum concentration reported for each site; a valid alternative approach would be to use an average or mean value. For non-detected chemicals we used the minimum laboratory reporting limit as an estimated concentration. The use of the laboratory reporting limit is considered an upper bound estimate of the actual concentration, which is some unknown value between zero and the reporting limit.

#### 6.1.3.1 Toxicity Criteria (book designation method)

The toxicity criteria were evaluated using the book designation method. Under the book designation method, the toxicity category (X, A, B, C, or D) for each chemical constituent is determined from available toxicity data sources (WAC 173-303-100(5)(b)(i)). For this evaluation we used toxicity data from the current Hazardous Substances Data Bank (HSDB)[9] and ECOTOXicology[10].

An equivalent percent concentration (EC) is then determined by weighting the total percent concentration for each toxic category in the waste:

$$EC(\%) = \frac{\sum X\%}{1} + \frac{\sum A\%}{10} + \frac{\sum B\%}{100} + \frac{\sum C\%}{1000} + \frac{\sum D\%}{10{,}000}$$

The percent concentrations and associated toxic category for each chemical at each site are shown in Tables 8, 9, and 10.

A waste is designated as follows under the Toxicity Criteria (WAC 173-303-100(5)(b)(iii)):

- If EC(%) < 0.001%, the waste is not a toxic dangerous waste
- If EC(%) > 0.001% and < 1%, the waste is designated as dangerous waste (WT02)
- If EC(%) > 1%, the waste is designated as extremely hazardous waste (EHW) and would be restricted for land disposal.

The results show the EC(%) at the three storage sites range from 0.57 to 0.73% and therefore do not designate as EHW under the toxicity criteria (Table 11).

#### 6.1.3.2 Persistence Criteria

The Persistence Criteria (WAC 173-303-100(6) considers chemical compounds which are either halogenated organic compounds (HOC) or polycyclic aromatic hydrocarbons (PAHs). Under the persistence criteria, the total HOC and PAH concentrations in the

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[9] http://toxnet.nlm.nih.gov/newtoxnet/hsdb.htm
[10] http://cfpub.epa.gov/ecotox/

waste are determined by summing the percent concentration for all HOC and all PAH compounds in the waste.

The percent concentrations and associated organic category (HOC or PAH) for each chemical at each site are shown in Tables 8, 9, and 10.

A waste is designated as follows under the Persistence Criteria (WAC 173-303=100(6)(d)):

- If total HOC = 0.01% to 1%, the waste is designated as dangerous waste (WP02)
- If total HOC > 1%, the waste is designated as extremely hazardous waste (EHW)
- If total PAH > 1%, the waste is designated as EHW

The results for the three storage sites show total percent HOC ranges from 0.13 to 0.46% (even with inclusion of the 2,3,7,8-TCDD Estimated Possible Maximum Concentrations) and total percent PAH ranges from 0.05% to 0.09% and therefore do not designate as EHW under the persistence criteria (Table 11).

### 6.1.4 Total Organic/Carbonaceous Waste Evaluation

Under the Land Disposal Restrictions (WAC 173-303-140), no person may dispose of organic carbonaceous waste defined as wastes containing combined organics > 10% (WAC 173-303-140(3)(c)).

The percent concentrations and organic designation for each chemical at each site are shown in Tables 8, 9, and 10.

The results for the three storage sites show the total percent organics at each site are 0.49%, 2.14%, and 10.26%. While two sites clearly do not designate as organic carbonaceous waste, Big Hanaford is marginally above 10% (Table 11). Our evaluation uses an upper bound estimate on non-detected chemicals and therefore the true value is most likely less than 10%. Also, our evaluation includes the 2,3,7,8-TCDD Estimated Possible Maximum Concentrations, which should be excluded.

Further, it appears that the sludge meets the requirements for Organic/Carbonaceous Waste Exemption (WAC 173-303-140), as it is 83.82 % water (Table 6) and with its water content, its caloric content is likely much less than 3000 BTU/LB:

(c) Organic/carbonaceous waste exemption. Any person may request an exemption from the requirements in subsection (4) of this section by demonstrating to the department that:

> (i) Alternative management methods for organic/carbonaceous waste are less protective of public health and the environment than stabilization or landfilling; or
>
> (ii) (A)The organic/carbonaceous waste has a heat content less than 3,000 BTU/LB or contains greater than sixty-five percent water or other noncombustible moisture; and

(B) Incineration is the only management method available within a radius of one thousand miles from Washington state's border (i.e., recycling or treatment are not available).

### 6.1.5 Land Disposal Restriction Evaluation Summary

Our evaluation indicates that the sludge at all three storage sites do not designate as wastes that would be restricted from land disposal under the State's Dangerous Waste Regulation (Table 11). Furthermore, because our evaluation uses an upper bound estimated concentration for non-detected chemicals, our evaluation provides a "worst-case" evaluation. As a result, even under a "worst-case" evaluation, the sludge would not be restricted from land disposal under the State's Dangerous Waste Regulation (WAC 173-303-140).

## 6.2 EVALUATION OF RESULTS - THE NATIONAL SEWAGE SLUDGE SURVEY

To evaluate whether the chemicals detected in the FMF sludge are characteristic of standard biosolids, we compared the analytical results to the average concentrations measured in sewage sludge from wastewater treatment plants.

In 1988, the U.S. EPA conducted the National Sewage Sludge Survey (NSSS) to identify and estimate the concentrations of expected pollutants in sewage sludge. The NSSS dataset includes concentration data for over 400 pollutants from samples collected at 178 Publicly Owned Treatment Works (POTWs) throughout the nation practicing at least secondary treatment of wastewater (U.S. EPA 1992 and 1996). Samples were collected just prior to the use or disposal of the sewage sludge. The results were used in establishing the Federal Biosolids rule in CFR 40 Part 50[11]. The U.S. EPA conducted statistical analyses of the NSSS dataset in 1992 (Round 1) and in 1996 (Round 2) and tabulated average concentrations, standard deviations, and percentiles for different pollutants (U.S. EPA 1992 and 1996).

Table 12 provides a comparison of the concentration of chemicals detected in the sludge at FMF relative to the mean concentrations calculated from the NSSS dataset (Round 1 and Round 2). The table provides a comparison of chemicals detected in at least one sample from the FMF site. Chemical concentrations from the FMF sites are shown in Table 12 as either the maximum detected value or as less than ("<") the minimum reporting limit (if the chemical was not detected at that site).

Mean values from the NSSS dataset are shown for both the Round 1 (U.S. EPA 1992) and Round 2 (U.S. EPA, 1996) analysis. Each round analyzed a different set of chemicals and a slightly different approach to calculating mean concentrations.

The mean value from the Round 1 NSSS dataset analysis is based on a multi-censored, maximum-likelihood estimation (MLE) statistical procedure for estimating non-detected concentrations for chemicals with a detection frequency greater than 10% (U.S. EPA,

[11] http://water.epa.gov/scitech/wastetech/biosolids/tnsss-overview.cfm#pastsurveys

1992). For chemicals with a detection frequency less than 10% the mean value is based on a non-parametric statistical method (U.S. EPA, 1992).

Two mean values were calculated during the Round 2 NSSS dataset analysis (U.S. EPA, 1996); one based on setting non-detections to a value of zero (a lower bound estimate) and another based on setting non-detections to the value of the reporting limit (an upper bound estimate).

The results show the chemical concentrations in the FMF sludge is either similar to or less than the mean chemical concentrations calculated from the NSSS dataset except for the following chemicals (in order from highest to lowest exceedance of the NSSS dataset) (Table 13):

- Cobalt at all three sites
- 4-Methylphenol at Big Hanaford
- Toluene at Newaukum Prairie and Big Hanaford
- Phenol at Big Hanaford
- Molybdenum at all three sites

Molybdenum concentrations in the FMF sludge (14 to 16 mg/kg) are only slightly higher than the mean concentration in the NSSS dataset (9.63 mg/kg) and well below the ceiling limit for Molybdenum (75 mg/kg) in the State Biosolids Rule (WAC 173-308-160).

Pollutant limits are not set for toluene, cobalt, 4-methylphenol, and phenol in the State Biosolids Rule.

## 6.3 EVALUATION OF RESULTS - STATE BIOSOLIDS MANAGEMENT RULE

Numerical limits for select metals are set under the State Biosolids Management Rule (WAC 173-308-160). The rule sets the maximum allowable concentration (ceiling limit) in biosolids that can be applied to land. The rule also sets pollutant concentration limits which, when achieved, relieves a biosolids facility operator from certain requirements related to recordkeeping, reporting, and labeling.

Comparison of the FMF sludge results to the rule limits show that all concentrations are below both the ceiling limits and the pollutant limits established under the rule (Table 12).

The geometric means of total fecal coliform results at the three sludge storage sites were 44 MPN per gram (dw) at Burnt Ridge; 145 MPN per gram (dw) at Big Hanaford; and 3,056 MPN per gram (dw) at Newaukum Prairie (Table 6). All values are well below the required threshold of 2,000,000 MPN per gram (dw) for Class B biosolids (WAC 173-308-170(5)).

# 7.0 REFERENCES


Pacific Groundwater Group, 2014. Fire Mountain Farms, Inc. Quality Assurance Project Plan Investigation of Emerald Kalama Chemical Sludge Comingled with Biosolids from Other Permitted Sources at Three Storage Sites.

U.S. Environmental Protection Agency, 1992. Statistical Support Documentation for the 40 CFR, Part 503. Final Standards for the Use or Disposal of Sewage Sludge Volume I. Final Report November 11, 1992

U.S. Environmental Protection Agency, 1996. Technical Support Document for the Round Two Sewage Sludge Pollutants. EPA-822-R-96-003.

Table 1. Chemical Analyses Performed on Each Sample Collected from Three Sludge Waste Sites at Fire Mountain Farms, Inc.
(see Table 6 for samples submitted for total coliform analysis)

| | | Sludge Samples | | | | | | | | | Water Cap Sample | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Newaukum Prairie | | | Big Hanaford | | | Burnt Ridge | | | Burnt Ridge | | | | |
| CHEMICAL ANALYSIS | Method | NP-Comp-1 | NP-Comp-2 | NP-Comp-3 | BH-Comp-1 | BH-Comp-2 | BH-Comp-3 | BR-Comp-1 | BR-Comp-2 | BR-Comp-3 | BR-I-9 | BR-II-8 | BR-III-8 | BR-IV-8.5 | BR-Comp |
| Volatile Organic Compounds | 8260C | X | X | X | X | X | X | X | X | X | X | X | X | X | |
| Semi-Volatile Organic Compounds | SW8270D | X | X | X | X | X | X | X | X | X | | | | | X |
| Metals | 6010C/7471A | X | X | X | X | X | X | X | X | X | | | | | X |
| Pesticides | SW8081B | X | X | | X | | | X | | | | | | | |
| Polychlorinated Biphenyls (PCB Aroclors) | SW8082A | X | X | | X | | | X | | | | | | | |
| Polychlorinated dibenzo-p-dioxin (2,3,7,8-TCDD) | EPA 1613B | X | | | X | | | X | | | | | | | |
| N-Nitrate | Calculated | X | | | X | | | X | | | | | | | X |
| N-Ammonia | EPA 350.1M | X | | | X | | | X | | | | | | | |
| Total Kjeldahl Nitrogen | EPA 351.2 | X | | | X | | | X | | | | | | | |
| Nitrate + Nitrite (NO3+NO2) | EPA 353.2 | X | | | X | | | X | | | | | | | X |
| N-Nitrite | EPA 353.2 | X | | | X | | | X | | | | | | | X |
| Total Solids | SM2540G | X | X | X | X | X | X | X | X | X | | | | | |
| Total Cyanide | EPA 335.4 | X | X | X | X | X | X | X | X | X | | | | | X |
| pH | SW9045 | X | | | X | | | X | | | | | | | |

Note: All samples were composited "Comp" from discrete grab samples (see Table #) except for the analysis of Volatile Organic Compounds from the water cap at the Burnt Ridge Site.

Table 2. Subsamples (grab samples) Collected for each Composite Sample (Fire Mountain Farms, Inc.)

| Newaukum Prairie Sludge Samples | | | Big Hanaford Sludge Samples | | | Burnt Ridge Sludge Samples | | | Burnt Ridge Water Cap Sample |
|---|---|---|---|---|---|---|---|---|---|
| NP-Comp-1 | NP-Comp-2 | NP-Comp-3 | BH-Comp-1 | BH-Comp-2 | BH-Comp-3 | BR-Comp-1 | BR-Comp-2 | BR-Comp-3 | BR-Comp |
| NP-A3-1-7 | NP-C1-2-6 | NP-A1-3-3 | BH-A7-1-2 | BH-A2-2-11 | BH-A3-3-10 | BR-A1-1-1 | BR-A1-2-3 | BR-A1-3-2 | BR-I-9 |
| NP-A2-1-7 | NP-C2-2-5 | NP-A2-3-3 | BH-A1-1-0 | BH-A5-2-4 | BH-A6-3-4.5 | BR-A2-1-3 | BR-A2-2-2 | BR-A2-3-1 | BR-II-8 |
| NP-A1-1-2 | NP-C3-2-7 | NP-A3-3-10 | BH-A4-1-7.5 | BH-A8-2-9 | BH-B1-3-1 | BR-A3-1-1 | BR-A3-2-2 | BR-A3-3-2 | BR-III-8 |
| NP-B1-1-10 | NP-B1-2-4 | NP-B1-3-1 | BH-C2-1-8 | BH-C1-2-1.5 | BH-B8-3-6 | BR-B1-1-3 | BR-B3-2-3 | BR-B3-3-1 | BR-IV-8.5 |
| NP-B2-1-7 | NP-B2-2-6 | NP-B2-3-6 | BH-C5-1-10 | BH-C4-2-10 | BH-C3-3-10 | BR-B2-1-3 | BR-B2-2-1 | BR-B2-3-2 | |
| NP-B3-1-3 | NP-B3-2-2 | NP-B3-3-3 | BH-C8-1-4 | BH-C7-2-2 | BH-C6-3-9 | BR-B3-1-3 | BR-B1-2-3 | BR-B1-3-2 | |
| NP-C3-1-6 | NP-A3-2-10 | NP-C1-3-3 | | | | BR-C1-1-3 | BR-C1-2-2 | BR-C1-3-3 | |
| NP-C2-1-5 | NP-A2-2-5 | NP-C2-3-3 | | | | BR-C2-1-2 | BR-C2-2-2 | BR-C2-3-2 | |
| NP-C1-1-7 | NP-A1-2-7 | NP-C3-3-8 | | | | BR-C3-1-3 | BR-C3-2-1 | BR-C3-3-3 | |

Sample ID Nomenclature for sludge samples (i.e. NP-A3-1-7)
NP = Site Name (Newaukum Prarire)
A3 = Grid Horizontal Location as Identified in QAPP
1 = Composite Number (in this case Comp-1)
7 = Sample Depth (7 feet)

Sample ID Nomenclature for water cap sample (i.e. BR-I-9)
BR = Site Name (Burnt Ridge)
I = Sampled Quadrant
9 = Sample Depth (9 feet)



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Table 3. Sludge Analytical Results - Newaukum Prairie Lagoon (Fire Mountain Farms)
Samples collected: 7/7/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | NP-Comp-1 | NP-Comp-2 | NP-Comp-3 |
|---|---|---|---|---|---|---|
| Volatile Organic Compounds (VOCs) | | | | | | |
| 1,1,1-Trichloroethane | 71-55-6 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| 1,1,2-Trichloroethane | 79-00-5 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| 1,1-Dichloroethane | 75-34-3 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| 1,1-Dichloroethene | 75-35-4 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| 1,2,4-Trichlorobenzene | 120-82-1 | 8260C | ug/kg | 19U | 19U | 16U |
| 1,2-Dichlorobenzene | 95-50-1 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| 1,2-Dichloroethane | 107-06-2 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| 1,2-Dichloropropane | 78-87-5 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| 1,3-Dichlorobenzene | 541-73-1 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| 1,4-Dichlorobenzene | 106-46-7 | 8260C | ug/kg | **91** | **120** | **97** |
| 2-Chloroethylvinylether | 110-75-8 | 8260C | ug/kg | 19U | 19U | 16U |
| Acrolein | 107-02-8 | 8260C | ug/kg | 190U | 190U | 160U |
| Acrylonitrile | 107-13-1 | 8260C | ug/kg | 19U | 19U | 16U |
| Benzene | 71-43-2 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Bromodichloromethane | 75-27-4 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Bromoform | 75-25-2 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Bromomethane | 74-83-9 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Carbon Tetrachloride | 56-23-5 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Chlorobenzene | 108-90-7 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Chloroethane | 75-00-3 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Chloroform | 67-66-3 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Chloromethane | 74-87-3 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| cis-1,3-Dichloropropene | 10061-01-5 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Dibromochloromethane | 124-48-1 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Ethylbenzene | 100-41-4 | 8260C | ug/kg | 3.9U | **4.60** | **3.50** |
| Hexachlorobutadiene | 87-68-3 | 8260C | ug/kg | 19U | 19U | 16U |
| Methylene Chloride | 75-09-2 | 8260C | ug/kg | 7.8U | 7.5U | 6.5U |
| Naphthalene | 91-20-3 | 8260C | ug/kg | 19U | 19U | 16U |
| Tetrachloroethene | 127-18-4 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Toluene | 108-88-3 | 8260C | ug/kg | **140,000** | **150,000** | **130,000** |
| trans-1,2-Dichloroethene | 156-60-5 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| trans-1,3-Dichloropropene | 10061-02-6 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Trichloroethene | 79-01-6 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Vinyl Chloride | 75-01-4 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).
U: Not detected at RL.
Y: Not detected at RL (raised RL).



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Table 3. Sludge Analytical Results - Newaukum Prairie Lagoon (Fire Mountain Farms)
Samples collected: 7/7/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | NP-Comp-1 | NP-Comp-2 | NP-Comp-3 |
|---|---|---|---|---|---|---|
| Metals | | | | | | |
| Antimony | 7440-36-0 | 6010C | mg/kg | 70U | 80U | 80U |
| Arsenic | 7440-38-2 | 6010C | mg/kg | 70U | 80U | 80U |
| Beryllium | 7440-41-7 | 6010C | mg/kg | 1U | 2U | 2U |
| Cadmium | 7440-43-9 | 6010C | mg/kg | 3U | 3U | 3U |
| Chromium | 7440-47-3 | 6010C | mg/kg | **24** | **26** | **27** |
| Cobalt | 7440-48-4 | 6010C | mg/kg | **76** | **87** | **89** |
| Copper | 7440-50-8 | 6010C | mg/kg | **440** | **493** | **503** |
| Lead | 7439-92-1 | 6010C | mg/kg | 30U | 30U | 30U |
| Molybdenum | 7439-98-7 | 6010C | mg/kg | **12** | **13** | **14** |
| Nickel | 7440-02-0 | 6010C | mg/kg | **30** | **30** | **30** |
| Selenium | 7782-49-2 | 6010C | mg/kg | 70U | 80U | 80U |
| Silver | 7440-22-4 | 6010C | mg/kg | 4U | 5U | 5U |
| Thallium | 7440-28-0 | 6010C | mg/kg | 70U | 80U | 80U |
| Zinc | 7440-66-6 | 6010C | mg/kg | **950** | **1,060** | **1,060** |
| Mercury | 7439-97-6 | 7471A | mg/kg | **1.2** | **0.9** | **1.2** |
| Semi-Volatile Organic Compounds (SVOCs) | | | | | | |
| 1,2,4-Trichlorobenzene | 120-82-1 | SW8270D | ug/kg | 420U | 380U | 300U |
| 1,2-Dichlorobenzene | 95-50-1 | SW8270D | ug/kg | 420U | 380U | 300U |
| 1,2-Diphenylhydrazine | 122-66-7 | SW8270D | ug/kg | 420U | 380U | 300U |
| 1,3-Dichlorobenzene | 541-73-1 | SW8270D | ug/kg | 420U | 380U | 300U |
| 1,4-Dichlorobenzene | 106-46-7 | SW8270D | ug/kg | **700** | **730** | **750** |
| 2,2'-Oxybis(1-Chloropropane) | 108-60-1 | SW8270D | ug/kg | 420U | 380U | 300U |
| 2,4,6-Trichlorophenol | 88-06-2 | SW8270D | ug/kg | 2100U | 1900U | 1500U |
| 2,4-Dichlorophenol | 120-83-2 | SW8270D | ug/kg | 2100U | 1900U | 1500U |
| 2,4-Dimethylphenol | 105-67-9 | SW8270D | ug/kg | 420U | 380U | 300U |
| 2,4-Dinitrophenol | 51-28-5 | SW8270D | ug/kg | 4200U | 3800U | 3000U |
| 2,4-Dinitrotoluene | 121-14-2 | SW8270D | ug/kg | 2100U | 1900U | 1500U |
| 2,6-Dinitrotoluene | 606-20-2 | SW8270D | ug/kg | 2100U | 1900U | 1500U |
| 2-Chloronaphthalene | 91-58-7 | SW8270D | ug/kg | 420U | 380U | 300U |
| 2-Chlorophenol | 95-57-8 | SW8270D | ug/kg | 420U | 380U | 300U |
| 2-Nitrophenol | 88-75-5 | SW8270D | ug/kg | 420U | 380U | 300U |
| 3,3'-Dichlorobenzidine | 91-94-1 | SW8270D | ug/kg | 2100U | 1900U | 1500U |
| 4,6-Dinitro-2-Methylphenol | 534-52-1 | SW8270D | ug/kg | 4200U | 3800U | 3000U |
| 4-Bromophenyl-phenylether | 101-55-3 | SW8270D | ug/kg | 420U | 380U | 300U |
| 4-Chlorophenyl-phenylether | 7005-72-3 | SW8270D | ug/kg | 420U | 380U | 300U |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).
U: Not detected at RL.
Y: Not detected at RL (raised RL).



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Table 3. Sludge Analytical Results - Newaukum Prairie Lagoon (Fire Mountain Farms)
Samples collected: 7/7/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | NP-Comp-1 | NP-Comp-2 | NP-Comp-3 |
|---|---|---|---|---|---|---|
| SVOC (cont.) | | | | | | |
| 4-Methylphenol | 106-44-5 | SW8270D | ug/kg | **2,400** | **2,400** | **2,600** |
| 4-Nitrophenol | 100-02-7 | SW8270D | ug/kg | 2100U | 1900U | 1500U |
| Acenaphthene | 83-32-9 | SW8270D | ug/kg | 420U | 380U | 300U |
| Acenaphthylene | 208-96-8 | SW8270D | ug/kg | 420U | 380U | 300U |
| Anthracene | 120-12-7 | SW8270D | ug/kg | 420U | 380U | 300U |
| Azobenzene | 103-33-3 | SW8270D | ug/kg | 420U | 380U | 300U |
| Benzo(a)anthracene | 56-55-3 | SW8270D | ug/kg | 420U | 380U | 300U |
| Benzo(a)pyrene | 50-32-8 | SW8270D | ug/kg | 420U | 380U | 300U |
| Benzo(b)fluoranthene | 205-99-2 | SW8270D | ug/kg | 420U | 380U | **360M** |
| Benzo(g,h,i)perylene | 191-24-2 | SW8270D | ug/kg | 420U | 380U | 300U |
| Benzo(k)fluoranthene | 207-08-9 | SW8270D | ug/kg | 420U | 380U | **340M** |
| bis(2-Chloroethoxy) Methane | 111-91-1 | SW8270D | ug/kg | 420U | 380U | 300U |
| Bis-(2-Chloroethyl) Ether | 111-44-4 | SW8270D | ug/kg | 420U | 380U | 300U |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | SW8270D | ug/kg | **19,000** | **20,000** | **19,000** |
| Butylbenzylphthalate | 85-68-7 | SW8270D | ug/kg | 420U | 380U | 300U |
| Chrysene | 218-01-9 | SW8270D | ug/kg | 420U | 380U | 300U |
| Dibenz(a,h)anthracene | 53-70-3 | SW8270D | ug/kg | 420U | 380U | 300U |
| Diethylphthalate | 84-66-2 | SW8270D | ug/kg | 420U | 380U | 300U |
| Dimethylphthalate | 131-11-3 | SW8270D | ug/kg | 420U | 380U | 300U |
| Di-n-Butylphthalate | 84-74-2 | SW8270D | ug/kg | 420U | 380U | 300U |
| Di-n-Octyl phthalate | 117-84-0 | SW8270D | ug/kg | 420U | 380U | 300U |
| Fluoranthene | 206-44-0 | SW8270D | ug/kg | **560** | **530** | **550** |
| Fluorene | 86-73-7 | SW8270D | ug/kg | 420U | 380U | 300U |
| Hexachlorobenzene | 118-74-1 | SW8270D | ug/kg | 420U | 380U | 300U |
| Hexachlorobutadiene | 87-68-3 | SW8270D | ug/kg | 420U | 380U | 300U |
| Hexachlorocyclopentadiene | 77-47-4 | SW8270D | ug/kg | 2100U | 1900U | 1500U |
| Hexachloroethane | 67-72-1 | SW8270D | ug/kg | 420U | 380U | 300U |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | SW8270D | ug/kg | **450M** | **470M** | **450M** |
| Isophorone | 78-59-1 | SW8270D | ug/kg | 420U | 380U | 300U |
| Naphthalene | 91-20-3 | SW8270D | ug/kg | 420U | 380U | 300U |
| Nitrobenzene | 98-95-3 | SW8270D | ug/kg | 420U | 380U | 300U |
| N-Nitrosodimethylamine | 62-75-9 | SW8270D | ug/kg | 2100U | 1900U | 1500U |
| N-Nitroso-Di-N-Propylamine | 621-64-7 | SW8270D | ug/kg | 420U | 380U | 300U |
| N-Nitrosodiphenylamine | 86-30-6 | SW8270D | ug/kg | 420U | 380U | 300U |
| Pentachlorophenol | 87-86-5 | SW8270D | ug/kg | 2100U | 1900U | 1500U |
| Phenanthrene | 85-01-8 | SW8270D | ug/kg | 420U | **440** | **360** |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).
U: Not detected at RL.
Y: Not detected at RL (raised RL).



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Table 3. Sludge Analytical Results - Newaukum Prairie Lagoon (Fire Mountain Farms)
Samples collected: 7/7/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | NP-Comp-1 | NP-Comp-2 | NP-Comp-3 |
|---|---|---|---|---|---|---|
| SVOC (cont.) | | | | | | |
| Phenol | 108-95-2 | SW8270D | ug/kg | **520** | **630** | **410** |
| Pyrene | 129-00-0 | SW8270D | ug/kg | **450** | **420** | **450** |
| Total Benzofluoranthenes | TOTBFA | SW8270D | ug/kg | 420U | 380U | **380M** |
| PCB (Aroclors) | | | | | | |
| Aroclor 1016 | 12674-11-2 | SW8082A | ug/kg | 9.8U | 9.9U | NA |
| Aroclor 1221 | 11104-28-2 | SW8082A | ug/kg | 9.8U | 9.9U | NA |
| Aroclor 1232 | 11141-16-5 | SW8082A | ug/kg | 9.8U | 9.9U | NA |
| Aroclor 1242 | 53469-21-9 | SW8082A | ug/kg | 9.8U | 9.9U | NA |
| Aroclor 1248 | 12672-29-6 | SW8082A | ug/kg | 49Y | 99Y | NA |
| Aroclor 1254 | 11097-69-1 | SW8082A | ug/kg | 150Y | 150Y | NA |
| Aroclor 1260 | 11096-82-5 | SW8082A | ug/kg | **33** | **40** | NA |
| Pesticides | | | | | | |
| 4,4'-DDD | 72-54-8 | SW8081B | ug/kg | 17U | 17U | NA |
| 4,4'-DDE | 72-55-9 | SW8081B | ug/kg | 17U | 27Y | NA |
| 4,4'-DDT | 50-29-3 | SW8081B | ug/kg | 170Y | 100Y | NA |
| Aldrin | 309-00-2 | SW8081B | ug/kg | 8.3U | 8.3U | NA |
| alpha-BHC | 319-84-6 | SW8081B | ug/kg | 8.3U | 13Y | NA |
| beta-BHC | 319-85-7 | SW8081B | ug/kg | 22Y | 8.3U | NA |
| cis-Chlordane | 5103-71-9 | SW8081B | ug/kg | 40Y | 33Y | NA |
| delta-BHC | 319-86-8 | SW8081B | ug/kg | 180Y | 200Y | NA |
| Endosulfan I | 959-98-8 | SW8081B | ug/kg | 8.3U | 21Y | NA |
| Endosulfan II | 33213-65-9 | SW8081B | ug/kg | 17U | 17U | NA |
| Endosulfan Sulfate | 1031-07-8 | SW8081B | ug/kg | 140Y | 120Y | NA |
| Endrin | 72-20-8 | SW8081B | ug/kg | 17U | 17U | NA |
| Endrin Aldehyde | 7421-93-4 | SW8081B | ug/kg | 17U | 17U | NA |
| gamma-BHC (Lindane) | 58-89-9 | SW8081B | ug/kg | 8.3U | 8.3U | NA |
| Heptachlor | 76-44-8 | SW8081B | ug/kg | 8.3U | 8.3U | NA |
| Heptachlor Epoxide | 1024-57-3 | SW8081B | ug/kg | 340Y | 280Y | NA |
| Toxaphene | 8001-35-2 | SW8081B | ug/kg | 830U | 830U | NA |
| trans-Chlordane | 5103-74-2 | SW8081B | ug/kg | 1300Y | 1400Y | NA |
| Polychlorinated dibenzo-p-dioxin | | | | | | |
| 2,3,7,8-TCDD | 1746-01-6 | EPA 1613B | pg/g | 11.5U | 11.2U | NA |

Bold: Detected
NA: Not Analyzed
2,3,7,8-TCDD Est. Max Possible Concentration 2.76, 1.93 NP-Comp1, 2.
J: Est. (less than RL).
M: Est. (detected and confirmed but with low spectral match).
U: Not detected.
Y: Not detected at raised RL.

Table 3. Sludge Analytical Results - Newaukum Prairie Lagoon (Fire Mountain Farms)
Samples collected: 7/7/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | NP-Comp-1 | NP-Comp-2 | NP-Comp-3 |
|---|---|---|---|---|---|---|
| Inorganic Parameters | | | | | | |
| N-Nitrate | NITRATE | Calculated | mg-N/kg | 1.48U | NA | NA |
| N-Ammonia | AMMONIA | EPA 350.1M | mg-N/kg | **21,400** | NA | NA |
| Total Kjeldahl Nitrogen | KJELDAHL-N | EPA 351.2 | mg-N/kg | **71,400** | NA | NA |
| Nitrate + Nitrite (NO3+NO2) | NITRATE-NITRITE | EPA 353.2 | mg-N/kg | **4.01** | NA | NA |
| N-Nitrite | NITRITE | EPA 353.2 | mg-N/kg | **6.09** | NA | NA |
| Total Solids | TS104 | SM2540G | Percent | **6.43** | **6.51** | **6.69** |
| Total Cyanide | TOT CYANIDE | EPA 335.4 | mg/kg | **1.73** | **1.69** | **1.87** |
| pH | PH | SW9045 | std units | **7.38** | NA | NA |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).
U: Not detected at RL.
Y: Not detected at RL (raised RL).

Table 4. Sludge Analytical Results - Big Hanaford Bunker (Fire Mountain Farms)
Samples collected: 7/8/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BH-Comp-1 | BH-Comp-2 | BH-Comp-3 |
|---|---|---|---|---|---|---|
| Volatile Organic Compounds (VOCs) | | | | | | |
| 1,1,1-Trichloroethane | 71-55-6 | 8260C | ug/kg | 780U | 800U | 860U |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 8260C | ug/kg | 780U | 800U | 860U |
| 1,1,2-Trichloroethane | 79-00-5 | 8260C | ug/kg | 780U | 800U | 860U |
| 1,1-Dichloroethane | 75-34-3 | 8260C | ug/kg | 780U | 800U | 860U |
| 1,1-Dichloroethene | 75-35-4 | 8260C | ug/kg | 780U | 800U | 860U |
| 1,2,4-Trichlorobenzene | 120-82-1 | 8260C | ug/kg | 3900U | 4000U | 4300U |
| 1,2-Dichlorobenzene | 95-50-1 | 8260C | ug/kg | 780U | 800U | 860U |
| 1,2-Dichloroethane | 107-06-2 | 8260C | ug/kg | 780U | 800U | 860U |
| 1,2-Dichloropropane | 78-87-5 | 8260C | ug/kg | 780U | 800U | 860U |
| 1,3-Dichlorobenzene | 541-73-1 | 8260C | ug/kg | 780U | 800U | 860U |
| 1,4-Dichlorobenzene | 106-46-7 | 8260C | ug/kg | **1,000** | **1,300** | **1,000** |
| 2-Chloroethylvinylether | 110-75-8 | 8260C | ug/kg | 3900U | 4000U | 4300U |
| Acrolein | 107-02-8 | 8260C | ug/kg | 39000U | 40000U | 43000U |
| Acrylonitrile | 107-13-1 | 8260C | ug/kg | 3900U | 4000U | 4300U |
| Benzene | 71-43-2 | 8260C | ug/kg | 780U | 800U | 860U |
| Bromodichloromethane | 75-27-4 | 8260C | ug/kg | 780U | 800U | 860U |
| Bromoform | 75-25-2 | 8260C | ug/kg | 780U | 800U | 860U |
| Bromomethane | 74-83-9 | 8260C | ug/kg | 780U | 800U | 860U |
| Carbon Tetrachloride | 56-23-5 | 8260C | ug/kg | 780U | 800U | 860U |
| Chlorobenzene | 108-90-7 | 8260C | ug/kg | 780U | 800U | 860U |
| Chloroethane | 75-00-3 | 8260C | ug/kg | 780U | 800U | 860U |
| Chloroform | 67-66-3 | 8260C | ug/kg | 780U | 800U | 860U |
| Chloromethane | 74-87-3 | 8260C | ug/kg | 780U | 800U | 860U |
| cis-1,3-Dichloropropene | 10061-01-5 | 8260C | ug/kg | 780U | 800U | 860U |
| Dibromochloromethane | 124-48-1 | 8260C | ug/kg | 780U | 800U | 860U |
| Ethylbenzene | 100-41-4 | 8260C | ug/kg | 780U | 800U | 860U |
| Hexachlorobutadiene | 87-68-3 | 8260C | ug/kg | 3900U | 4000U | 4300U |
| Methylene Chloride | 75-09-2 | 8260C | ug/kg | 1600U | 1600U | 1700U |
| Naphthalene | 91-20-3 | 8260C | ug/kg | 3900U | 4000U | 4300U |
| Tetrachloroethene | 127-18-4 | 8260C | ug/kg | 780U | 800U | 860U |
| Toluene | 108-88-3 | 8260C | ug/kg | **8,300** | **120,000** | **82,000** |
| trans-1,2-Dichloroethene | 156-60-5 | 8260C | ug/kg | 780U | 800U | 860U |
| trans-1,3-Dichloropropene | 10061-02-6 | 8260C | ug/kg | 780U | 800U | 860U |
| Trichloroethene | 79-01-6 | 8260C | ug/kg | 780U | 800U | 860U |
| Vinyl Chloride | 75-01-4 | 8260C | ug/kg | 780U | 800U | 860U |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).
U: Not detected at RL.
Y: Not detected at RL (raised RL).



PGG

Table 4. Sludge Analytical Results - Big Hanaford Bunker (Fire Mountain Farms)
Samples collected: 7/8/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BH-Comp-1 | BH-Comp-2 | BH-Comp-3 |
|---|---|---|---|---|---|---|
| Metals | | | | | | |
| Antimony | 7440-36-0 | 6010C | mg/kg | 30U | 30U | 30U |
| Arsenic | 7440-38-2 | 6010C | mg/kg | 30U | 30U | 30U |
| Beryllium | 7440-41-7 | 6010C | mg/kg | 0.6U | 0.6U | 0.7U |
| Cadmium | 7440-43-9 | 6010C | mg/kg | **2** | **2** | **2** |
| Chromium | 7440-47-3 | 6010C | mg/kg | **25** | **29** | **28** |
| Cobalt | 7440-48-4 | 6010C | mg/kg | **15** | **64** | **165** |
| Copper | 7440-50-8 | 6010C | mg/kg | **473** | **485** | **521** |
| Lead | 7439-92-1 | 6010C | mg/kg | **30** | **20** | **20** |
| Molybdenum | 7439-98-7 | 6010C | mg/kg | **12** | **15** | **13** |
| Nickel | 7440-02-0 | 6010C | mg/kg | **27** | **38** | **42** |
| Selenium | 7782-49-2 | 6010C | mg/kg | 30U | 30U | 30U |
| Silver | 7440-22-4 | 6010C | mg/kg | **6** | **4** | **4** |
| Thallium | 7440-28-0 | 6010C | mg/kg | 30U | 30U | 30U |
| Zinc | 7440-66-6 | 6010C | mg/kg | **1,030** | **1,100** | **1,070** |
| Mercury | 7439-97-6 | 7471A | mg/kg | **1** | **1.2** | **3** |
| Semi-Volatile Organic Compounds (SVOCs) | | | | | | |
| 1,2,4-Trichlorobenzene | 120-82-1 | SW8270D | ug/kg | 580U | 600U | 720U |
| 1,2-Dichlorobenzene | 95-50-1 | SW8270D | ug/kg | 580U | 600U | 720U |
| 1,2-Diphenylhydrazine | 122-66-7 | SW8270D | ug/kg | 570U | 600U | 710U |
| 1,3-Dichlorobenzene | 541-73-1 | SW8270D | ug/kg | 580U | 600U | 720U |
| 1,4-Dichlorobenzene | 106-46-7 | SW8270D | ug/kg | **860** | **750** | 720U |
| 2,2'-Oxybis(1-Chloropropane) | 108-60-1 | SW8270D | ug/kg | 580U | 600U | 720U |
| 2,4,6-Trichlorophenol | 88-06-2 | SW8270D | ug/kg | 2800U | 3000U | 3500U |
| 2,4-Dichlorophenol | 120-83-2 | SW8270D | ug/kg | 2800U | 3000U | 3500U |
| 2,4-Dimethylphenol | 105-67-9 | SW8270D | ug/kg | 580U | 600U | 720U |
| 2,4-Dinitrophenol | 51-28-5 | SW8270D | ug/kg | 5800U | 6000U | 7200U |
| 2,4-Dinitrotoluene | 121-14-2 | SW8270D | ug/kg | 2800U | 3000U | 3500U |
| 2,6-Dinitrotoluene | 606-20-2 | SW8270D | ug/kg | 2800U | 3000U | 3500U |
| 2-Chloronaphthalene | 91-58-7 | SW8270D | ug/kg | 580U | 600U | 720U |
| 2-Chlorophenol | 95-57-8 | SW8270D | ug/kg | 580U | 600U | 720U |
| 2-Nitrophenol | 88-75-5 | SW8270D | ug/kg | 580U | 600U | 720U |
| 3,3'-Dichlorobenzidine | 91-94-1 | SW8270D | ug/kg | 2800U | 3000U | 3500U |
| 4,6-Dinitro-2-Methylphenol | 534-52-1 | SW8270D | ug/kg | 5800U | 6000U | 7200U |
| 4-Bromophenyl-phenylether | 101-55-3 | SW8270D | ug/kg | 580U | 600U | 720U |
| 4-Chlorophenyl-phenylether | 7005-72-3 | SW8270D | ug/kg | 580U | 600U | 720U |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).
U: Not detected at RL.
Y: Not detected at RL (raised RL).



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Table 4. Sludge Analytical Results - Big Hanaford Bunker (Fire Mountain Farms)
Samples collected: 7/8/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BH-Comp-1 | BH-Comp-2 | BH-Comp-3 |
|---|---|---|---|---|---|---|
| SVOC (cont.) | | | | | | |
| 4-Methylphenol | 106-44-5 | SW8270D | ug/kg | **480,000** | **720,000** | **540,000** |
| 4-Nitrophenol | 100-02-7 | SW8270D | ug/kg | 2800U | 3000U | 3500U |
| Acenaphthene | 83-32-9 | SW8270D | ug/kg | 580U | 600U | 720U |
| Acenaphthylene | 208-96-8 | SW8270D | ug/kg | 580U | 600U | 720U |
| Anthracene | 120-12-7 | SW8270D | ug/kg | 580U | 600U | 720U |
| Azobenzene | 103-33-3 | SW8270D | ug/kg | 580U | 600U | 720U |
| Benzo(a)anthracene | 56-55-3 | SW8270D | ug/kg | 580U | 600U | 720U |
| Benzo(a)pyrene | 50-32-8 | SW8270D | ug/kg | 580U | 600U | 720U |
| Benzo(b)fluoranthene | 205-99-2 | SW8270D | ug/kg | 570U | 600U | 710U |
| Benzo(g,h,i)perylene | 191-24-2 | SW8270D | ug/kg | 580U | 600U | 720U |
| Benzo(k)fluoranthene | 207-08-9 | SW8270D | ug/kg | 570U | 600U | 710U |
| bis(2-Chloroethoxy) Methane | 111-91-1 | SW8270D | ug/kg | 580U | 600U | 720U |
| Bis-(2-Chloroethyl) Ether | 111-44-4 | SW8270D | ug/kg | 580U | 600U | 720U |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | SW8270D | ug/kg | **25,000** | **25,000** | **24,000** |
| Butylbenzylphthalate | 85-68-7 | SW8270D | ug/kg | 580U | 600U | 720U |
| Chrysene | 218-01-9 | SW8270D | ug/kg | 580U | 600U | 720U |
| Dibenz(a,h)anthracene | 53-70-3 | SW8270D | ug/kg | 580U | 600U | 720U |
| Diethylphthalate | 84-66-2 | SW8270D | ug/kg | 580U | 600U | 720U |
| Dimethylphthalate | 131-11-3 | SW8270D | ug/kg | 580U | 600U | 720U |
| Di-n-Butylphthalate | 84-74-2 | SW8270D | ug/kg | 580U | 600U | 720U |
| Di-n-Octyl phthalate | 117-84-0 | SW8270D | ug/kg | 580U | 600U | 720U |
| Fluoranthene | 206-44-0 | SW8270D | ug/kg | **640** | 600U | 720U |
| Fluorene | 86-73-7 | SW8270D | ug/kg | 580U | 600U | 720U |
| Hexachlorobenzene | 118-74-1 | SW8270D | ug/kg | 580U | 600U | 720U |
| Hexachlorobutadiene | 87-68-3 | SW8270D | ug/kg | 580U | 600U | 720U |
| Hexachlorocyclopentadiene | 77-47-4 | SW8270D | ug/kg | 2800U | 3000U | 3500U |
| Hexachloroethane | 67-72-1 | SW8270D | ug/kg | 580U | 600U | 720U |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | SW8270D | ug/kg | 580U | 600U | 720U |
| Isophorone | 78-59-1 | SW8270D | ug/kg | 580U | 600U | 720U |
| Naphthalene | 91-20-3 | SW8270D | ug/kg | 580U | 600U | 720U |
| Nitrobenzene | 98-95-3 | SW8270D | ug/kg | 580U | 600U | 720U |
| N-Nitrosodimethylamine | 62-75-9 | SW8270D | ug/kg | 2800U | 3000U | 3500U |
| N-Nitroso-Di-N-Propylamine | 621-64-7 | SW8270D | ug/kg | 580U | 600U | 720U |
| N-Nitrosodiphenylamine | 86-30-6 | SW8270D | ug/kg | **1200M** | **1100M** | **1400M** |
| Pentachlorophenol | 87-86-5 | SW8270D | ug/kg | 2800U | 3000U | 3500U |
| Phenanthrene | 85-01-8 | SW8270D | ug/kg | 580U | 600U | 720U |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).
U: Not detected at RL.
Y: Not detected at RL (raised RL).



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Table 4. Sludge Analytical Results - Big Hanaford Bunker (Fire Mountain Farms)
Samples collected: 7/8/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BH-Comp-1 | BH-Comp-2 | BH-Comp-3 |
|---|---|---|---|---|---|---|
| SVOC (cont.) | | | | | | |
| Phenol | 108-95-2 | SW8270D | ug/kg | **14,000** | **23,000** | **16,000** |
| Pyrene | 129-00-0 | SW8270D | ug/kg | 580U | 600U | 720U |
| Total Benzofluoranthenes | TOTBFA | SW8270D | ug/kg | 580U | 600U | 720U |
| PCB (Aroclors) | | | | | | |
| Aroclor 1016 | 12674-11-2 | SW8082A | ug/kg | 9.9U | NA | NA |
| Aroclor 1221 | 11104-28-2 | SW8082A | ug/kg | 9.9U | NA | NA |
| Aroclor 1232 | 11141-16-5 | SW8082A | ug/kg | 9.9U | NA | NA |
| Aroclor 1242 | 53469-21-9 | SW8082A | ug/kg | 9.9U | NA | NA |
| Aroclor 1248 | 12672-29-6 | SW8082A | ug/kg | 99Y | NA | NA |
| Aroclor 1254 | 11097-69-1 | SW8082A | ug/kg | 150Y | NA | NA |
| Aroclor 1260 | 11096-82-5 | SW8082A | ug/kg | **35** | NA | NA |
| Pesticides | | | | | | |
| 4,4'-DDD | 72-54-8 | SW8081B | ug/kg | 17U | NA | NA |
| 4,4'-DDE | 72-55-9 | SW8081B | ug/kg | 17U | NA | NA |
| 4,4'-DDT | 50-29-3 | SW8081B | ug/kg | 120Y | NA | NA |
| Aldrin | 309-00-2 | SW8081B | ug/kg | 8.3U | NA | NA |
| alpha-BHC | 319-84-6 | SW8081B | ug/kg | 8.3U | NA | NA |
| beta-BHC | 319-85-7 | SW8081B | ug/kg | 8.3U | NA | NA |
| cis-Chlordane | 5103-71-9 | SW8081B | ug/kg | 34Y | NA | NA |
| delta-BHC | 319-86-8 | SW8081B | ug/kg | 180Y | NA | NA |
| Dieldrin | 60-57-1 | SW8081B | ug/kg | 39Y | NA | NA |
| Endosulfan I | 959-98-8 | SW8081B | ug/kg | 22Y | NA | NA |
| Endosulfan II | 33213-65-9 | SW8081B | ug/kg | 17U | NA | NA |
| Endosulfan Sulfate | 1031-07-8 | SW8081B | ug/kg | 17U | NA | NA |
| Endrin | 72-20-8 | SW8081B | ug/kg | 49Y | NA | NA |
| Endrin Aldehyde | 7421-93-4 | SW8081B | ug/kg | 77Y | NA | NA |
| gamma-BHC (Lindane) | 58-89-9 | SW8081B | ug/kg | 25Y | NA | NA |
| Heptachlor | 76-44-8 | SW8081B | ug/kg | 8.3U | NA | NA |
| Heptachlor Epoxide | 1024-57-3 | SW8081B | ug/kg | 690Y | NA | NA |
| Toxaphene | 8001-35-2 | SW8081B | ug/kg | 830U | NA | NA |
| trans-Chlordane | 5103-74-2 | SW8081B | ug/kg | 1200Y | NA | NA |
| Polychlorinated dibenzo-p-dioxin | | | | | | |
| 2,3,7,8-TCDD | 1746-01-6 | EPA 1613B | pg/g | 5.71U | NA | NA |

Bold: Detected
NA: Not Analyzed
2,3,7,8-TCDD Est. Max Possible Concentration 0.72 BH-Comp1
J: Est. (less than RL).
M: Est. (detected and confirmed but with low spectral match).
U: Not detected at RL.
Y: Not detected at RL (raised RL).

Table 4. Sludge Analytical Results - Big Hanaford Bunker (Fire Mountain Farms)
Samples collected: 7/8/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BH-Comp-1 | BH-Comp-2 | BH-Comp-3 |
|---|---|---|---|---|---|---|
| Inorganic Parameters | | | | | | |
| N-Nitrate | NITRATE | Calculated | mg-N/kg | 0.57U | NA | NA |
| N-Ammonia | AMMONIA | EPA 350.1M | mg-N/kg | **24,800** | NA | NA |
| Total Kjeldahl Nitrogen | KJELDAHL-N | EPA 351.2 | mg-N/kg | **76,800** | NA | NA |
| Nitrate + Nitrite (NO3+NO2) | ΓRATE-NITRITE | EPA 353.2 | mg-N/kg | **7.01** | NA | NA |
| N-Nitrite | NITRITE | EPA 353.2 | mg-N/kg | **7.86** | NA | NA |
| Total Solids | TS104 | SM2540G | Percent | **16.33** | **17.04** | **15.16** |
| Total Cyanide | TOT CYANIDE | EPA 335.4 | mg/kg | **1.60** | **2.39** | **1.77** |
| pH | PH | SW9045 | std units | **7.91** | NA | NA |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).
U: Not detected at RL.
Y: Not detected at RL (raised RL).



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Table 5. Sludge Analytical Results - Burnt Ridge Lagoon (Fire Mountain Farms)
Samples collected: 7/9/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BR-Comp-1 | BR-Comp-2 | BR-Comp-3 |
|---|---|---|---|---|---|---|
| Volatile Organic Compounds (VOCs) | | | | | | |
| 1,1,1-Trichloroethane | 71-55-6 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| 1,1,2-Trichloroethane | 79-00-5 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| 1,1-Dichloroethane | 75-34-3 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| 1,1-Dichloroethene | 75-35-4 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| 1,2,4-Trichlorobenzene | 120-82-1 | 8260C | ug/kg | 12U | 10U | 9U |
| 1,2-Dichlorobenzene | 95-50-1 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| 1,2-Dichloroethane | 107-06-2 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| 1,2-Dichloropropane | 78-87-5 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| 1,3-Dichlorobenzene | 541-73-1 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| 1,4-Dichlorobenzene | 106-46-7 | 8260C | ug/kg | **48** | **26** | **32** |
| 2-Chloroethylvinylether | 110-75-8 | 8260C | ug/kg | 12U | 10U | 9U |
| Acrolein | 107-02-8 | 8260C | ug/kg | 120U | 100U | 90U |
| Acrylonitrile | 107-13-1 | 8260C | ug/kg | 12U | 10U | 9U |
| Benzene | 71-43-2 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Bromodichloromethane | 75-27-4 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Bromoform | 75-25-2 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Bromomethane | 74-83-9 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Carbon Tetrachloride | 56-23-5 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Chlorobenzene | 108-90-7 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Chloroethane | 75-00-3 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Chloroform | 67-66-3 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Chloromethane | 74-87-3 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| cis-1,3-Dichloropropene | 10061-01-5 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Dibromochloromethane | 124-48-1 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Ethylbenzene | 100-41-4 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Hexachlorobutadiene | 87-68-3 | 8260C | ug/kg | 12U | 10U | 9U |
| Methylene Chloride | 75-09-2 | 8260C | ug/kg | 4.6U | 4U | 3.6U |
| Naphthalene | 91-20-3 | 8260C | ug/kg | 12U | 10U | 9U |
| Tetrachloroethene | 127-18-4 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Toluene | 108-88-3 | 8260C | ug/kg | **20** | **35** | **19** |
| trans-1,2-Dichloroethene | 156-60-5 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| trans-1,3-Dichloropropene | 10061-02-6 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Trichloroethene | 79-01-6 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Vinyl Chloride | 75-01-4 | 8260C | ug/kg | 2.3U | 2U | 1.8U |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).



PgG

Table 5. Sludge Analytical Results - Burnt Ridge Lagoon (Fire Mountain Farms)
Samples collected: 7/9/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BR-Comp-1 | BR-Comp-2 | BR-Comp-3 |
|---|---|---|---|---|---|---|
| Metals | | | | | | |
| Antimony | 7440-36-0 | 6010C | mg/kg | 40U | 30U | 30U |
| Arsenic | 7440-38-2 | 6010C | mg/kg | 40U | 30U | 30U |
| Beryllium | 7440-41-7 | 6010C | mg/kg | 0.7U | 0.7U | 0.6U |
| Cadmium | 7440-43-9 | 6010C | mg/kg | **3** | **3** | **3** |
| Chromium | 7440-47-3 | 6010C | mg/kg | **31** | **45** | **35** |
| Cobalt | 7440-48-4 | 6010C | mg/kg | **43** | **48** | **37** |
| Copper | 7440-50-8 | 6010C | mg/kg | **379** | **417** | **358** |
| Lead | 7439-92-1 | 6010C | mg/kg | **40** | **30** | **30** |
| Molybdenum | 7439-98-7 | 6010C | mg/kg | **14** | **16** | **16** |
| Nickel | 7440-02-0 | 6010C | mg/kg | **28** | **45** | **31** |
| Selenium | 7782-49-2 | 6010C | mg/kg | 40U | 30U | 30U |
| Silver | 7440-22-4 | 6010C | mg/kg | **5** | **5** | **6** |
| Thallium | 7440-28-0 | 6010C | mg/kg | 40U | 30U | 30U |
| Zinc | 7440-66-6 | 6010C | mg/kg | **886** | **969** | **876** |
| Mercury | 7439-97-6 | 7471A | mg/kg | **1** | **1.9** | **1.8** |
| Semi-Volatile Organic Compounds (SVOCs) | | | | | | |
| 1,2,4-Trichlorobenzene | 120-82-1 | SW8270D | ug/kg | 260U | 310U | 260U |
| 1,2-Dichlorobenzene | 95-50-1 | SW8270D | ug/kg | 260U | 310U | 260U |
| 1,2-Diphenylhydrazine | 122-66-7 | SW8270D | ug/kg | 260U | 310U | 260U |
| 1,3-Dichlorobenzene | 541-73-1 | SW8270D | ug/kg | 260U | 310U | 260U |
| 1,4-Dichlorobenzene | 106-46-7 | SW8270D | ug/kg | **480** | **540** | 260U |
| 2,2'-Oxybis(1-Chloropropane) | 108-60-1 | SW8270D | ug/kg | 260U | 310U | 260U |
| 2,4,6-Trichlorophenol | 88-06-2 | SW8270D | ug/kg | 1300U | 1500U | 1300U |
| 2,4-Dichlorophenol | 120-83-2 | SW8270D | ug/kg | 1300U | 1500U | 1300U |
| 2,4-Dimethylphenol | 105-67-9 | SW8270D | ug/kg | 260U | 310U | 260U |
| 2,4-Dinitrophenol | 51-28-5 | SW8270D | ug/kg | 2600U | 3100U | 2600U |
| 2,4-Dinitrotoluene | 121-14-2 | SW8270D | ug/kg | 1300U | 1500U | 1300U |
| 2,6-Dinitrotoluene | 606-20-2 | SW8270D | ug/kg | 1300U | 1500U | 1300U |
| 2-Chloronaphthalene | 91-58-7 | SW8270D | ug/kg | 260U | 310U | 260U |
| 2-Chlorophenol | 95-57-8 | SW8270D | ug/kg | 260U | 310U | 260U |
| 2-Nitrophenol | 88-75-5 | SW8270D | ug/kg | 260U | 310U | 260U |
| 3,3'-Dichlorobenzidine | 91-94-1 | SW8270D | ug/kg | 1300U | 1500U | 1300U |
| 4,6-Dinitro-2-Methylphenol | 534-52-1 | SW8270D | ug/kg | 2600U | 3100U | 2600U |
| 4-Bromophenyl-phenylether | 101-55-3 | SW8270D | ug/kg | 260U | 310U | 260U |
| 4-Chlorophenyl-phenylether | 7005-72-3 | SW8270D | ug/kg | 260U | 310U | 260U |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).



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Table 5. Sludge Analytical Results - Burnt Ridge Lagoon (Fire Mountain Farms)
Samples collected: 7/9/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BR-Comp-1 | BR-Comp-2 | BR-Comp-3 |
|---|---|---|---|---|---|---|
| SVOC (cont.) | | | | | | |
| 4-Methylphenol | 106-44-5 | SW8270D | ug/kg | **1,100** | **450** | **460** |
| 4-Nitrophenol | 100-02-7 | SW8270D | ug/kg | 1300U | 1500U | 1300U |
| Acenaphthene | 83-32-9 | SW8270D | ug/kg | 260U | 310U | 260U |
| Acenaphthylene | 208-96-8 | SW8270D | ug/kg | 260U | 310U | 260U |
| Anthracene | 120-12-7 | SW8270D | ug/kg | 260U | 310U | 260U |
| Azobenzene | 103-33-3 | SW8270D | ug/kg | 260U | 310U | 260U |
| Benzo(a)anthracene | 56-55-3 | SW8270D | ug/kg | 260U | 310U | 260U |
| Benzo(a)pyrene | 50-32-8 | SW8270D | ug/kg | 260U | 310U | 260U |
| Benzo(b)fluoranthene | 205-99-2 | SW8270D | ug/kg | **330M** | 310U | **380M** |
| Benzo(g,h,i)perylene | 191-24-2 | SW8270D | ug/kg | 260U | 310U | 260U |
| Benzo(k)fluoranthene | 207-08-9 | SW8270D | ug/kg | **330M** | 310U | **360M** |
| bis(2-Chloroethoxy) Methane | 111-91-1 | SW8270D | ug/kg | 260U | 310U | 260U |
| Bis-(2-Chloroethyl) Ether | 111-44-4 | SW8270D | ug/kg | 260U | 310U | 260U |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | SW8270D | ug/kg | **10,000** | **12,000** | **9,100** |
| Butylbenzylphthalate | 85-68-7 | SW8270D | ug/kg | 260U | 310U | 260U |
| Chrysene | 218-01-9 | SW8270D | ug/kg | 260U | 310U | 260U |
| Dibenz(a,h)anthracene | 53-70-3 | SW8270D | ug/kg | 260U | 310U | 260U |
| Diethylphthalate | 84-66-2 | SW8270D | ug/kg | 260U | 310U | 260U |
| Dimethylphthalate | 131-11-3 | SW8270D | ug/kg | 260U | 310U | 260U |
| Di-n-Butylphthalate | 84-74-2 | SW8270D | ug/kg | 260U | 310U | 260U |
| Di-n-Octyl phthalate | 117-84-0 | SW8270D | ug/kg | 260U | 310U | 260U |
| Fluoranthene | 206-44-0 | SW8270D | ug/kg | **360** | **390** | **450** |
| Fluorene | 86-73-7 | SW8270D | ug/kg | 260U | 310U | 260U |
| Hexachlorobenzene | 118-74-1 | SW8270D | ug/kg | 260U | 310U | 260U |
| Hexachlorobutadiene | 87-68-3 | SW8270D | ug/kg | 260U | 310U | 260U |
| Hexachlorocyclopentadiene | 77-47-4 | SW8270D | ug/kg | 1300U | 1500U | 1300U |
| Hexachloroethane | 67-72-1 | SW8270D | ug/kg | 260U | 310U | 260U |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | SW8270D | ug/kg | 260U | 310U | **400** |
| Isophorone | 78-59-1 | SW8270D | ug/kg | 260U | 310U | 260U |
| Naphthalene | 91-20-3 | SW8270D | ug/kg | 260U | 310U | 260U |
| Nitrobenzene | 98-95-3 | SW8270D | ug/kg | 260U | 310U | 260U |
| N-Nitrosodimethylamine | 62-75-9 | SW8270D | ug/kg | 1300U | 1500U | 1300U |
| N-Nitroso-Di-N-Propylamine | 621-64-7 | SW8270D | ug/kg | 260U | 310U | 260U |
| N-Nitrosodiphenylamine | 86-30-6 | SW8270D | ug/kg | 260U | 310U | 260U |
| Pentachlorophenol | 87-86-5 | SW8270D | ug/kg | 1300U | 1500U | 1300U |
| Phenanthrene | 85-01-8 | SW8270D | ug/kg | 260U | 310U | 260U |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).

Table 5. Sludge Analytical Results - Burnt Ridge Lagoon (Fire Mountain Farms)
Samples collected: 7/9/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BR-Comp-1 | BR-Comp-2 | BR-Comp-3 |
|---|---|---|---|---|---|---|
| SVOC (cont.) | | | | | | |
| Phenol | 108-95-2 | SW8270D | ug/kg | 260U | 310U | 260U |
| Pyrene | 129-00-0 | SW8270D | ug/kg | **390** | **310** | **270** |
| Total Benzofluoranthenes | TOTBFA | SW8270D | ug/kg | **350M** | 310U | **400M** |
| PCB (Aroclors) | | | | | | |
| Aroclor 1016 | 12674-11-2 | SW8082A | ug/kg | 9.8U | NA | NA |
| Aroclor 1221 | 11104-28-2 | SW8082A | ug/kg | 9.8U | NA | NA |
| Aroclor 1232 | 11141-16-5 | SW8082A | ug/kg | 9.8U | NA | NA |
| Aroclor 1242 | 53469-21-9 | SW8082A | ug/kg | 9.8U | NA | NA |
| Aroclor 1248 | 12672-29-6 | SW8082A | ug/kg | 98Y | NA | NA |
| Aroclor 1254 | 11097-69-1 | SW8082A | ug/kg | 150Y | NA | NA |
| Aroclor 1260 | 11096-82-5 | SW8082A | ug/kg | **61** | NA | NA |
| Pesticides | | | | | | |
| 4,4'-DDD | 72-54-8 | SW8081B | ug/kg | 16U | NA | NA |
| 4,4'-DDE | 72-55-9 | SW8081B | ug/kg | 16U | NA | NA |
| 4,4'-DDT | 50-29-3 | SW8081B | ug/kg | 16U | NA | NA |
| Aldrin | 309-00-2 | SW8081B | ug/kg | 8.2U | NA | NA |
| alpha-BHC | 319-84-6 | SW8081B | ug/kg | 8.2U | NA | NA |
| beta-BHC | 319-85-7 | SW8081B | ug/kg | 8.2U | NA | NA |
| cis-Chlordane | 5103-71-9 | SW8081B | ug/kg | 19Y | NA | NA |
| delta-BHC | 319-86-8 | SW8081B | ug/kg | 110Y | NA | NA |
| Dieldrin | 60-57-1 | SW8081B | ug/kg | 57Y | NA | NA |
| Endosulfan I | 959-98-8 | SW8081B | ug/kg | 14Y | NA | NA |
| Endosulfan II | 33213-65-9 | SW8081B | ug/kg | 16U | NA | NA |
| Endosulfan Sulfate | 1031-07-8 | SW8081B | ug/kg | 72Y | NA | NA |
| Endrin | 72-20-8 | SW8081B | ug/kg | 25Y | NA | NA |
| Endrin Aldehyde | 7421-93-4 | SW8081B | ug/kg | 16U | NA | NA |
| gamma-BHC (Lindane) | 58-89-9 | SW8081B | ug/kg | 8.2U | NA | NA |
| Heptachlor | 76-44-8 | SW8081B | ug/kg | 8.2U | NA | NA |
| Heptachlor Epoxide | 1024-57-3 | SW8081B | ug/kg | 8.2U | NA | NA |
| Toxaphene | 8001-35-2 | SW8081B | ug/kg | 820U | NA | NA |
| trans-Chlordane | 5103-74-2 | SW8081B | ug/kg | 1100Y | NA | NA |
| Polychlorinated dibenzo-p-dioxin | | | | | | |
| 2,3,7,8-TCDD | 1746-01-6 | EPA 1613B | pg/g | **2.35JEMPC** | NA | NA |

Bold: Detected
NA: Not Analyzed
2,3,7,8-TCDD Est. Max Possible Concentration 2.35 BR-Comp1.
J: Est. (less than RL).
M: Est. (detected and confirmed but with low spectral match).



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Table 5. Sludge Analytical Results - Burnt Ridge Lagoon (Fire Mountain Farms)
Samples collected: 7/9/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BR-Comp-1 | BR-Comp-2 | BR-Comp-3 |
|---|---|---|---|---|---|---|
| Inorganic Parameters | | | | | | |
| N-Nitrate | NITRATE | Calculated | mg-N/kg | 0.6U | NA | NA |
| N-Ammonia | AMMONIA | EPA 350.1M | mg-N/kg | **7,600** | NA | NA |
| Total Kjeldahl Nitrogen | KJELDAHL-N | EPA 351.2 | mg-N/kg | **33,700** | NA | NA |
| Nitrate + Nitrite (NO3+NO2) | NITRATE-NITRITE | EPA 353.2 | mg-N/kg | **0.60** | NA | NA |
| N-Nitrite | NITRITE | EPA 353.2 | mg-N/kg | **0.72** | NA | NA |
| Total Solids | TS104 | SM2540G | Percent | **15.06** | **13.40** | **15.91** |
| Total Cyanide | TOT CYANIDE | EPA 335.4 | mg/kg | **1.05** | **1.42** | **1.08** |
| pH | PH | SW9045 | std units | **7.43** | NA | NA |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).



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Table 6. Total Fecal Coliform Analytical Results (Fire Mountain Farms)

| Sample Location and ID | MPN per 100 grams (wet weight) | MPN per grams (wet weight) | Total Solids (Percent)* | MPN per grams (dry weight) | Geometric Mean MPN per grams (dry weight) |
|---|---|---|---|---|---|
| Newaukum Prairie | | | | | |
| NP-A3-1-7 | 49,000 | 490 | 6.54 | 7,489 | 3,056 |
| NP-A2-1-7 | 17,000 | 170 | 6.54 | 2,598 | |
| NP-A1-1-2 | 3,300 | 33 | 6.54 | 504 | |
| NP-B1-1-10 | 49,000 | 490 | 6.54 | 7,489 | |
| NP-B2-1-7 | 79,000 | 790 | 6.54 | 12,073 | |
| NP-B3-1-3 | 17,000 | 170 | 6.54 | 2,598 | |
| NP-C3-1-6 | 92,000 | 920 | 6.54 | 14,060 | |
| NP-C1-1-7 | 8,400 | 84 | 6.54 | 1,284 | |
| NP-C2-1-5 | 7,000 | 70 | 6.54 | 1,070 | |
| NP-C1-2-6 | 18,000 | 180 | 6.54 | 2,751 | |
| NP-C3-2-7 | 7,900 | 79 | 6.54 | 1,207 | |
| NP-B1-2-4 | 49,000 | 490 | 6.54 | 7,489 | |
| NP-B2-2-6 | 49,000 | 490 | 6.54 | 7,489 | |
| NP-B3-2-2 | 4,900 | 49 | 6.54 | 749 | |
| Big Hanaford | | | | | |
| BH-A4-1-3.5 | 7,900 | 79 | 16.18 | 488 | 145 |
| BH-A7-1-1 | 330 | 3 | 16.18 | 20 | |
| BH-C2-1-8 | 23,000 | 230 | 16.18 | 1,422 | |
| BH-A5-2-4 | 2,300 | 23 | 16.18 | 142 | |
| BH-A6-3-4.5 | 78 | 1 | 16.18 | 5 | |
| BH-B8-3-6 | 110,000 | 1,100 | 16.18 | 6,800 | |
| BH-C8-1-4 | 330 | 3 | 16.18 | 20 | |
| Burnt Ridge | | | | | |
| BR-A1-1-1 | 330 | 3 | 14.79 | 22 | 44 |
| BR-A2-1-3 | 330 | 3 | 14.79 | 22 | |
| BR-A3-1-1 | 490 | 5 | 14.79 | 33 | |
| BR-B1-1-3 | 2,300 | 23 | 14.79 | 156 | |
| BR-B2-1-3 | 1,300 | 13 | 14.79 | 88 | |
| BR-B3-1-3 | 230 | 2 | 14.79 | 16 | |
| BR-C1-1-3 | 1,300 | 13 | 14.79 | 88 | |

MPN: Most Probable Number
Samples analyzed using method 9221E
*Total Solids: avg. value from composited samples at each location

Table 7. Water Cap Analytical Results - Burnt Ridge Lagoon (Fire Mountain Farms)
Samples collected: 7/17/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | GRAB BR-I-9 | GRAB BR-II-8 | GRAB BR-III-8 | GRAB BR-IV-8.5 | COMP BR-Comp |
|---|---|---|---|---|---|---|---|---|
| Volatile Organic Compounds (VOCs) | | | | | | | | |
| 1,1,1-Trichloroethane | 71-55-6 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| 1,1,2-Trichloroethane | 79-00-5 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| 1,1-Dichloroethane | 75-34-3 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| 1,1-Dichloroethene | 75-35-4 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| 1,2,4-Trichlorobenzene | 120-82-1 | 8260C | ug/L | 2.5U | 2.5U | 2.5U | 2.5U | NA |
| 1,2-Dichlorobenzene | 95-50-1 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| 1,2-Dichloroethane | 107-06-2 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| 1,2-Dichloropropane | 78-87-5 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| 1,3-Dichlorobenzene | 541-73-1 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| 1,4-Dichlorobenzene | 106-46-7 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| 2-Chloroethylvinylether | 110-75-8 | 8260C | ug/L | 5U | 5U | 5U | 5U | NA |
| Acrolein | 107-02-8 | 8260C | ug/L | 25U | 25U | 25U | 25U | NA |
| Acrylonitrile | 107-13-1 | 8260C | ug/L | 5U | 5U | 5U | 5U | NA |
| Benzene | 71-43-2 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Bromodichloromethane | 75-27-4 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Bromoform | 75-25-2 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Bromomethane | 74-83-9 | 8260C | ug/L | 5U | 5U | 5U | 5U | NA |
| Carbon Tetrachloride | 56-23-5 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Chlorobenzene | 108-90-7 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Chloroethane | 75-00-3 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Chloroform | 67-66-3 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Chloromethane | 74-87-3 | 8260C | ug/L | 2.5U | 2.5U | 2.5U | 2.5U | NA |
| cis-1,3-Dichloropropene | 10061-01-5 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Dibromochloromethane | 124-48-1 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Ethylbenzene | 100-41-4 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Hexachlorobutadiene | 87-68-3 | 8260C | ug/L | 2.5U | 2.5U | 2.5U | 2.5U | NA |
| Methylene Chloride | 75-09-2 | 8260C | ug/L | 5U | 5U | 5U | 5U | NA |
| Naphthalene | 91-20-3 | 8260C | ug/L | 2.5U | 2.5U | 2.5U | 2.5U | NA |
| Tetrachloroethene | 127-18-4 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Toluene | 108-88-3 | 8260C | ug/L | **35** | **31** | **41** | **26** | NA |
| trans-1,2-Dichloroethene | 156-60-5 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| trans-1,3-Dichloropropene | 10061-02-6 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Trichloroethene | 79-01-6 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Vinyl Chloride | 75-01-4 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |

Bold: Detected Value
NA: Not Analyzed
U: Not detected at RL.
GRAB: Discrete grab samples
COMP: Composited grab samples

Table 7. Water Cap Analytical Results - Burnt Ridge Lagoon (Fire Mountain Farms)
Samples collected: 7/17/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | GRAB | | | | COMP |
|---|---|---|---|---|---|---|---|---|
| | | | | BR-I-9 | BR-II-8 | BR-III-8 | BR-IV-8.5 | BR-Comp |
| Metals | | | | | | | | |
| Antimony, Total | 7440-36-0 | SW6010C | mg/L | NA | NA | NA | NA | 0.05U |
| Arsenic, Total | 7440-38-2 | SW6010C | mg/L | NA | NA | NA | NA | 0.05U |
| Beryllium, Total | 7440-41-7 | SW6010C | mg/L | NA | NA | NA | NA | 0.001U |
| Cadmium, Total | 7440-43-9 | SW6010C | mg/L | NA | NA | NA | NA | 0.002U |
| Chromium, Total | 7440-47-3 | SW6010C | mg/L | NA | NA | NA | NA | **0.012** |
| Cobalt, Total | 7440-48-4 | SW6010C | mg/L | NA | NA | NA | NA | **0.017** |
| Copper, Total | 7440-50-8 | SW6010C | mg/L | NA | NA | NA | NA | **0.057** |
| Lead, Total | 7439-92-1 | SW6010C | mg/L | NA | NA | NA | NA | 0.02U |
| Molybdenum, Total | 7439-98-7 | SW6010C | mg/L | NA | NA | NA | NA | **0.006** |
| Nickel, Total | 7440-02-0 | SW6010C | mg/L | NA | NA | NA | NA | **0.02** |
| Selenium, Total | 7782-49-2 | SW6010C | mg/L | NA | NA | NA | NA | 0.05U |
| Silver, Total | 7440-22-4 | SW6010C | mg/L | NA | NA | NA | NA | 0.003U |
| Thallium, Total | 7440-28-0 | SW6010C | mg/L | NA | NA | NA | NA | 0.05U |
| Zinc, Total | 7440-66-6 | SW6010C | mg/L | NA | NA | NA | NA | **0.18** |
| Mercury, Total | 7439-97-6 | SW7470A | mg/L | NA | NA | NA | NA | **0.0003** |
| Semi-Volatile Organic Compounds (SVOCs) | | | | | | | | |
| 1,2,4-Trichlorobenzene | 120-82-1 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| 1,2-Dichlorobenzene | 95-50-1 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| 1,2-Diphenylhydrazine | 122-66-7 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| 1,3-Dichlorobenzene | 541-73-1 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| 1,4-Dichlorobenzene | 106-46-7 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| 2,2'-Oxybis(1-Chloropropane) | 108-60-1 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| 2,4,6-Trichlorophenol | 88-06-2 | SW8270D | ug/L | NA | NA | NA | NA | 3U |
| 2,4-Dichlorophenol | 120-83-2 | SW8270D | ug/L | NA | NA | NA | NA | 3U |
| 2,4-Dimethylphenol | 105-67-9 | SW8270D | ug/L | NA | NA | NA | NA | 3U |
| 2,4-Dinitrophenol | 51-28-5 | SW8270D | ug/L | NA | NA | NA | NA | 20U |
| 2,4-Dinitrotoluene | 121-14-2 | SW8270D | ug/L | NA | NA | NA | NA | 3U |
| 2,6-Dinitrotoluene | 606-20-2 | SW8270D | ug/L | NA | NA | NA | NA | 3U |
| 2-Chloronaphthalene | 91-58-7 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| 2-Chlorophenol | 95-57-8 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| 2-Nitrophenol | 88-75-5 | SW8270D | ug/L | NA | NA | NA | NA | 3U |
| 3,3'-Dichlorobenzidine | 91-94-1 | SW8270D | ug/L | NA | NA | NA | NA | 5U |
| 4,6-Dinitro-2-Methylphenol | 534-52-1 | SW8270D | ug/L | NA | NA | NA | NA | 10U |
| 4-Bromophenyl-phenylether | 101-55-3 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| 4-Chlorophenyl-phenylether | 7005-72-3 | SW8270D | ug/L | NA | NA | NA | NA | 1U |

Bold: Detected Value
NA: Not Analyzed
U: Not detected at RL.
GRAB: Discrete grab samples
COMP: Composited grab samples



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Table 7. Water Cap Analytical Results - Burnt Ridge Lagoon (Fire Mountain Farms)
Samples collected: 7/17/14

| | | | | GRAB | | | | COMP |
|---|---|---|---|---|---|---|---|---|
| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BR-I-9 | BR-II-8 | BR-III-8 | BR-IV-8.5 | BR-Comp |
| SVOC (cont.) | | | | | | | | |
| 4-Methylphenol | 106-44-5 | SW8270D | ug/L | NA | NA | NA | NA | 2U |
| 4-Nitrophenol | 100-02-7 | SW8270D | ug/L | NA | NA | NA | NA | 10U |
| Acenaphthene | 83-32-9 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Acenaphthylene | 208-96-8 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Anthracene | 120-12-7 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Azobenzene | 103-33-3 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Benzo(a)anthracene | 56-55-3 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Benzo(a)pyrene | 50-32-8 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Benzo(b)fluoranthene | 205-99-2 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Benzo(g,h,i)perylene | 191-24-2 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Benzo(k)fluoranthene | 207-08-9 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| bis(2-Chloroethoxy) Methane | 111-91-1 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Bis-(2-Chloroethyl) Ether | 111-44-4 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | SW8270D | ug/L | NA | NA | NA | NA | 3U |
| Butylbenzylphthalate | 85-68-7 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Chrysene | 218-01-9 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Dibenz(a,h)anthracene | 53-70-3 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Diethylphthalate | 84-66-2 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Dimethylphthalate | 131-11-3 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Di-n-Butylphthalate | 84-74-2 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Di-n-Octyl phthalate | 117-84-0 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Fluoranthene | 206-44-0 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Fluorene | 86-73-7 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Hexachlorobenzene | 118-74-1 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Hexachlorobutadiene | 87-68-3 | SW8270D | ug/L | NA | NA | NA | NA | 3U |
| Hexachlorocyclopentadiene | 77-47-4 | SW8270D | ug/L | NA | NA | NA | NA | 5U |
| Hexachloroethane | 67-72-1 | SW8270D | ug/L | NA | NA | NA | NA | 2U |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Isophorone | 78-59-1 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Naphthalene | 91-20-3 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Nitrobenzene | 98-95-3 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| N-Nitrosodimethylamine | 62-75-9 | SW8270D | ug/L | NA | NA | NA | NA | 3U |
| N-Nitroso-Di-N-Propylamine | 621-64-7 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| N-Nitrosodiphenylamine | 86-30-6 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Pentachlorophenol | 87-86-5 | SW8270D | ug/L | NA | NA | NA | NA | 10U |
| Phenanthrene | 85-01-8 | SW8270D | ug/L | NA | NA | NA | NA | 1U |

Bold: Detected Value
NA: Not Analyzed
U: Not detected at RL.
GRAB: Discrete grab samples
COMP: Composited grab samples



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Table 7. Water Cap Analytical Results - Burnt Ridge Lagoon (Fire Mountain Farms)
Samples collected: 7/17/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | GRAB BR-I-9 | GRAB BR-II-8 | GRAB BR-III-8 | GRAB BR-IV-8.5 | COMP BR-Comp |
|---|---|---|---|---|---|---|---|---|
| SVOC (cont.) | | | | | | | | |
| Phenol | 108-95-2 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Pyrene | 129-00-0 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Total Benzofluoranthenes | TOTBFA | SW8270D | ug/L | NA | NA | NA | NA | 2U |
| Inorganic Parameters | | | | | | | | |
| N-Nitrate | NITRATE | Calculated | mg-N/L | NA | NA | NA | NA | 0.01U |
| Nitrate + Nitrite | NITRATE-NITRITE | EPA 353.2 | mg-N/L | NA | NA | NA | NA | **0.014** |
| N-Nitrite | NITRITE | EPA 353.2 | mg-N/L | NA | NA | NA | NA | **0.051** |
| Total Cyanide | TOT CYANIDE | EPA 335.4 | mg/L | NA | NA | NA | NA | 0.005U |

Bold: Detected Value
NA: Not Analyzed
U: Not detected at RL.
GRAB: Discrete grab samples
COMP: Composited grab samples



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Table 8. Newaukum Prairie Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| Volatile Organic Compounds (VOCs) | | | | | |
| 1,1,1-Trichloroethane | ug/kg | 3.2 | 3.20E-07 | D | HOC |
| 1,1,2,2-Tetrachloroethane | ug/kg | 3.2 | 3.20E-07 | C | HOC |
| 1,1,2-Trichloroethane | ug/kg | 3.2 | 3.20E-07 | D | HOC |
| 1,1-Dichloroethane | ug/kg | 3.2 | 3.20E-07 | D | HOC |
| 1,1-Dichloroethene | ug/kg | 3.2 | 3.20E-07 | C | HOC |
| 1,2,4-Trichlorobenzene | ug/kg | 16 | 1.60E-06 | C | HOC |
| 1,2-Dichlorobenzene | ug/kg | 3.2 | 3.20E-07 | C | HOC |
| 1,2-Dichloroethane | ug/kg | 3.2 | 3.20E-07 | D | HOC |
| 1,2-Dichloropropane | ug/kg | 3.2 | 3.20E-07 | C | HOC |
| 1,3-Dichlorobenzene | ug/kg | 3.2 | 3.20E-07 | C | HOC |
| 1,4-Dichlorobenzene | ug/kg | See Semi-VOCs | | | |
| 2-Chloroethylvinylether | ug/kg | 16 | 1.60E-06 | C | HOC |
| Acrolein | ug/kg | 160 | 1.60E-05 | A | C-H |
| Acrylonitrile | ug/kg | 16 | 1.60E-06 | C | C-H |
| Benzene | ug/kg | 3.2 | 3.20E-07 | D | C-H |
| Bromodichloromethane | ug/kg | 3.2 | 3.20E-07 | D | HOC |
| Bromoform | ug/kg | 3.2 | 3.20E-07 | C | C-H |
| Bromomethane | ug/kg | 3.2 | 3.20E-07 | B | HOC |
| Carbon Tetrachloride | ug/kg | 3.2 | 3.20E-07 | C | HOC |
| Chlorobenzene | ug/kg | 3.2 | 3.20E-07 | C | HOC |
| Chloroethane | ug/kg | 3.2 | 3.20E-07 | No Data | HOC |
| Chloroform | ug/kg | 3.2 | 3.20E-07 | C | HOC |
| Chloromethane | ug/kg | 3.2 | 3.20E-07 | C | HOC |
| cis-1,3-Dichloropropene | ug/kg | 3.2 | 3.20E-07 | No Data | HOC |
| Dibromochloromethane | ug/kg | 3.2 | 3.20E-07 | D | HOC |
| Ethylbenzene | ug/kg | 4.6 | 4.60E-07 | C | C-H |
| Hexachlorobutadiene | ug/kg | 16 | 1.60E-06 | A | HOC |
| Methylene Chloride | ug/kg | 6.5 | 6.50E-07 | D | HOC |
| Naphthalene | ug/kg | 16 | 1.60E-06 | C | C-H |
| Tetrachloroethene | ug/kg | 3.2 | 3.20E-07 | C | HOC |
| Toluene | ug/kg | 150,000 | 1.50E-02 | A | C-H |
| trans-1,2-Dichloroethene | ug/kg | 3.2 | 3.20E-07 | D | HOC |
| trans-1,3-Dichloropropene | ug/kg | 3.2 | 3.20E-07 | No Data | HOC |
| Trichloroethene | ug/kg | 3.2 | 3.20E-07 | D | HOC |
| Vinyl Chloride | ug/kg | 3.2 | 3.20E-07 | D | HOC |

Note1:
Toxicity Categories based on toxicity data
from HSDB or ECOTOX online databases [WAC 173-303-100(5)(b)(i)]

Organic Catogories:
HOC = Halogenated Organics
C-H = Carbon-Hydrogen Oranics
PAH = Polyaromatic Hydrocarbons



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Table 8. Newaukum Prairie Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| Metals | | | | | |
| Antimony | mg/kg | 70 | 7.00E-03 | D | Non-Organic |
| Arsenic | mg/kg | 70 | 7.00E-03 | C | Non-Organic |
| Beryllium | mg/kg | 1 | 1.00E-04 | No Data | Non-Organic |
| Cadmium | mg/kg | 3 | 3.00E-04 | C | Non-Organic |
| Chromium | mg/kg | 27 | 2.70E-03 | D | Non-Organic |
| Cobalt | mg/kg | 89 | 8.90E-03 | C | Non-Organic |
| Copper | mg/kg | 503 | 5.03E-02 | No Data | Non-Organic |
| Lead | mg/kg | 30 | 3.00E-03 | No Data | Non-Organic |
| Molybdenum | mg/kg | 14 | 1.40E-03 | B | Non-Organic |
| Nickel | mg/kg | 30 | 3.00E-03 | X | Non-Organic |
| Selenium | mg/kg | 70 | 7.00E-03 | C | Non-Organic |
| Silver | mg/kg | 4 | 4.00E-04 | X | Non-Organic |
| Thallium | mg/kg | 70 | 7.00E-03 | C | Non-Organic |
| Zinc | mg/kg | 1,060 | 1.06E-01 | D | Non-Organic |
| Mercury | mg/kg | 1.2 | 1.20E-04 | B | Non-Organic |
| Semi-Volatile Organic Compounds (SVOCs) | | | | | |
| 1,2,4-Trichlorobenzene | ug/kg | See VOCs | | | |
| 1,2-Dichlorobenzene | ug/kg | See VOCs | | | |
| 1,2-Diphenylhydrazine | ug/kg | 300 | 3.00E-05 | B | C-H |
| 1,3-Dichlorobenzene | ug/kg | See VOCs | | | |
| 1,4-Dichlorobenzene | ug/kg | 750 | 7.50E-05 | B | HOC |
| 2,2'-Oxybis(1-Chloropropane) | ug/kg | 300 | 3.00E-05 | C | HOC |
| 2,4,6-Trichlorophenol | ug/kg | 1,500 | 1.50E-04 | C | HOC |
| 2,4-Dichlorophenol | ug/kg | 1,500 | 1.50E-04 | C | HOC |
| 2,4-Dimethylphenol | ug/kg | 300 | 3.00E-05 | D | C-H |
| 2,4-Dinitrophenol | ug/kg | 3,000 | 3.00E-04 | B | C-H |
| 2,4-Dinitrotoluene | ug/kg | 1,500 | 1.50E-04 | C | C-H |
| 2,6-Dinitrotoluene | ug/kg | 1,500 | 1.50E-04 | D | C-H |
| 2-Chloronaphthalene | ug/kg | 300 | 3.00E-05 | D | HOC |
| 2-Chlorophenol | ug/kg | 300 | 3.00E-05 | C | HOC |
| 2-Nitrophenol | ug/kg | 300 | 3.00E-05 | C | C-H |
| 3,3'-Dichlorobenzidine | ug/kg | 1,500 | 1.50E-04 | D | HOC |
| 4,6-Dinitro-2-Methylphenol | ug/kg | 3,000 | 3.00E-04 | A | C-H |
| 4-Bromophenyl-phenylether | ug/kg | 300 | 3.00E-05 | C | C-H |
| 4-Chlorophenyl-phenylether | ug/kg | 300 | 3.00E-05 | B | HOC |

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Toxicity Categories based on toxicity data
from HSDB or ECOTOX online databases [WAC 173-303-100(5)(b)(i)]

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Table 8. Newaukum Prairie Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| SVOC (cont.) | | | | | |
| 4-Methylphenol | ug/kg | 2,600 | 2.60E-04 | C | C-H |
| 4-Nitrophenol | ug/kg | 1,500 | 1.50E-04 | C | C-H |
| Acenaphthene | ug/kg | 300 | 3.00E-05 | B | PAH |
| Acenaphthylene | ug/kg | 300 | 3.00E-05 | No Data | PAH |
| Anthracene | ug/kg | 300 | 3.00E-05 | B | PAH |
| Azobenzene | ug/kg | 300 | 3.00E-05 | B | C-H |
| Benzo(a)anthracene | ug/kg | 300 | 3.00E-05 | X | PAH |
| Benzo(a)pyrene | ug/kg | 300 | 3.00E-05 | X | PAH |
| Benzo(b)fluoranthene | ug/kg | 360 | 3.60E-05 | No Data | PAH |
| Benzo(g,h,i)perylene | ug/kg | 300 | 3.00E-05 | No Data | PAH |
| Benzo(k)fluoranthene | ug/kg | 340 | 3.40E-05 | No Data | PAH |
| bis(2-Chloroethoxy) Methane | ug/kg | 300 | 3.00E-05 | C | HOC |
| Bis-(2-Chloroethyl) Ether | ug/kg | 300 | 3.00E-05 | C | HOC |
| bis(2-Ethylhexyl)phthalate | ug/kg | 20,000 | 2.00E-03 | B | C-H |
| Butylbenzylphthalate | ug/kg | 300 | 3.00E-05 | C | C-H |
| Chrysene | ug/kg | 300 | 3.00E-05 | No Data | PAH |
| Dibenz(a,h)anthracene | ug/kg | 300 | 3.00E-05 | No Data | PAH |
| Diethylphthalate | ug/kg | 300 | 3.00E-05 | D | C-H |
| Dimethylphthalate | ug/kg | 300 | 3.00E-05 | D | C-H |
| Di-n-Butylphthalate | ug/kg | 300 | 3.00E-05 | C | C-H |
| Di-n-Octyl phthalate | ug/kg | 300 | 3.00E-05 | D | C-H |
| Fluoranthene | ug/kg | 560 | 5.60E-05 | C | PAH |
| Fluorene | ug/kg | 300 | 3.00E-05 | B | PAH |
| Hexachlorobenzene | ug/kg | 300 | 3.00E-05 | D | HOC |
| Hexachlorobutadiene | ug/kg | See VOCs | | | HOC |
| Hexachlorocyclopentadiene | ug/kg | 1,500 | 1.50E-04 | X | HOC |
| Hexachloroethane | ug/kg | 300 | 3.00E-05 | B | HOC |
| Indeno(1,2,3-cd)pyrene | ug/kg | 470 | 4.70E-05 | No Data | PAH |
| Isophorone | ug/kg | 300 | 3.00E-05 | C | C-H |
| Naphthalene | ug/kg | See VOCs | | | |
| Nitrobenzene | ug/kg | 300 | 3.00E-05 | D | C-H |
| N-Nitrosodimethylamine | ug/kg | 1,500 | 1.50E-04 | B | C-H |
| N-Nitroso-Di-N-Propylamine | ug/kg | 300 | 3.00E-05 | D | C-H |
| N-Nitrosodiphenylamine | ug/kg | 300 | 3.00E-05 | C | C-H |
| Pentachlorophenol | ug/kg | 1,500 | 1.50E-04 | A | C-H |
| Phenanthrene | ug/kg | 440 | 4.40E-05 | A | PAH |

Note1:
Toxicity Categories based on toxicity data
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Table 8. Newaukum Prairie Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| SVOC (cont.) | | | | | |
| Phenol | ug/kg | 630 | 6.30E-05 | C | C-H |
| Pyrene | ug/kg | 450 | 4.50E-05 | C | PAH |
| Total Benzofluoranthenes | ug/kg | 380 | 3.80E-05 | Not Applicable | Not Applicable |
| PCB (Aroclors) | | | | | |
| Aroclor 1016 | ug/kg | 9.8 | 9.80E-07 | B | HOC |
| Aroclor 1221 | ug/kg | 9.8 | 9.80E-07 | C | HOC |
| Aroclor 1232 | ug/kg | 9.8 | 9.80E-07 | C | HOC |
| Aroclor 1242 | ug/kg | 9.8 | 9.80E-07 | A | HOC |
| Aroclor 1248 | ug/kg | 49 | 4.90E-06 | X | HOC |
| Aroclor 1254 | ug/kg | 150 | 1.50E-05 | X | HOC |
| Aroclor 1260 | ug/kg | 40 | 4.00E-06 | A | HOC |
| Pesticides | | | | | |
| 4,4'-DDD | ug/kg | 17 | 1.70E-06 | A | HOC |
| 4,4'-DDE | ug/kg | 17 | 1.70E-06 | A | HOC |
| 4,4'-DDT | ug/kg | 100 | 1.00E-05 | X | HOC |
| Aldrin | ug/kg | 8.3 | 8.30E-07 | X | HOC |
| alpha-BHC | ug/kg | 8.3 | 8.30E-07 | B | HOC |
| beta-BHC | ug/kg | 8.3 | 8.30E-07 | C | HOC |
| cis-Chlordane | ug/kg | 33 | 3.30E-06 | X | HOC |
| delta-BHC | ug/kg | 180 | 1.80E-05 | B | HOC |
| Endosulfan I | ug/kg | 8.3 | 8.30E-07 | X | HOC |
| Endosulfan II | ug/kg | 17 | 1.70E-06 | X | HOC |
| Endosulfan Sulfate | ug/kg | 120 | 1.20E-05 | X | HOC |
| Endrin | ug/kg | 17 | 1.70E-06 | X | HOC |
| Endrin Aldehyde | ug/kg | 17 | 1.70E-06 | No Data | HOC |
| gamma-BHC (Lindane) | ug/kg | 8.3 | 8.30E-07 | X | HOC |
| Heptachlor | ug/kg | 8.3 | 8.30E-07 | X | HOC |
| Heptachlor Epoxide | ug/kg | 280 | 2.80E-05 | A | HOC |
| Toxaphene | ug/kg | 830 | 8.30E-05 | X | HOC |
| trans-Chlordane | ug/kg | 1,300 | 1.30E-04 | A | HOC |
| Polychlorinated dibenzo-p-dioxin | | | | | |
| 2,3,7,8-TCDD | pg/g | 2.76 | 2.76E-04 | X | HOC |
| Inorganic Parameters | | | | | |
| Total Cyanide | mg/kg | 1.87 | 1.87E-04 | B | Non-Organic |

Note1:
Toxicity Categories based on toxicity data
from HSDB or ECOTOX online databases [WAC 173-303-100(5)(b)(i)]

Organic Catogories:
HOC = Halogenated Organics
C-H = Carbon-Hydrogen Oranics
PAH = Polyaromatic Hydrocarbons



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Table 9. Big Hanaford Sludge - Parameters for Land Disposal Restriction Evaluation (see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| Volatile Organic Compounds (VOCs) | | | | | |
| 1,1,1-Trichloroethane | ug/kg | 780 | 7.80E-05 | D | HOC |
| 1,1,2,2-Tetrachloroethane | ug/kg | 780 | 7.80E-05 | C | HOC |
| 1,1,2-Trichloroethane | ug/kg | 780 | 7.80E-05 | D | HOC |
| 1,1-Dichloroethane | ug/kg | 780 | 7.80E-05 | D | HOC |
| 1,1-Dichloroethene | ug/kg | 780 | 7.80E-05 | C | HOC |
| 1,2,4-Trichlorobenzene | ug/kg | See Semi-VOCs | | | |
| 1,2-Dichlorobenzene | ug/kg | See Semi-VOCs | | | |
| 1,2-Dichloroethane | ug/kg | 780 | 7.80E-05 | D | HOC |
| 1,2-Dichloropropane | ug/kg | 780 | 7.80E-05 | C | HOC |
| 1,3-Dichlorobenzene | ug/kg | See Semi-VOCs | | | |
| 1,4-Dichlorobenzene | ug/kg | 1,300 | 1.30E-04 | B | HOC |
| 2-Chloroethylvinylether | ug/kg | 3,900 | 3.90E-04 | C | HOC |
| Acrolein | ug/kg | 39,000 | 3.90E-03 | A | C-H |
| Acrylonitrile | ug/kg | 3,900 | 3.90E-04 | C | C-H |
| Benzene | ug/kg | 780 | 7.80E-05 | D | C-H |
| Bromodichloromethane | ug/kg | 780 | 7.80E-05 | D | HOC |
| Bromoform | ug/kg | 780 | 7.80E-05 | C | C-H |
| Bromomethane | ug/kg | 780 | 7.80E-05 | B | HOC |
| Carbon Tetrachloride | ug/kg | 780 | 7.80E-05 | C | HOC |
| Chlorobenzene | ug/kg | 780 | 7.80E-05 | C | HOC |
| Chloroethane | ug/kg | 780 | 7.80E-05 | No Data | HOC |
| Chloroform | ug/kg | 780 | 7.80E-05 | C | HOC |
| Chloromethane | ug/kg | 780 | 7.80E-05 | C | HOC |
| cis-1,3-Dichloropropene | ug/kg | 780 | 7.80E-05 | No Data | HOC |
| Dibromochloromethane | ug/kg | 780 | 7.80E-05 | D | HOC |
| Ethylbenzene | ug/kg | 780 | 7.80E-05 | C | C-H |
| Hexachlorobutadiene | ug/kg | See Semi-VOCs | | | |
| Methylene Chloride | ug/kg | 1600 | 1.60E-04 | D | HOC |
| Naphthalene | ug/kg | See Semi-VOCs | | | |
| Tetrachloroethene | ug/kg | 780 | 7.80E-05 | C | HOC |
| Toluene | ug/kg | 120,000 | 1.20E-02 | A | C-H |
| trans-1,2-Dichloroethene | ug/kg | 780 | 7.80E-05 | D | HOC |
| trans-1,3-Dichloropropene | ug/kg | 780 | 7.80E-05 | No Data | HOC |
| Trichloroethene | ug/kg | 780 | 7.80E-05 | D | HOC |
| Vinyl Chloride | ug/kg | 780 | 7.80E-05 | D | HOC |

Note1:
Toxicity Categories based on toxicity data
from HSDB or ECOTOX online databases [WAC 173-303-100(5)(b)(i)]

Organic Catogories:
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PAH = Polyaromatic Hydrocarbons

Table 9. Big Hanaford Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| Metals | | | | | |
| Antimony | mg/kg | 30 | 3.00E-03 | D | Non-Organic |
| Arsenic | mg/kg | 30 | 3.00E-03 | C | Non-Organic |
| Beryllium | mg/kg | 0.6 | 6.00E-05 | No Data | Non-Organic |
| Cadmium | mg/kg | 2 | 2.00E-04 | C | Non-Organic |
| Chromium | mg/kg | 29 | 2.90E-03 | D | Non-Organic |
| Cobalt | mg/kg | 165 | 1.65E-02 | C | Non-Organic |
| Copper | mg/kg | 521 | 5.21E-02 | No Data | Non-Organic |
| Lead | mg/kg | 30 | 3.00E-03 | No Data | Non-Organic |
| Molybdenum | mg/kg | 15 | 1.50E-03 | B | Non-Organic |
| Nickel | mg/kg | 42 | 4.20E-03 | X | Non-Organic |
| Selenium | mg/kg | 30 | 3.00E-03 | C | Non-Organic |
| Silver | mg/kg | 6 | 6.00E-04 | X | Non-Organic |
| Thallium | mg/kg | 30 | 3.00E-03 | C | Non-Organic |
| Zinc | mg/kg | 1,100 | 1.10E-01 | D | Non-Organic |
| Mercury | mg/kg | 3 | 3.00E-04 | B | Non-Organic |
| Semi-Volatile Organic Compounds (SVOCs) | | | | | |
| 1,2,4-Trichlorobenzene | ug/kg | 580 | 5.80E-05 | C | HOC |
| 1,2-Dichlorobenzene | ug/kg | 580 | 5.80E-05 | C | HOC |
| 1,2-Diphenylhydrazine | ug/kg | 570 | 5.70E-05 | B | C-H |
| 1,3-Dichlorobenzene | ug/kg | 580 | 5.80E-05 | C | HOC |
| 1,4-Dichlorobenzene | ug/kg | See VOCs | | | |
| 2,2'-Oxybis(1-Chloropropane) | ug/kg | 580 | 5.80E-05 | C | HOC |
| 2,4,6-Trichlorophenol | ug/kg | 2,800 | 2.80E-04 | C | HOC |
| 2,4-Dichlorophenol | ug/kg | 2,800 | 2.80E-04 | C | HOC |
| 2,4-Dimethylphenol | ug/kg | 580 | 5.80E-05 | D | C-H |
| 2,4-Dinitrophenol | ug/kg | 5,800 | 5.80E-04 | B | C-H |
| 2,4-Dinitrotoluene | ug/kg | 2,800 | 2.80E-04 | C | C-H |
| 2,6-Dinitrotoluene | ug/kg | 2,800 | 2.80E-04 | D | C-H |
| 2-Chloronaphthalene | ug/kg | 580 | 5.80E-05 | D | HOC |
| 2-Chlorophenol | ug/kg | 580 | 5.80E-05 | C | HOC |
| 2-Nitrophenol | ug/kg | 580 | 5.80E-05 | C | C-H |
| 3,3'-Dichlorobenzidine | ug/kg | 2,800 | 2.80E-04 | D | HOC |
| 4,6-Dinitro-2-Methylphenol | ug/kg | 5,800 | 5.80E-04 | A | C-H |
| 4-Bromophenyl-phenylether | ug/kg | 580 | 5.80E-05 | C | C-H |
| 4-Chlorophenyl-phenylether | ug/kg | 580 | 5.80E-05 | B | HOC |

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Table 9. Big Hanaford Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| SVOC (cont.) | | | | | |
| 4-Methylphenol | ug/kg | 720,000 | 7.20E-02 | C | C-H |
| 4-Nitrophenol | ug/kg | 2,800 | 2.80E-04 | C | C-H |
| Acenaphthene | ug/kg | 580 | 5.80E-05 | B | PAH |
| Acenaphthylene | ug/kg | 580 | 5.80E-05 | No Data | PAH |
| Anthracene | ug/kg | 580 | 5.80E-05 | B | PAH |
| Azobenzene | ug/kg | 580 | 5.80E-05 | B | C-H |
| Benzo(a)anthracene | ug/kg | 580 | 5.80E-05 | X | PAH |
| Benzo(a)pyrene | ug/kg | 580 | 5.80E-05 | X | PAH |
| Benzo(b)fluoranthene | ug/kg | 570 | 5.70E-05 | No Data | PAH |
| Benzo(g,h,i)perylene | ug/kg | 580 | 5.80E-05 | No Data | PAH |
| Benzo(k)fluoranthene | ug/kg | 570 | 5.70E-05 | No Data | PAH |
| bis(2-Chloroethoxy) Methane | ug/kg | 580 | 5.80E-05 | C | HOC |
| Bis-(2-Chloroethyl) Ether | ug/kg | 580 | 5.80E-05 | C | HOC |
| bis(2-Ethylhexyl)phthalate | ug/kg | 25,000 | 2.50E-03 | B | C-H |
| Butylbenzylphthalate | ug/kg | 580 | 5.80E-05 | C | C-H |
| Chrysene | ug/kg | 580 | 5.80E-05 | No Data | PAH |
| Dibenz(a,h)anthracene | ug/kg | 580 | 5.80E-05 | No Data | PAH |
| Diethylphthalate | ug/kg | 580 | 5.80E-05 | D | C-H |
| Dimethylphthalate | ug/kg | 580 | 5.80E-05 | D | C-H |
| Di-n-Butylphthalate | ug/kg | 580 | 5.80E-05 | C | C-H |
| Di-n-Octyl phthalate | ug/kg | 580 | 5.80E-05 | D | C-H |
| Fluoranthene | ug/kg | 640 | 6.40E-05 | C | PAH |
| Fluorene | ug/kg | 580 | 5.80E-05 | B | PAH |
| Hexachlorobenzene | ug/kg | 580 | 5.80E-05 | D | HOC |
| Hexachlorobutadiene | ug/kg | 580 | 5.80E-05 | A | HOC |
| Hexachlorocyclopentadiene | ug/kg | 2,800 | 2.80E-04 | X | HOC |
| Hexachloroethane | ug/kg | 580 | 5.80E-05 | B | HOC |
| Indeno(1,2,3-cd)pyrene | ug/kg | 580 | 5.80E-05 | No Data | PAH |
| Isophorone | ug/kg | 580 | 5.80E-05 | C | C-H |
| Naphthalene | ug/kg | 580 | 5.80E-05 | C | C-H |
| Nitrobenzene | ug/kg | 580 | 5.80E-05 | D | C-H |
| N-Nitrosodimethylamine | ug/kg | 2,800 | 2.80E-04 | B | C-H |
| N-Nitroso-Di-N-Propylamine | ug/kg | 580 | 5.80E-05 | D | C-H |
| N-Nitrosodiphenylamine | ug/kg | 1,400 | 1.40E-04 | C | C-H |
| Pentachlorophenol | ug/kg | 2,800 | 2.80E-04 | A | C-H |
| Phenanthrene | ug/kg | 580 | 5.80E-05 | A | PAH |

Note1:
Toxicity Categories based on toxicity data
from HSDB or ECOTOX online databases [WAC 173-303-100(5)(b)(i)]

Organic Catogories:
HOC = Halogenated Organics
C-H = Carbon-Hydrogen Oranics
PAH = Polyaromatic Hydrocarbons

Table 9. Big Hanaford Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| SVOC (cont.) | | | | | |
| Phenol | ug/kg | 23,000 | 2.30E-03 | C | C-H |
| Pyrene | ug/kg | 580 | 5.80E-05 | C | PAH |
| Total Benzofluoranthenes | ug/kg | 580 | 5.80E-05 | Not Applicable | Not Applicable |
| PCB (Aroclors) | | | | | |
| Aroclor 1016 | ug/kg | 9.9 | 9.90E-07 | B | HOC |
| Aroclor 1221 | ug/kg | 9.9 | 9.90E-07 | C | HOC |
| Aroclor 1232 | ug/kg | 9.9 | 9.90E-07 | C | HOC |
| Aroclor 1242 | ug/kg | 9.9 | 9.90E-07 | A | HOC |
| Aroclor 1248 | ug/kg | 99 | 9.90E-06 | X | HOC |
| Aroclor 1254 | ug/kg | 150 | 1.50E-05 | X | HOC |
| Aroclor 1260 | ug/kg | 35 | 3.50E-06 | A | HOC |
| Pesticides | | | | | |
| 4,4'-DDD | ug/kg | 17 | 1.70E-06 | A | HOC |
| 4,4'-DDE | ug/kg | 17 | 1.70E-06 | A | HOC |
| 4,4'-DDT | ug/kg | 120 | 1.20E-05 | X | HOC |
| Aldrin | ug/kg | 8.3 | 8.30E-07 | X | HOC |
| alpha-BHC | ug/kg | 8.3 | 8.30E-07 | B | HOC |
| beta-BHC | ug/kg | 8.3 | 8.30E-07 | C | HOC |
| cis-Chlordane | ug/kg | 34 | 3.40E-06 | X | HOC |
| delta-BHC | ug/kg | 180 | 1.80E-05 | B | HOC |
| Dieldrin | ug/kg | 39 | 3.90E-06 | X | HOC |
| Endosulfan I | ug/kg | 22 | 2.20E-06 | X | HOC |
| Endosulfan II | ug/kg | 17 | 1.70E-06 | X | HOC |
| Endosulfan Sulfate | ug/kg | 17 | 1.70E-06 | X | HOC |
| Endrin | ug/kg | 49 | 4.90E-06 | X | HOC |
| Endrin Aldehyde | ug/kg | 77 | 7.70E-06 | No Data | HOC |
| gamma-BHC (Lindane) | ug/kg | 25 | 2.50E-06 | X | HOC |
| Heptachlor | ug/kg | 8.3 | 8.30E-07 | X | HOC |
| Heptachlor Epoxide | ug/kg | 690 | 6.90E-05 | A | HOC |
| Toxaphene | ug/kg | 830 | 8.30E-05 | X | HOC |
| trans-Chlordane | ug/kg | 1,200 | 1.20E-04 | A | HOC |
| Polychlorinated dibenzo-p-dioxin | | | | | |
| 2,3,7,8-TCDD | pg/g | 0.72 | 7.20E-05 | X | HOC |
| Inorganic Parameters | | | | | |
| Total Cyanide | mg/kg | 2.39 | 2.39E-04 | B | Non-Organic |

Note1:
Toxicity Categories based on toxicity data
from HSDB or ECOTOX online databases [WAC 173-303-100(5)(b)(i)]

Organic Catogories:
HOC = Halogenated Organics
C-H = Carbon-Hydrogen Oranics
PAH = Polyaromatic Hydrocarbons



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Table 10. Burnt Ridge Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| Volatile Organic Compounds (VOCs) | | | | | |
| 1,1,1-Trichloroethane | ug/kg | 1.8 | 1.80E-07 | D | HOC |
| 1,1,2,2-Tetrachloroethane | ug/kg | 1.8 | 1.80E-07 | C | HOC |
| 1,1,2-Trichloroethane | ug/kg | 1.8 | 1.80E-07 | D | HOC |
| 1,1-Dichloroethane | ug/kg | 1.8 | 1.80E-07 | D | HOC |
| 1,1-Dichloroethene | ug/kg | 1.8 | 1.80E-07 | C | HOC |
| 1,2,4-Trichlorobenzene | ug/kg | 9 | 9.00E-07 | C | HOC |
| 1,2-Dichlorobenzene | ug/kg | 1.8 | 1.80E-07 | C | HOC |
| 1,2-Dichloroethane | ug/kg | 1.8 | 1.80E-07 | D | HOC |
| 1,2-Dichloropropane | ug/kg | 1.8 | 1.80E-07 | C | HOC |
| 1,3-Dichlorobenzene | ug/kg | 1.8 | 1.80E-07 | C | HOC |
| 1,4-Dichlorobenzene | ug/kg | See Semi-VOCs | | | |
| 2-Chloroethylvinylether | ug/kg | 9 | 9.00E-07 | C | HOC |
| Acrolein | ug/kg | 90 | 9.00E-06 | A | C-H |
| Acrylonitrile | ug/kg | 9 | 9.00E-07 | C | C-H |
| Benzene | ug/kg | 1.8 | 1.80E-07 | D | C-H |
| Bromodichloromethane | ug/kg | 1.8 | 1.80E-07 | D | HOC |
| Bromoform | ug/kg | 1.8 | 1.80E-07 | C | C-H |
| Bromomethane | ug/kg | 1.8 | 1.80E-07 | B | HOC |
| Carbon Tetrachloride | ug/kg | 1.8 | 1.80E-07 | C | HOC |
| Chlorobenzene | ug/kg | 1.8 | 1.80E-07 | C | HOC |
| Chloroethane | ug/kg | 1.8 | 1.80E-07 | No Data | HOC |
| Chloroform | ug/kg | 1.8 | 1.80E-07 | C | HOC |
| Chloromethane | ug/kg | 1.8 | 1.80E-07 | C | HOC |
| cis-1,3-Dichloropropene | ug/kg | 1.8 | 1.80E-07 | No Data | HOC |
| Dibromochloromethane | ug/kg | 1.8 | 1.80E-07 | D | HOC |
| Ethylbenzene | ug/kg | 1.8 | 1.80E-07 | C | C-H |
| Hexachlorobutadiene | ug/kg | 9 | 9.00E-07 | A | HOC |
| Methylene Chloride | ug/kg | 3.6 | 3.60E-07 | D | HOC |
| Naphthalene | ug/kg | 9 | 9.00E-07 | C | C-H |
| Tetrachloroethene | ug/kg | 1.8 | 1.80E-07 | C | HOC |
| Toluene | ug/kg | 35 | 3.50E-06 | A | C-H |
| trans-1,2-Dichloroethene | ug/kg | 1.8 | 1.80E-07 | D | HOC |
| trans-1,3-Dichloropropene | ug/kg | 1.8 | 1.80E-07 | No Data | HOC |
| Trichloroethene | ug/kg | 1.8 | 1.80E-07 | D | HOC |
| Vinyl Chloride | ug/kg | 1.8 | 1.80E-07 | D | HOC |

Note1: Parameters analyzed as VOCs and Semi-VOCs use only one value - selection based on max detect value or min RL (if ND)

Note2:
Tox. Cat. from HSDB or ECOTOX
HOC: Halogenated
C-H: Carbon-Hydrogen
PAH: Polyaromatic Hydrocarbons

Table 10. Burnt Ridge Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| Metals | | | | | |
| Antimony | mg/kg | 30 | 3.00E-03 | D | Non-Organic |
| Arsenic | mg/kg | 30 | 3.00E-03 | C | Non-Organic |
| Beryllium | mg/kg | 0.6 | 6.00E-05 | No Data | Non-Organic |
| Cadmium | mg/kg | 3 | 3.00E-04 | C | Non-Organic |
| Chromium | mg/kg | 45 | 4.50E-03 | D | Non-Organic |
| Cobalt | mg/kg | 48 | 4.80E-03 | C | Non-Organic |
| Copper | mg/kg | 417 | 4.17E-02 | No Data | Non-Organic |
| Lead | mg/kg | 40 | 4.00E-03 | No Data | Non-Organic |
| Molybdenum | mg/kg | 16 | 1.60E-03 | B | Non-Organic |
| Nickel | mg/kg | 45 | 4.50E-03 | X | Non-Organic |
| Selenium | mg/kg | 30 | 3.00E-03 | C | Non-Organic |
| Silver | mg/kg | 6 | 6.00E-04 | X | Non-Organic |
| Thallium | mg/kg | 30 | 3.00E-03 | C | Non-Organic |
| Zinc | mg/kg | 969 | 9.69E-02 | D | Non-Organic |
| Mercury | mg/kg | 1.9 | 1.90E-04 | B | Non-Organic |
| Semi-Volatile Organic Compounds (SVOCs) | | | | | |
| 1,2,4-Trichlorobenzene | ug/kg | VOC | | | |
| 1,2-Dichlorobenzene | ug/kg | VOC | | | |
| 1,2-Diphenylhydrazine | ug/kg | 260 | 2.60E-05 | B | C-H |
| 1,3-Dichlorobenzene | ug/kg | See VOCs | | | |
| 1,4-Dichlorobenzene | ug/kg | 540 | 5.40E-05 | B | HOC |
| 2,2'-Oxybis(1-Chloropropane) | ug/kg | 260 | 2.60E-05 | C | HOC |
| 2,4,6-Trichlorophenol | ug/kg | 1,300 | 1.30E-04 | C | HOC |
| 2,4-Dichlorophenol | ug/kg | 1,300 | 1.30E-04 | C | HOC |
| 2,4-Dimethylphenol | ug/kg | 260 | 2.60E-05 | D | C-H |
| 2,4-Dinitrophenol | ug/kg | 2,600 | 2.60E-04 | B | C-H |
| 2,4-Dinitrotoluene | ug/kg | 1,300 | 1.30E-04 | C | C-H |
| 2,6-Dinitrotoluene | ug/kg | 1,300 | 1.30E-04 | D | C-H |
| 2-Chloronaphthalene | ug/kg | 260 | 2.60E-05 | D | HOC |
| 2-Chlorophenol | ug/kg | 260 | 2.60E-05 | C | HOC |
| 2-Nitrophenol | ug/kg | 260 | 2.60E-05 | C | C-H |
| 3,3'-Dichlorobenzidine | ug/kg | 1,300 | 1.30E-04 | D | HOC |
| 4,6-Dinitro-2-Methylphenol | ug/kg | 2,600 | 2.60E-04 | A | C-H |
| 4-Bromophenyl-phenylether | ug/kg | 260 | 2.60E-05 | C | C-H |
| 4-Chlorophenyl-phenylether | ug/kg | 260 | 2.60E-05 | B | HOC |

Note1: Parameters analyzed as VOCs and Semi-VOCs use only one value - selection based on max detect value or min RL (if ND)

Note2:
Tox. Cat. from HSDB or ECOTOX
HOC: Halogenated
C-H: Carbon-Hydrogen
PAH: Polyaromatic Hydrocarbons

Table 10. Burnt Ridge Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| SVOC (cont.) | | | | | |
| 4-Methylphenol | ug/kg | 1,100 | 1.10E-04 | C | C-H |
| 4-Nitrophenol | ug/kg | 1,300 | 1.30E-04 | C | C-H |
| Acenaphthene | ug/kg | 260 | 2.60E-05 | B | PAH |
| Acenaphthylene | ug/kg | 260 | 2.60E-05 | No Data | PAH |
| Anthracene | ug/kg | 260 | 2.60E-05 | B | PAH |
| Azobenzene | ug/kg | 260 | 2.60E-05 | B | C-H |
| Benzo(a)anthracene | ug/kg | 260 | 2.60E-05 | X | PAH |
| Benzo(a)pyrene | ug/kg | 260 | 2.60E-05 | X | PAH |
| Benzo(b)fluoranthene | ug/kg | 380 | 3.80E-05 | No Data | PAH |
| Benzo(g,h,i)perylene | ug/kg | 260 | 2.60E-05 | No Data | PAH |
| Benzo(k)fluoranthene | ug/kg | 360 | 3.60E-05 | No Data | PAH |
| bis(2-Chloroethoxy) Methane | ug/kg | 260 | 2.60E-05 | C | HOC |
| Bis-(2-Chloroethyl) Ether | ug/kg | 260 | 2.60E-05 | C | HOC |
| bis(2-Ethylhexyl)phthalate | ug/kg | 12,000 | 1.20E-03 | B | C-H |
| Butylbenzylphthalate | ug/kg | 260 | 2.60E-05 | C | C-H |
| Chrysene | ug/kg | 260 | 2.60E-05 | No Data | PAH |
| Dibenz(a,h)anthracene | ug/kg | 260 | 2.60E-05 | No Data | PAH |
| Diethylphthalate | ug/kg | 260 | 2.60E-05 | D | C-H |
| Dimethylphthalate | ug/kg | 260 | 2.60E-05 | D | C-H |
| Di-n-Butylphthalate | ug/kg | 260 | 2.60E-05 | C | C-H |
| Di-n-Octyl phthalate | ug/kg | 260 | 2.60E-05 | D | C-H |
| Fluoranthene | ug/kg | 450 | 4.50E-05 | C | PAH |
| Fluorene | ug/kg | 260 | 2.60E-05 | B | PAH |
| Hexachlorobenzene | ug/kg | 260 | 2.60E-05 | D | HOC |
| Hexachlorobutadiene | ug/kg | 260 | 2.60E-05 | A | HOC |
| Hexachlorocyclopentadiene | ug/kg | 1,300 | 1.30E-04 | X | HOC |
| Hexachloroethane | ug/kg | 260 | 2.60E-05 | B | HOC |
| Indeno(1,2,3-cd)pyrene | ug/kg | 400 | 4.00E-05 | No Data | PAH |
| Isophorone | ug/kg | 260 | 2.60E-05 | C | C-H |
| Naphthalene | ug/kg | 260 | 2.60E-05 | C | C-H |
| Nitrobenzene | ug/kg | 260 | 2.60E-05 | D | C-H |
| N-Nitrosodimethylamine | ug/kg | 1,300 | 1.30E-04 | B | C-H |
| N-Nitroso-Di-N-Propylamine | ug/kg | 260 | 2.60E-05 | D | C-H |
| N-Nitrosodiphenylamine | ug/kg | 260 | 2.60E-05 | C | C-H |
| Pentachlorophenol | ug/kg | 1,300 | 1.30E-04 | A | C-H |
| Phenanthrene | ug/kg | 260 | 2.60E-05 | A | PAH |

Note1: Parameters analyzed as VOCs and Semi-VOCs use only one value - selection based on max detect value or min RL (if ND)

Note2:
Tox. Cat. from HSDB or ECOTOX
HOC: Halogenated
C-H: Carbon-Hydrogen
PAH: Polyaromatic Hydrocarbons



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Table 10. Burnt Ridge Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| SVOC (cont.) | | | | | |
| Phenol | ug/kg | 260 | 2.60E-05 | C | C-H |
| Pyrene | ug/kg | 390 | 3.90E-05 | C | PAH |
| Total Benzofluoranthenes | ug/kg | 400 | 4.00E-05 | Not Applicable | Not Applicable |
| PCB (Aroclors) | | | | | |
| Aroclor 1016 | ug/kg | 9.8 | 9.80E-07 | B | HOC |
| Aroclor 1221 | ug/kg | 9.8 | 9.80E-07 | C | HOC |
| Aroclor 1232 | ug/kg | 9.8 | 9.80E-07 | C | HOC |
| Aroclor 1242 | ug/kg | 9.8 | 9.80E-07 | A | HOC |
| Aroclor 1248 | ug/kg | 98 | 9.80E-06 | X | HOC |
| Aroclor 1254 | ug/kg | 150 | 1.50E-05 | X | HOC |
| Aroclor 1260 | ug/kg | 61 | 6.10E-06 | A | HOC |
| Pesticides | | | | | |
| 4,4'-DDD | ug/kg | 16 | 1.60E-06 | A | HOC |
| 4,4'-DDE | ug/kg | 16 | 1.60E-06 | A | HOC |
| 4,4'-DDT | ug/kg | 16 | 1.60E-06 | X | HOC |
| Aldrin | ug/kg | 8.2 | 8.20E-07 | X | HOC |
| alpha-BHC | ug/kg | 8.2 | 8.20E-07 | B | HOC |
| beta-BHC | ug/kg | 8.2 | 8.20E-07 | C | HOC |
| cis-Chlordane | ug/kg | 19 | 1.90E-06 | X | HOC |
| delta-BHC | ug/kg | 110 | 1.10E-05 | B | HOC |
| Dieldrin | ug/kg | 57 | 5.70E-06 | X | HOC |
| Endosulfan I | ug/kg | 14 | 1.40E-06 | X | HOC |
| Endosulfan II | ug/kg | 16 | 1.60E-06 | X | HOC |
| Endosulfan Sulfate | ug/kg | 72 | 7.20E-06 | X | HOC |
| Endrin | ug/kg | 25 | 2.50E-06 | X | HOC |
| Endrin Aldehyde | ug/kg | 16 | 1.60E-06 | No Data | HOC |
| gamma-BHC (Lindane) | ug/kg | 8.2 | 8.20E-07 | X | HOC |
| Heptachlor | ug/kg | 8.2 | 8.20E-07 | X | HOC |
| Heptachlor Epoxide | ug/kg | 8.2 | 8.20E-07 | A | HOC |
| Toxaphene | ug/kg | 820 | 8.20E-05 | X | HOC |
| trans-Chlordane | ug/kg | 1,100 | 1.10E-04 | A | HOC |
| Polychlorinated dibenzo-p-dioxin | | | | | |
| 2,3,7,8-TCDD | pg/g | 2.35 | 2.35E-04 | X | HOC |
| Inorganic Parameters | | | | | |
| Total Cyanide | mg/kg | 1.42 | 1.42E-04 | B | Non-Organic |

Note1: Parameters analyzed as VOCs and Semi-VOCs use only one value - selection based on max detect value or min RL (if ND)

Note2:
Tox. Cat. from HSDB or ECOTOX
HOC: Halogenated
C-H: Carbon-Hydrogen
PAH: Polyaromatic Hydrocarbons



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Table 11. Land Disposal Restriction Evaluation (Fire Mountain Farms)
(WAC 173-303-100 and WAC 173-303-140)

| Toxicity Critiera (Book Designation) | | | | Persistence Criteria | | | | Organic/Carbonaceous Criteria Restriction | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Toxic Cat. | Newaukum Prairie | Big Hanaford | Burnt Ridge | Persistence Cat. | Newaukum Prairie | Big Hanaford | Burnt Ridge | Sum Org./Carb % | Newaukum Prairie | Big Hanaford | Burnt Ridge |
| X (Sum%) | 0.402% | 0.541% | 0.565% | Sum HOC% | 0.15% | 0.46% | 0.13% | Sum% | 2.14% | 10.26% | 0.49% |
| A (Sum %) | 1.568% | 1.707% | 0.058% | Sum PAH % | 0.05% | 0.09% | 0.05% | | | | |
| B (Sum %) | 0.446% | 0.603% | 0.377% | | | | | | | | |
| C (Sum %) | 3.154% | 10.370% | 1.513% | | | | | | | | |
| D (Sum %) | 11.624% | 11.786% | 10.487% | | | | | | | | |
| EC (%) | 0.568% | 0.729% | 0.577% | | | | | | | | |
| Toxicity Designation | DW (WT02) | DW (WT02) | DW (WT02) | Persistence Designation | DW (WP02) | DW (WP02) | DW (WP02) | >10%? | No | Yes | No |
| Land Disposal Restriction (WAC-173-303-140) | No | No | No | Land Disposal Restriction (WAC-173-303-140) | No | No | No | Land Disposal Restriction (WAC-173-303-140) | No | No | No |

Table 12. Comparison of Detected Concentrations of Organics and Metals in FMF Sludge to U.S. EPA National Sewage Sludge Survey (NSSS) Dataset and WAC 173-308-160 (Biosolids Pollutant Limits)

| | | Max Concentration (non-detections shown as < RL) | | | WAC 173-308-160 | | USEPA National Sewage Sludge Survey Data | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Round 1 (1992)[See Note 2] | | | Round 2 (1996)[See Note 3] | | | |
| DETECTED PARAMETERS[See Note 1] | UNITS | Newaukum Prairie | Big Hanaford | Burnt Ridge | Ceiling Limit | Pollutant Limit | Percent Detection | Mean | Standard Deviation (SD) | Percent Detection | Mean (ND = Zero) | 50th Percentile (ND = Zero) | Mean (ND - Min Level) |
| VOCs | | | | | | | | | | | | | |
| Ethylbenzene | ug/kg | 4.6 | <780 | <1.8 | | | No Data | No Data | No Data | 4% | 24.80 | 0.00 | 995.0 |
| Toluene | ug/kg | 150,000 | 120,000 | 35 | | | No Data | No Data | No Data | 61% | 40,800 | 92,400 | 41,300 |
| Metals | | | | | | | | | | | | | |
| Cadmium | mg/kg | <3 | 2 | 3 | 85 | 39 | 69% | 7.18 | 0.78 | No Data | No Data | No Data | No Data |
| Chromium | mg/kg | 27 | 29 | 45 | | | 91% | 124 | 34 | No Data | No Data | No Data | No Data |
| Cobalt | mg/kg | 89 | 165 | 48 | | | No Data | No Data | | 9% | 1.15 | 0.00 | 24 |
| Copper | mg/kg | 503 | 521 | 417 | 4,300 | 1,500 | 100% | 724 | 110 | No Data | No Data | No Data | No Data |
| Lead | mg/kg | <30 | 30 | 40 | 840 | 300 | 80% | 131 | 20 | No Data | No Data | No Data | No Data |
| Molybdenum | mg/kg | 14 | 15 | 16 | 75 | | 53% | 9.63 | 2.03 | No Data | No Data | No Data | No Data |
| Nickel | mg/kg | 30 | 42 | 45 | 420 | 420 | 67% | 46 | 12.3 | No Data | No Data | No Data | No Data |
| Silver | mg/kg | <4 | 6 | 6 | | | No Data | No Data | | No Data | No Data | No Data | No Data |
| Zinc | mg/kg | 1,060 | 1,100 | 969 | 7,500 | 2,800 | 100% | 1,220 | 151 | No Data | No Data | No Data | No Data |
| Mercury | mg/kg | 1.2 | 3 | 1.9 | 57 | 17 | 64% | 5.3 | 2.03 | No Data | No Data | No Data | No Data |
| Semi-VOCs | | | | | | | | | | | | | |
| 1,4-Dichlorobenzene | ug/kg | 750 | 1,300 | 540 | | | No Data | No Data | No Data | 2% | 88.90 | 0.00 | 9,720 |
| 4-Methylphenol | ug/kg | 2,600 | 720,000 | 1,100 | | | No Data | No Data | No Data | 43% | 46,200 | 202,000 | 52,300 |
| Benzo(b)fluoranthene | ug/kg | 360 | <570 | 380 | | | No Data | No Data | No Data | 6% | 181 | 0.0 | 9,830 |
| Benzo(k)fluoranthene | ug/kg | 340 | <570 | 360 | | | No Data | No Data | No Data | 4% | 136 | 0.0 | 9,790 |
| bis(2-Ethylhexyl)phthalate | ug/kg | 20,000 | 25,000 | 12,000 | | | 63% | 73,600 | 46,400 | 62% | 50,500 | 148,000 | 55,800 |
| Fluoranthene | ug/kg | 560 | 640 | 450 | | | No Data | No Data | No Data | 5% | 331 | 0.0 | 9,950 |
| N-Nitrosodiphenylamine | ug/kg | <300 | 1,200 | <260 | | | No Data | No Data | No Data | 1% | 101 | 0.0 | 19,400 |
| Indeno(1,2,3-cd)pyrene | ug/kg | 470 | <580 | 400 | | | No Data | No Data | No Data | 0% | 0.0 | 0.0 | 19,400 |
| Phenanthrene | ug/kg | 440 | <580 | <260 | | | No Data | No Data | No Data | No Data | No Data | No Data | No Data |
| Phenol | ug/kg | 630 | 23,000 | <260 | | | No Data | No Data | No Data | 34% | 12,200 | 0.0 | 18,700 |
| Pyrene | ug/kg | 450 | <580 | 390 | | | No Data | No Data | No Data | 5% | 320 | 0.0 | 9,950 |
| Other | | | | | | | | | | | | | |
| Aroclor 1260 | ug/kg | 40 | 35 | 61 | | | 10% | 62.3 (307) | 35.1 (43.80) | 10% | 97.20 | 0.00 | 337 |
| 2,3,7,8-TCDD[See Note 4] | pg/g | 2.76 | 0.72 | 2.35 | | | No Data | No Data | No Data | 16% | 1.71 | 0.00 | 10.80 |
| Total Cyanide | mg/kg | 1.87 | 2.39 | 1.42 | | | No Data | No Data | No Data | 37% | 14.30 | 0.00 | 35.20 |

Note 1 Shaded parameters and concentrations are above the mean values measured in the USEPA National Sewage Sludge Survey
None of the metals regulated under Washington State Biosolids Management rule had concentrations exceeding the State's limits (Chapter WAC 173-308-160)

Note 2 Values are from Tables 7-9 and 7-10 (U.S. EAP, 1992 Statistical Support Documentation for the 40 CFR, Part 503 - Final Standards for the Use or Disposal of Sewage Sludge)
For all parameters with detection frequency (df) > 10%, mean value is based on the "Multi-Censored, Maximum-Likelihood Method" under an assumption of a log normal distribution
df </= 10%, mean value based on a non-parammetric method. Lower values for Aroclor 1260 assume non-detects = zero and higher value assumes non-detects = reporting limit

Note 3 Tables 3 and 4 in Appendix B (U.S. EPA, 1996 Technical Support Document for the Round Two Sewage Sludge Pollutants)

Note 4 2,3,7,8-TCDD were flagged by the analytical laboratory as Estimated Maximum Possible Concentration (JEMPC) due to sludge matrix and moisture content.
JEMPC data is not considered sufficiently accurate to serve as a basis for regulatory decisions.

Table 13. Parameter Exceedance Factors in Composite Sludge Samples from Fire Mountain Farms, Inc. (Exceedance of the NSSS mean)

| | | | Exccedance Factors in Composite Sluge Samples | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Newaukum Prairie | | | Big Hanaford | | | Burnt Ridge | | |
| Parameter | Units | NSSS Mean | Comp-1 | Comp-2 | Comp-3 | Comp-1 | Comp-2 | Comp-3 | Comp-1 | Comp-2 | Comp-3 |
| Toluene | ug/kg | 40,800 | 3.4 | 3.7 | 3.2 | 0.2 | 2.9 | 2.0 | 0.00 | 0.00 | 0.00 |
| Cobalt | mg/kg | 1.15 | 66.1 | 75.7 | 77.4 | 13.0 | 55.7 | 143.5 | 37.4 | 41.7 | 32.2 |
| Molybdenum | mg/kg | 9.63 | 1.2 | 1.3 | 1.5 | 1.2 | 1.6 | 1.3 | 1.5 | 1.7 | 1.7 |
| 4-Methylphenol | ug/kg | 46,200 | 0.05 | 0.05 | 0.06 | 10.4 | 15.6 | 11.7 | 0.02 | 0.01 | 0.01 |
| Phenol | ug/kg | 12,200 | 0.04 | 0.05 | 0.03 | 1.1 | 1.9 | 1.3 | ND | ND | ND |

Exceedance Factor = NSSS Mean/Analytical Results.

Shaded = Exceedance Factor > 1  (analytical results are higher than the NSSS Mean value)

Only the Parameters with EF >1 in one or more samples from one or more sites are shown

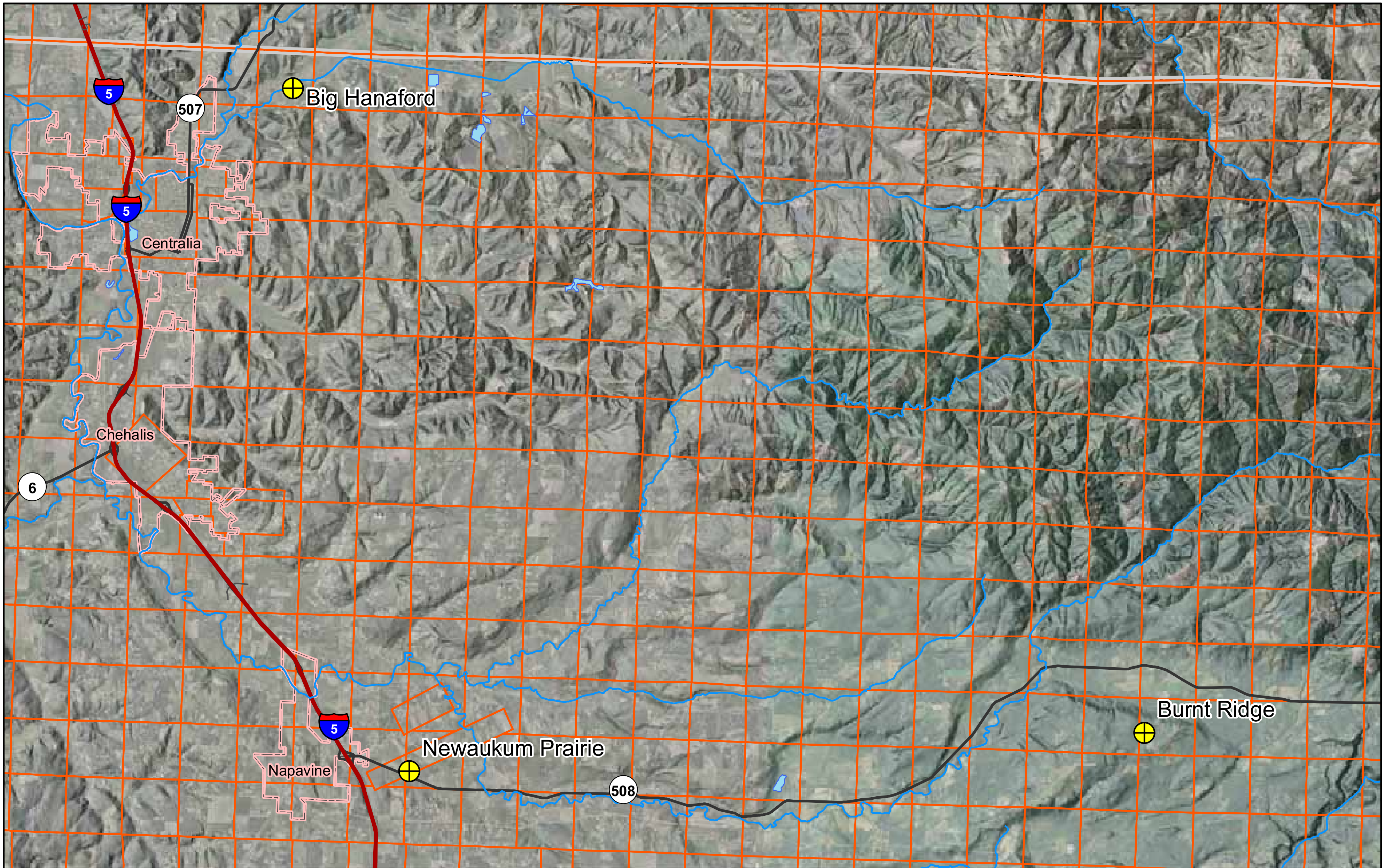


Figure 1
Fire Mountain Farm
Sampling Sites

0 Feet 10,000
0 Miles 2

K:\Linton\FireMtn_JW9901\GIS\FireMtFarmSites.mxd 6/18/2014

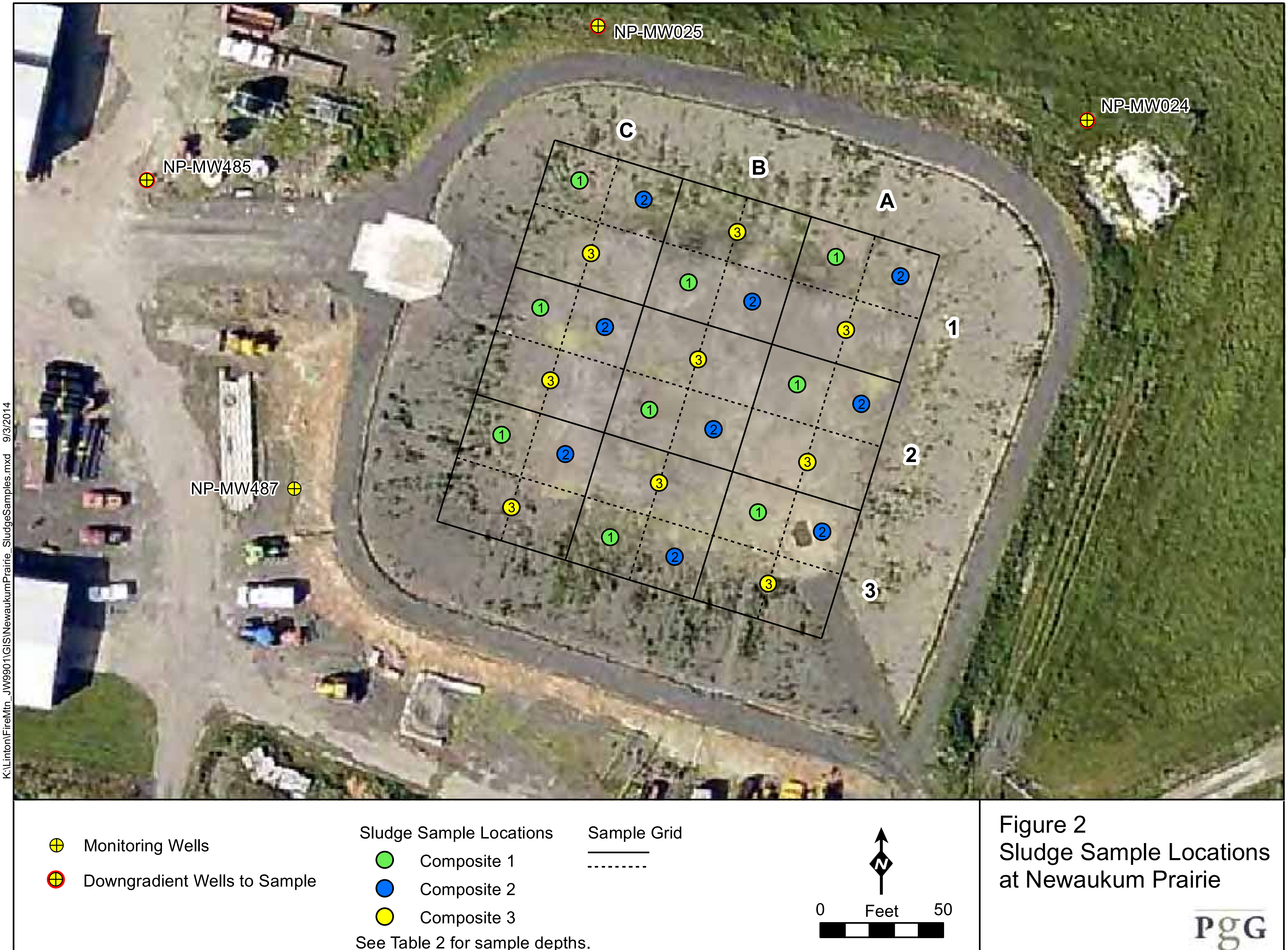


Figure 2
Sludge Sample Locations
at Newaukum Prairie

PgG

K:\Linton\FireMtn_JW9901\GIS\NewaukumPrairie_SludgeSamples.mxd 9/3/2014


Sludge Sample Locations

- Composite 1
- Composite 2
- Composite 3
- Sample Grid

See Table 2 for sample depths.

N

0 Feet 50

Figure 3
Sludge Sample Locations
at Big Hanaford

PgG

K:\Linton\FireMtn_JW9901\GIS\BigHanford_SludgeSamples.mxd 9/3/2014

# Figure 4
## Sludge Sample Locations at Burnt Ridge

PgG


Sludge Sample Locations
- Composite 1
- Composite 2
- Composite 3

Sample Grid

- Monitoring Wells
- Downgradient Wells to Sample

See Table 2 for sample depths.

N

0 Feet 50

K:\Linton\FireMtn_JW9901\GIS\BurntRidgeRanch_SludgeSamples.mxd 9/3/2014

# Figure 5
## Water Cap Sample Locations at Burnt Ridge

PgG


Water Sample Locations

Sample Grid

Monitoring Wells

Downgradient Wells to Sample

N

0 Feet 50

K:\Linton\FireMtn_JW9901\GIS\BurntRidgeRanch_LagoonWaterSamples.mxd 8/26/2014

# APPENDIX A
# QUALITY ASSURANCE AND QUALITY CONTROL

Analytical data collected for this investigation have been validated in accordance with the QAPP, including both laboratory and field quality assurance quality control procedures (PGG, 2014). Tables A1 through A4 provide a summary of the quality assurance and quality control evaluation for each site

Sludge samples from the Newaukum Prairie, Big Hanaford, and Burnt Ridge storage sites were collected and delivered to Analytical Resources, Inc. (ARI) on July 7, through July 9, 2014. Water cap samples from the Burnt Ridge site were collected and delivered to Analytical Resources, Inc. (ARI) on July 17, 2014. Fecal coliform sludge samples were collected on July 7, through July 9, 2014 and run by Water Management Laboratories, Inc.

All analyses were completed within their respective holding times. Surrogate spikes, blank spikes, and standard references were added to samples for analyses, and recoveries were all within acceptable ranges. Method blanks were run for all analytes and no analytes were detected. Trip Blanks were submitted and analyzed for volatile constituents and none were detected. The Relative Percent Differences (RPD) for all matrix spike duplicates were generally within the required limits with exceptions noted below.

The QA/QC data are satisfactory and indicate that the data are acceptable for the projects purposes. The following irregularities are noted:

- Dioxin/Furan concentrations in the Fire Mountain Farms sludge samples were less than the lab reporting limit (RL), also referred to as the practical quantitation limit (PQL). To meet project purposes, PGG requested that the lab quantify concentrations less than the RL and above the method detection limit (MDL) instead of reporting the results as non-detect at the RL. Following standard procedure, Analytical Resources Incorporated (ARI) flagged all dioxin/furan concentrations between the RL and the MDL as estimated maximum possible concentration (JEMPC).

- Total Solids analysis were not run for lab batch YR29 (Big Hanaford sludge samples for VOC analysis). As authorized by PGG, ARI reported the VOC data using the total solids from samples associated with lab batch YQ99 (Big Hanaford sludge samples for SVOC, Dioxin/Furans, metals, pH, PCBs, Pesticides, and TKN).

- Laboratory Control Samples (LCS) were run for all batches and spike recovery for dibenz (a,h) anthracene was out of control low for all batches. All other spike recoveries were within laboratory control limits. dibenz (a,h) anthracene was not detected in any of the samples.

- Continuing calibrations for 2x dilution pesticides batches YQ84, YQ99, and YR00 were out of control low, reported data were in control.

- Continuing calibrations for semi-volatile batches YQ84, YQ99, and YR00 were out of control low; these compounds were not detected in any samples.

- The reporting limits for various batches and analyses were elevated resulting from sample dilutions. Semi-volatile reporting limits for batches YQ99 and YR00 were elevated due to sample dilutions resulting from matrix interference. Pesticide reporting limits for batches YQ84, YQ99 and YR00 were elevated due to sample dilutions resulting from matrix interference.

- Matrix spike was out of control high for mercury in lab batch YQ99 no other irregularities with this analysis.

- Matrix spike was out of control low for total cyanide in lab batch YQ84 no other irregularities with this analysis.

- Matrix spike relative percent difference was outside the laboratory control limits for lab batch YQ99, cobalt in sample BH-COMP1. All other analytes were in control and there were no other irregularities with this analysis.

- Continuing calibration was out of control low for batches YQ80, YQ96, and YR29, VOC analyses, bromomethane. All other constituents were in control, there were no other irregularities.

- Surrogate recoveries for d8-toluene in samples NP-COMP-2 and NP-COMP-3 were out of control low, samples were reanalyzed, and surrogate recoveries were in control.

- The matrix spike duplicate for 1,2,4-Trichlorobenzen in lab batch YQ80 was out of control low. All other recoveries were in control, and there were no other irregularities with the analyses.

- Continuing calibration was out of control low for lab batch YS17, 3,3-Dichlorobenzidine. All other analytes were in control, there were no other irregularities.

- Matrix spike matrix spike duplicate relative percent difference was low for lab batch YS17 nitrate/nitrite, water cap sample BR-COMP.

Table A1. Quality Assurance Quality Control Summary for Sludge Samples at Newaukum Prairie

| LAB BATCH ID | yq80 | yq84 | yq84 | yq84 | yq84 | yq84 | yq84 | yq84 | yq84 | yq84 | | yq84 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **METHODOLOGY** | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge |
| Method | VOCS SW8260 | SVOCS SW8270 | Metals | Nitrate/Nitrite | PCBs Aroclor | Pesticides | TKN | Total Solids | pH | 2,3,7,8 TCDD | Total Coliform | Total cyanide |
| Date Sampled | July 7, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 7, 2014 | July 9, 2014 |
| Date Extracted | July 14, 2014 | July 14, 2014 | July 10, 2014 | July 10, 2014 | July 16, 2014 | July 14, 2014 | July 10, 2014 | July 10, 2014 | July 9, 2014 | September 1, 2014 | July 7, 2014 | July 21, 2014 |
| Date Analyzed | July 14, 2014 | July 17, 2014 | July 14, 2014 | July 10, 2014 | July 20, 2014 | 7/17/2014-7/19/2014 | July 10, 2014 | July 10, 2014 | July 9, 2014 | September 4, 2014 | July 7, 2014 | July 21, 2014 |
| Holding Time | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good |
| Acceptability | Good | Good, continuing calibration is out of control low. | Good | Good | Good | Good, raised reporting limits due to sample dilution. | Good | Good | Good | Concentrations between PQL/RL and MDL flagged as estimated | Good | Good |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **SURROGATE SPIKES/Standard Reference Results (Conventionals)/Blank Spikes (metals)** | | | | | | | | | | | | |
| Sample Spike Recovery | Within Range | Within Range | Within Range | Within Range | Within Range | Within Range | NA | NA | NA | NA | NA | Within Range |
| Acceptability | Good | Good | Good | Good | Good | Good | NA | NA | NA | NA | NA | Good |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **MS/MSD** | | | | | | | | | | | | |
| MS Recovery | Within Range | NA | NA | Within Range | NA | NA | NA | NA | NA | NA | NA | Within Range |
| DMS Recovery | Within Range (out of control low 1,2,4 trichlorobenzene) | NA | NA | Within Range | NA | NA | NA | NA | NA | NA | NA | Within Range, matrix spike recovery for total cyanide was out of cotrol low, all other spike recoveries were within lab control limits. |
| Surrogate Recovery | Within Range | NA | NA | Within Range | NA | NA | NA | NA | NA | NA | NA | Within Range |
| RPD | Within Range | NA | NA | Within Range | NA | NA | NA | NA | NA | NA | NA | Within Range |
| Acceptability | Good | NA | NA | Good | NA | NA | NA | NA | NA | NA | NA | Good |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **METHOD BLANK** | | | | | | | | | | | | |
| Detections | None | None | None | None | None | None | None | None | NA | None | NA | None |
| Acceptability | Good | Good | Good | Good | Good | Good | Good | Good | NA | Good | NA | Good |
| | | | | | | | | | | | | |
| **TRIP BLANK** | | | | | | | | | | | | |
| Detections | None | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | Good | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| **FIELD BLANK** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Detections | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| **FIELD DUPLICATES** | | | | | | | | | | | | |
| Sample: | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| RPD | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| **LAB DUPLICATES** | | | | | | | | | | | | |
| RPD | NA | NA | NA | Within Range | NA | NA | NA | NA | Within Range | NA | NA | Within Range |
| Acceptability | NA | NA | NA | Good | NA | NA | NA | NA | Good | NA | NA | Good |
| | | | | | | | | | | | | |
| **LAB CONTROL** | | | | | | | | | | | | |
| Spike Recovery | Within Range | Within Range, LCS/LCSD spike recovery is out of control low for dibenz (a,h) anthracene, all other recoveries were in control. | Within Range | NA | NA | Within Range | Within Range | NA | Within Range | Within Range | NA | NA |
| Surrogate Recovery | Within Range | Within Range | Within Range | NA | NA | Within Range | Within Range | NA | Within Range | Within Range | NA | NA |
| Acceptability | Good | Good | Good | NA | NA | Good | Good | NA | Good | Good | NA | NA |
| | | | | | | | | | | | | |
| **COC** | | | | | | | | | | | | |
| Acceptability | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good |

1. All other QA/QC = good, samples not flagged
2. RPD >30%, Samples "J" Flagged
RPD = 2 x (C1 - C2) x 100/(C1 + C2)

Table A2. Quality Assurance Quality Control Summary for Sludge Samples at Big Hanaford

| **LAB BATCH ID** | yr29 | yq99 | yq99 | yq99 | yq99 | yq99 | yq99 | yq99 | yq99 | yq99 | | yq99 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **METHODOLOGY** | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge |
| Method | VOCS SW8260 | SVOCS SW8270 | Metals | Nitrate/Nitrite | PCBs Aroclor | Pesticides | TKN | Total Solids | pH | 2,3,7,8 TCDD | Total Coliform | Total cyanide |
| Date Sampled | July 8, 2014 | July 8, 2014 | July 7, 2014 | July 8, 2014 | July 8, 2014 | July 8, 2014 | July 8, 2014 | July 8, 2014 | July 8, 2014 | July 8, 2014 | July 8, 2014 | July 8, 2014 |
| Date Extracted | July 15, 2014 | July 14, 2014 | July 11, 2014 | July 10, 2014 | July 16, 2014 | July 14, 2014 | July 10, 2014 | July 14, 2014 | July 14, 2014 | September 1, 2014 | July 8, 2014 | July 21, 2014 |
| Date Analyzed | July 15, 2014 | July 17, 2014 | July 15, 2014 | July 10, 2014 | July 20, 2014 | July 19, 2014 | July 10, 2014 | July 14, 2014 | July 14, 2014 | September 4, 2014 | July 8, 2014 | July 21, 2014 |
| Holding Time | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good |
| Acceptability | Good | Good, continuing calibration is out of control low. | Good | Good | Good | Good, raised reporting limits due to sample dilution. | Good | Good | Good | Concentrations between PQL/RL and MDL flagged as estimated | Good | Good |
| **SURROGATE SPIKES/Standard Reference Results (Conventionals)/Blank Spikes (metals)** | | | | | | | | | | | | |
| Sample Spike Recovery | Within Range | Within Range | Within Range | Within Range | Within Range | Within Range | Within Range | NA | NA | NA | NA | Within Range |
| Acceptability | Good | Good | Good | Good | Good | Good | Good | NA | NA | NA | NA | Good |
| **MS/MSD** | | | | | | | | | | | | |
| MS Recovery | NA | NA | Within Range , Matrix spike recovery was outside laboratory recovery limits for mercury, all other spike recoveries were within control limits. | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| DMS Recovery | NA | NA | Within Range | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Surrogate Recovery | NA | NA | Within Range | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| RPD | NA | NA | Within Range except the following; MS RPD cadmium 66.7%. Cobalt 30.8%, lead 40%, silver 40% | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | NA | NA | Good | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **METHOD BLANK** | | | | | | | | | | | | |
| Detections | None | None | None | None | None | None | None | None | NA | None | NA | None |
| Acceptability | Good | Good | Good | Good | Good | Good | Good | Good | NA | Good | NA | Good |
| **TRIP BLANK** | | | | | | | | | | | | |
| Detections | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **FIELD BLANK** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Detections | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **FIELD DUPLICATES** | | | | | | | | | | | | |
| Sample: | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| RPD | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **LAB DUPLICATES** | | | | | | | | | | | | |
| RPD | NA | NA | NA | NA | NA | NA | NA | Within Range | Within Range | NA | NA | Within Range |
| Acceptability | NA | NA | NA | NA | NA | NA | NA | Good | Good | NA | NA | Good |
| **LAB CONTROL** | | | | | | | | | | | | |
| Spike Recovery | Within Range | Within Range, LCS/LCSD spike recovery is out of control low for dibenz (a,h) anthracene, all other recoveries were in control. | NA | NA | Within Range | Within Range | Within Range | NA | Within Range | Within Range | NA | NA |
| Surrogate Recovery | Within Range | Within Range | NA | NA | Within Range | Within Range | Within Range | NA | Within Range | Within Range | NA | NA |
| Acceptability | Good | Good | NA | NA | Good | Good | Good | NA | Good | Good | NA | NA |
| **COC** | | | | | | | | | | | | |
| Acceptability | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good |

1. All other QA/QC = good, samples not flagged
2. RPD >30%, Samples "J" Flagged
RPD = 2 x (C1 - C2) x 100/(C1 + C2)

Table A3. Quality Assurance Quality Control Summary for Sludge Samples at Burnt Ridge

| LAB BATCH ID | yq96 | yr00 | yr00 | yr00 | yr00 | yr00 | yr00 | yr00 | yr00 | yr00 | | yr00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **METHODOLOGY** | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge |
| Method | VOCS SW8260 | SVOCS SW8270 | Metals | Nitrate/Nitrite | PCBs Aroclor | Pesticides | TKN | Total Solids | pH | 2,3,7,8 TCDD | Total Coliform | Total cyanide |
| Date Sampled | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 |
| Date Extracted | July 15, 2014 | July 14, 2014 | July 11, 2014 | July 10, 2014 | July 16, 2014 | July 14, 2014 | July 10, 2014 | July 14, 2014 | July 14, 2014 | September 1, 2014 | July 9, 2014 | July 21, 2014 |
| Date Analyzed | July 15, 2014 | July 17, 2014 | July 15, 2014 | July 10, 2014 | July 20, 2014 | 7/18/2014-7/19/2014 | July 10, 2014 | July 14, 2014 | July 14, 2014 | September 4, 2014 | July 9, 2014 | July 21, 2014 |
| Holding Time | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good |
| Acceptability | Good | Good, continuing calibration is out of control low. | Good | Good | Good | Good, raised reporting limits due to sample dilution. | Good | Good | Good | Concentrations between PQL/RL and MDL flagged as estimated | Good | Good |
| **SURROGATE SPIKES/Standard Reference Results (Conventionals)/Blank Spikes (metals)** | | | | | | | | | | | | |
| Sample Spike Recovery | Within Range | Within Range | Within Range | Within Range | Within Range | Within Range | Within Range | NA | NA | NA | NA | Within Range |
| Acceptability | Good | Good | Good | Good | Good | Good | Good | NA | NA | NA | NA | Good |
| **MS/MSD** | | | | | | | | | | | | |
| MS Recovery | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| DMS Recovery | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Surrogate Recovery | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| RPD | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **METHOD BLANK** | | | | | | | | | | | | |
| Detections | None | None | None | None | None | None | None | None | NA | None | NA | None |
| Acceptability | Good | Good | Good | Good | Good | Good | Good | Good | NA | Good | NA | Good |
| **TRIP BLANK** | | | | | | | | | | | | |
| Detections | None | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | Good | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **FIELD BLANK** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Detections | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **FIELD DUPLICATES** | | | | | | | | | | | | |
| Sample: | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| RPD | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **LAB DUPLICATES** | | | | | | | | | | | | |
| RPD | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **LAB CONTROL** | | | | | | | | | | | | |
| Spike Recovery | Within Range | Within Range, LCS/LCSD spike recovery is out of control low for dibenz (a,h) anthracene, all other recoveries were in control. | NA | NA | Within Range | Within Range | Within Range | NA | Within Range | Within Range | NA | NA |
| Surrogate Recovery | Within Range | Within Range | NA | NA | Within Range | Within Range | Within Range | NA | Within Range | Within Range | NA | NA |
| Acceptability | Good | Good | NA | NA | Good | Good | Good | NA | Good | Good | NA | NA |
| **COC** | | | | | | | | | | | | |
| Acceptability | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good |

1. All other QA/QC = good, samples not flagged
2. RPD >30%, Samples "J" Flagged
RPD = 2 x (C1 - C2) x 100/(C1 + C2)

Table A4. Quality Assurance Quality Control Summary for Water Cap Samples at Big Hanaford

| **BATCH** | ys16 | ys17 | ys17 | ys17 | ys17 |
|---|---|---|---|---|---|
| **METHODOLOGY** | Watercap | Watercap | Watercap | Watercap | Watercap |
| Method | VOCS SW8260 | SVOCS SW8270 | Metals | Nitrate/Nitrite | Total cyanide |
| Date Sampled | July 17, 2014 | July 17, 2014 | July 17, 2014 | July 17, 2014 | July 17, 2014 |
| Date Extracted | July 25, 2014 | July 21, 2014 | July 21, 2014 | 7/18/2014-7/23/2014 | July 28, 2014 |
| Date Analyzed | July 25, 2014 | July 23, 2014 | 7/22/2014-7/24/2014 | 7/18/2014-7/23/2014 | July 28, 2014 |
| Holding Time | Good | Good | Good | Good | Good |
| Acceptability | Good | Good | Good | Good | Good |
| | | | | | |
| | | | | | |
| **SURROGATE SPIKES/Standard Reference Results (Conventionals)/Blank Spikes (metals)** | | | | | |
| Sample Spike Recovery | Within Range | Within Range | Within Range | Within Range | Within Range |
| Acceptability | Good | Good | Good | Good | Good |
| | | | | | |
| | | | | | |
| **MS/MSD** | | | | | |
| MS Recovery | NA | NA | NA | Within Range, Matrix spike matrix spike duplicate relative percent difference was low for lab batch YS17 nitrate/nitrite, water cap sample BR-COMP. | Within Range |
| DMS Recovery | NA | NA | NA | Within Range | Within Range |
| Surrogate Recovery | NA | NA | NA | Within Range | Within Range |
| RPD | NA | NA | NA | Within Range | Within Range |
| Acceptability | NA | NA | NA | Good | Good |
| | | | | | |
| | | | | | |
| **METHOD BLANK** | | | | | |
| Detections | None | None | None | None | None |
| Acceptability | Good | Good | Good | Good | Good |
| | | | | | |
| **LAB DUPLICATES** | | | | | |
| RPD | NA | NA | NA | Within Range | Within Range |
| Acceptability | NA | NA | NA | Good | Good |
| | | | | | |
| **LAB CONTROL** | | | | | |
| Spike Recovery | Within Range | Within Range | Within Range | NA | NA |
| Surrogate Recovery | Within Range | Within Range | Within Range | NA | NA |
| Acceptability | Good | Good | Good | NA | NA |
| | | | | | |
| **COC** | | | | | |
| Acceptability | Good | Good | Good | Good | Good |
| | | | | | |
| | | | | | |

1. All other QA/QC = good, samples not flagged
2. RPD >30%, Samples "J" Flagged
RPD = 2 x (C1 - C2) x 100/(C1 + C2)

# APPENDI B
# FIELD PHOTOS

**Field Photos from Burnt Ridge Site:**

**Field Photos from Newaukum Prairie Site:**

**Field Photos from Big Hanaford Site:**

# APPENDI C
# LABORATORY REPORTS

Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units, Lewis County, Washington (Landau Associates, Inc. July 2017)

# Waste Characterization Plan
# Fire Mountain Farms
# Mixed Material Storage Units
# Lewis County, Washington

Revision 3
July 27, 2017

Prepared for

Perkins Coie LLP
Emerald Kalama Chemical, LLC

LANDAU ASSOCIATES

# Waste Characterization Plan
# Fire Mountain Farms Mixed Material Storage Units
# Lewis County, Washington

This document was prepared by, or under the direct supervision of, the technical professionals noted below.

Document prepared by: ______________________ Allison Bergseng, PE
Senior Project Engineer

Document reviewed by: ______________________ Kristy J. Hendrickson, PE
Principal

| | |
|---|---|
| Date: | July 27, 2017 |
| Project No.: | 0066045.040 |
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| Project Coordinator: | kes |

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# APPENDICES

# LIST OF ABBREVIATIONS AND ACRONYMS

2,3,7,8-TCDD ........ 2,3,7,8-tetrachlorodibenzodioxin
AMSA ........ Association of Metropolitan Sewerage Agencies
biosolids........ sewage sludge from municipal wastewater treatment or septage
°C........ degrees Celsius
cy........ cubic yards
DRAS ........ Delisting Risk Assessment Software
EC ........ equivalent concentration
Ecology ........ Washington State Department of Ecology
Emerald ........ Emerald Kalama Chemical, LLC
EPA........ U.S. Environmental Protection Agency
FMF ........ Fire Mountain Farms
ft........ feet, foot
GCL........ geosynthetic clay liner
GPS........ global positioning system
HASP........ health and safety plan
HDPE ........ high-density polyethylene
HOC........ halogenated organic compound
IWBS........ industrial wastewater treatment biological solids
LAI ........ Landau Associates, Inc.
LDR........ land disposal restriction
µg/kg........ microgram per kilogram
mg/L........ milligram per liter
mixed material ........ mixture of industrial wastewater treatment biological solids, biosolids, and wastewater-generated material from other sources
NPDES ........ National Pollutant Discharge Elimination System
PAH ........ polycyclic aromatic hydrocarbon
PCB........ polychlorinated biphenyl
PDL........ preliminary delisting level
Perkins ........ Perkins Coie LLP
PGG ........ Pacific Groundwater Group
POTW ........ publicly owned treatment works
ppm........ parts per million
QAPP ........ Quality Assurance Project Plan
RCRA ........ Resource Conservation and Recovery Act
RL........ reporting limit
sf ........ square feet
SM........ standard method
SVOC ........ semivolatile organic compound
SWTS........ secondary wastewater treatment solids
TCLP ........ toxicity characteristic leaching procedure
TCLP list........ Toxicity Characteristics List
TCLP-PDL ........ preliminary delisting level for protection of groundwater using toxicity characteristic leaching procedure

# LIST OF ABBREVIATIONS AND ACRONYMS (CONT.)

TEQ……………………………………………………………………………………… ............toxicity equivalence
TKN.........................................................................................Total Kjeldahl Nitrogen
TNSSS .............................................................Targeted National Sewage Sludge Survey
VOC ......................................................................................... volatile organic compound
WTSS ....................................................................wastewater treatment system solids
WWTP ...................................................................................wastewater treatment plant

# 1.0 INTRODUCTION

Landau Associates, Inc. (LAI) was retained by Perkins Coie LLP (Perkins) on behalf of Emerald Kalama Chemical, LLC (Emerald), to provide technical support and environmental services related to Administrative Order No. 10938 (Administrative Order) issued by the Washington State Department of Ecology (Ecology) to Emerald and Fire Mountain Farms, Inc. (FMF) (Ecology 2014) and the Agreement for Conditional Compliance with Ecology Administrative Order No 10938 During Judicial Review (Agreement) between Ecology, Emerald, and FMF, dated June 3, 2016 (Ecology 2016a).

According to Ecology, three storage units located at Newaukum Prairie, Burnt Ridge, and Big Hanaford, which are owned and operated by FMF, received industrial wastewater treatment biological solids (IWBS) from Emerald that are a listed dangerous/hazardous waste. Ecology alleges that Emerald's IWBS carry two listed hazardous waste codes: U019 (benzene) and U220 (toluene). As part of the Agreement, Emerald and FMF will petition Ecology and the US Environmental Protection Agency (EPA) to delist the mixed material in the three storage units. Once the mixed material is delisted, it will be placed in a Subtitle D landfill. No other disposal option is proposed.

The three storage units were used to hold biosolids, IWBS, and wastewater-generated material from other sources. This material will be referred to in this plan as "mixed material." Eighty-two percent of the mixed material is comprised of biosolids from municipal wastewater treatment plants (WWTP); however, material from four non-municipal WWTP sources, exclusive of the IWBS, was also placed into the storage units. These four sources are described below. All of the sources of the mixed material in each storage unit are listed in Table 1.

- The Burnt Ridge storage unit was used to contain runoff from the livestock barn lot. The runoff material is cow manure diluted with water. Cow manure has long been applied to farm fields to replenish nitrogen and other nutrients that are required by crops. Based on the source, there are likely no chemicals of concern associated with the cow manure in the mixed material.
- The Burnt Ridge and Newaukum Prairie storage units accepted secondary wastewater treatment solids (SWTS) from the Darigold Chehalis facility. The Chehalis plant produces dry milk products. The SWTS have historically been applied to agricultural fields as a nitrogen supplement. Ecology approved the SWTS for beneficial use (BUD-SA-15-08). Based on a review of the Darigold products, the Ecology-issued National Pollutant Discharge Elimination System (NPDES) permit, and a comparison with the PGG analytical results; there are likely no chemicals of concern associated with the SWTS in the mixed material.
- Material from Bio Recycling, a company that treats septage, was stored in the Big Hanaford unit. Septage is defined by the EPA as "the liquid and solid material pumped from a septic tank, cesspool, or other primary treatment source." After the septage is processed, the resulting biosolids meet EPA's Class B standards and are permitted for land application by Ecology. Based on a review of the Bio Recycling process and comparison with the PGG analytical results, there are likely no chemicals of concern associated with the biosolids in the mixed material.

- Wastewater treatment system solids (WTSS) from the Port of Longview were placed in the Newaukum Prairie storage unit. The Port operates a small wastewater treatment system to provide primary treatment of the water that was used to clean the dock, conveyor system, and associated sumps at Berth 2. Berth 2 is used to transfer sodium carbonate, aluminum silicate (bentonite clay), soy meal, potassium salts (potash), dry distiller's grains, and magnesium silicate (talc) from railcars to ships. After loading, the dock and conveyor system are washed down with water. The water is directed to a series of tanks for pH adjustment, and solids settlement. The wastewater is sent to a municipal WWTP in accordance with State Waste Discharge Permit No. ST 6081. The WTSS are currently sent to a Subtitle D landfill. Based on a review of the materials transferred at Berth 2 and comparison with the PGG analytical results, there are likely no chemicals of concern associated with the WTSS in the mixed material.

This waste characterization sampling plan is being prepared in response to the Agreement for purposes of waste characterization in the context of delisting the mixed material at the three storage units. Data obtained via implementation of the waste characterization sampling plan will be used to supplement analytical results from a 2014 investigation conducted by Pacific Groundwater Group (PGG) for FMF (PGG 2014a), and to fill identified data gaps. Prior to development of this sampling plan, data gaps were identified by reviewing the existing PGG data. Toward this effort, the PGG analytical data were compared to the Preliminary Delisting Levels (PDLs) and the Toxicity Characteristic Screening Levels (TCLP-PDL x 20). The validity and appropriateness of the data were considered in the context of characterizing the comingled materials at the three FMF storage units, with respect to the delisting.

Additionally, the PGG data were compared to concentration-based Land Disposal Restriction (LDR) levels. This comparison was performed for the purpose of evaluating compliance with these criteria in the event the waste is delisted.

Based on our review, the PGG data are considered valid for comparison with the regulatory levels and thresholds. The samples were collected in accordance with the Ecology-approved Quality Assurance Project Plan (QAPP) (PGG 2014b). At each of two storage units – Burnt Ridge and Newaukum Prairie – PGG collected 27 grab samples from various locations and depths. Due to the difficulty in reaching the center of the Big Hanaford storage unit, only 18 grab samples were planned and collected. For samples from both Burnt Ridge and Newaukum Prairie, one composite sample was made from nine grab samples, resulting in three composite samples for each storage unit. At Big Hanaford, three composite samples were created, each consisting of six grab samples. The method of sample collection produced composite samples that are representative of the mixed material.

The list of analytes for which each of the mixed material samples was tested was extensive and went beyond the chemical classes that would be expected to be present based on the mixed waste sources and the listed hazardous waste codes associated with the mixed waste. This fact makes it unlikely that any chemical present at a significant concentration with respect to the cited delisting decision criteria would have been overlooked.

The mixed material in the Burnt Ridge and Newaukum Prairie storage units is relatively homogenous. FMF utilized two propeller-driven mixers and a recirculation pump at each location to mix and aerate the mixed material. In contrast, the mixed material is stratified at the Big Hanaford storage unit. To better characterize the stratified material at Big Hanaford, core samples will be collected from various depths under the proposed sampling plan.

The homogeneous nature of the material stored in the Burnt Ridge and Newaukum Prairie storage units is evident in the PGG sampling results. The composite samples collected from the Burnt Ridge and Newaukum Prairie storage units exhibit less variability in chemical concentrations than the Big Hanaford composite samples. This indicates that the Burnt Ridge and Newaukum Prairie units are more homogenous as compared with the Big Hanaford storage unit.

The analytical data from the sampling described in this plan combined with the existing analytical data will support the delisting petitions and are anticipated to demonstrate that material in the three storage units will comply with applicable requirements.

Burnt Ridge and Newaukum Prairie are both lined storage units intended to hold mixed material that have a water cap (composed of precipitation) and a submerged mixed material zone. Big Hanaford is a covered concrete storage unit that contains mixed material only.

Although the delisting process for the mixed material must follow the regulations provided in 40 CFR 260.20, it is important to document supportive information in order to provide perspective regarding similar materials, their uses, and the associated regulations.

The mixed material is primarily composed of municipal WWTP biosolids (between 77 and 86 percent by mass, depending upon the unit). Biosolids from municipal WWTP sources have been approved for use as soil amendments by the EPA and Ecology.

Between 6 and 17 percent of the mixed material originates from other sources that do not use or produce Resource Conservation and Recovery Act (RCRA)-listed chemicals; such as manure from livestock handling, dairy products for human consumption, septage treatment, and bulk material transfer. The wastewater treatment solids from the dairy operations have been granted a beneficial use determination by Ecology. The biosolids from the septage treatment facility meet EPA’s Class B standards and are permitted for land application by Ecology. The wastewater from the bulk material handling operation is sent to a municipal WWTP for secondary treatment and the solids from the primary treatment of the wastewater are disposed of in a subtitle D landfill.

The Emerald IWBS comprise between 5 and 8 percent of the mixed material by mass. Several fish bioassays have been performed on the IWBS; each time with zero mortality. On a routine basis, Emerald collected and analyzed 312 samples of the IWBS for various classes of chemicals including volatiles, semivolatiles, pesticides, and a number of inorganic parameters. The analytical data not only prove that the IWBS do not contain the chemicals associated with the RCRA waste codes in question, but are better from a chemical contaminant perspective than the municipal WWTP biosolids that are currently land applied.

Despite the preponderance of evidence to indicate that the mixed material does not pose a risk to human health or the environment, after delisting the mixed material will be placed in a Subtitle D landfill which will prevent public exposure. No other disposal options are proposed.

## 1.1 Burnt Ridge

The FMF Burnt Ridge storage unit is located at 856 Burnt Ridge Road, in Onalaska, Washington (Figure 1). The storage unit is contained by an embankment constructed into sloping natural terrain. The unit is approximately square, as shown on Figure 2, with approximate dimensions of 220 feet (ft) on each side and a surface area at the top of about 48,000 square feet (sf). The level-top embankment matches existing grades on the north side, with perimeter berms on the south, east, and west sides that extend above surrounding grades. According to the design (Thode 1998), the internal slopes of the unit are 3 horizontal to 1 vertical (3H:1V), the external slopes of the perimeter berms are 2H:1V, and the storage unit is approximately 14 ft deep (Figure 3). According to the design drawing, the unit is lined with Claymax 600CL geosynthetic clay liner (GCL) material manufactured by Colloid Environmental Technologies Company. LAI assumes that approximately 12 inches of soil was placed on top of the liner in accordance with typical manufacturer recommendations for GCL installations.

The storage unit currently contains mixed material and accumulated precipitation. According to estimates made by PGG, and confirmed during the land application event in December 2014, the accumulated mixed material is 3 ft or less in thickness (PGG 2014a; see Appendix A). Based on the design dimensions and the estimated mixed material thickness, the storage unit is estimated to contain approximately 500,000 gallons or 2,350 cubic yards (cy) of saturated mixed material covered by a water cap.

FMF was preparing to reline the Burnt Ridge storage unit, therefore material was not added to the unit after 2013. The storage unit is equipped with two propeller-driven mixers and a recirculation pump. The mixed material in the Burnt Ridge storage unit is already several years old, is well-mixed, and is completely settled as the unit has not been mechanically disturbed for more than two years. Therefore, the collection of multiple core samples from various locations is appropriate to characterize the mixed material.

## 1.2 Newaukum Prairie

The FMF Newaukum Prairie storage unit is located at 349 State Route 508, in Chehalis, Washington (Figure 4). The storage unit is approximately square with a constructed berm on each side (Figure 5). According to the original design drawing, each side of the storage unit is approximately 220 ft in length with a total depth of 12 ft (Thode 1998). The berms are sloped 3H:1V on the interior and 2H:1V on the exterior of the storage unit, and the inside face of the berms is lined with a 3-ft layer of compacted clay, according to the design drawing (Thode 1998). According to FMF, the storage unit was reconstructed and relined in 2013; the bottom of the storage unit reportedly has dimensions of roughly 148 ft by 148 ft and has a total depth of approximately 14 ft (Figure 6) (Thode 2013). The storage unit is lined with a dual liner system consisting of a 60 mil high-density polyethylene (HDPE) primary liner, a geonet leak detection layer, and a 30 mil HDPE secondary liner. At the toe of the concrete ramp in the northwest corner is a 2-ft deep sump. The bottom of the storage unit is graded at a 1% slope toward this sump causing slight variations in the total depth throughout the storage unit.

The storage unit currently contains saturated mixed material and accumulated precipitation. PGG estimated the mixed material thickness in July 2014 to be 8 to 9 ft. LAI measured the mixed material thickness in December 2015 and found that it varied between 2.5 and 5.2 ft thick; mixed material thickness at a location near the concrete ramp was 1.5 ft. Based on the reconstructed dimensions and the maximum 2015 measured mixed material thickness of 5.2 ft, the storage unit is estimated to contain approximately 1.1 million gallons or 5,200 cy of saturated mixed material covered by a water cap.

Material was added to the storage unit until Ecology ordered FMF to cease operations in 2014. The storage unit is equipped with two propeller-driven mixers and recirculation pump. The mixed material in the Newaukum Prairie storage unit is already several years old, is well-mixed, and is settled. Therefore, the collection of multiple core samples from various locations is appropriate to characterize the mixed material.

## 1.3 Big Hanaford

The FMF Big Hanaford storage unit is located at 307 Big Hanaford Road, in Centralia, Washington (Figure 7). Mixed material is stored at this facility in a roofed concrete storage unit (Figure 8). The metal roof is supported by wooden structural members that are anchored at grade. The floor of the structure is concrete. Concrete panels are used to contain the mixed material. The facility is approximately 100 ft long by 60 ft wide. The concrete panel height is approximately 11.5 ft; the mixed material was within about 1 ft of the top of the panels on October 21, 2015. Based on the dimensions and the estimated mixed material thickness, the storage unit is estimated to contain approximately 2,500 cy of wet mixed material.

Material was added to the Big Hanaford storage unit until Ecology ordered FMF to cease operations in 2014. The material was delivered to the storage unit via a ramp located on the south side of the unit. Trucks would back up to the ramp and dump the load of material into the storage unit. Although the bulk of the material is comprised of water, the material would ooze off in all directions, rather than flowing quickly. Mechanical means were used to push the mixed material outward from the offloading ramp in order to allow for the deposition of additional material. The physical layout of the storage unit and the nature of the mixed material resulted in horizontally stratified layers of material. Samples collected from several depths and locations would therefore not be expected to be similar. Therefore, the collection of grab samples from various depths and locations is appropriate to characterize the mixed material.

## 1.4 Prior Investigations

FMF retained PGG to conduct an investigation of the mixed material at the three storage units in September 2014. The sampling is described in the investigation plan (PGG 2014b) included as Appendix B of this plan. Three composite mixed material samples were collected from each storage unit. At Burnt Ridge and Newaukum Prairie, each composite sample consisted of nine grab samples collected from various depths. Each composite sample collected at Big Hanaford consisted of six grab samples collected from various depths.

Each composite sample was analyzed for the following constituents or constituent groups: volatile organic compounds (VOCs) (EPA Method 8260C), semivolatile organic compounds (SVOCs) (EPA Method 8270D), total metals (EPA Methods 6010C/7471A), total cyanide (EPA Method 335.4), and total solids (Standard Method [SM] 2540G). The specific analytes included in the analysis are defined by the analytical method used for each group. Analytes are shown on Tables 2-4.

In addition, two composite samples from the Newaukum Prairie storage unit and one composite sample each from the Burnt Ridge and Big Hanaford storage units were analyzed for the remaining priority pollutants: pesticides (EPA Method 8081B); polychlorinated biphenyl (PCB) aroclors (EPA Method 8082A); dioxins and furans, reported as 2,3,7,8-tetrachlorodibenzodioxin toxicity equivalence (2,3,7,8-TCDD TEQ) (EPA Method 1613B); nitrite (EPA Method 353.2); ammonia (EPA Method 350.1M); Total Kjeldahl Nitrogen (TKN) (EPA Method 351.2); nitrate + nitrite (EPA Method 353.2); and pH (SM 9045); the concentration of nitrate was calculated by the analytical laboratory. Tables 2-4 show the analytical results for each of the composite samples at each of the storage units; detected concentrations are presented in bold font.

Fourteen grab samples from the Newaukum Prairie storage unit and seven grab samples each from the Burnt Ridge and Big Hanaford storage units were analyzed for total fecal coliform; results are presented in the PGG investigation report (PGG 2014a) included as Appendix A of this plan but are not used in the delisting evaluation.

## 1.5 Evaluation of Previous Results

Preliminary delisting levels based on maximum allowable total concentrations (PDLs) and maximum allowable toxicity characteristic leaching procedure (TCLP) concentrations (TCLP-PDLs) were developed by Ecology using EPA's Hazardous Waste Delisting Risk Assessment Software for each of the storage units and were provided to Emerald (Ecology 2016b). Analytical results for each storage unit were compared to the PDLs; there are no detected results from any of the three storage units that exceed the PDLs. Because the PGG samples were analyzed for total concentrations rather than

TCLP concentrations, the TCLP-PDLs were multiplied by 20 to account for the dilution by 20 that is part of the TCLP analysis prior to comparison to the analytical results, in accordance with what is known as the rule of 20. The concentration of cobalt in samples from each of the storage units and the concentration of 4-methylphenol in samples from Big Hanaford are the only detected results that exceed the TCLP-PDLs x 20. Tables 2-4 show the PDLs and the TCLP-PDLs x 20 as well as the analytical results for the Burnt Ridge, Newaukum Prairie, and Big Hanaford storage units, respectively. As discussed in detail in section 1.6.1, three additional samples each from the Burnt Ridge and Newaukum Prairie storage units were collected, composited into one sample for each storage unit, and analyzed for total and TCLP cobalt prior to the waste characterization sampling described in this plan (Table 5). Samples from Big Hanaford only will be collected and analyzed for cobalt during the waste characterization sampling described in this plan. Additionally, samples will be collected from Big Hanaford and analyzed for 4-methylphenol; cobalt; 2,4-dinitrotoluene; 2,6-dinitrotoluene; acrylonitrile; and naphthalene. Last, three samples from Big Hanaford will be analyzed for PCBs; this is further addressed in section 1.6.2.

Each chemical in the PGG study with an RL greater than the TCLP PDL X 20 is discussed below. The majority of the material is from municipal WWTPs. Biosolids generated from the treatment of municipal WWTPs have been analyzed for many of the chemicals included in the PGG study and the expected concentrations of these chemicals are well-documented. None of the chemicals are expected to be present at concentrations deemed to pose a risk to human health or the environment. The materials from Darigold, the Port of Longview, Bio Recycling, and the cow manure are not likely to contain any chemicals of concern as described in Section 1. Emerald's IWBS have either been analyzed for these chemicals, or the chemicals are known to not be present based on the chemistry used by the facility. In addition to these facts, the mixed material is not being used as a soil amendment, but will be placed in a Subtitle D landfill. No other disposal options are proposed.

A review of the investigation conducted by PGG indicates the following data gap: grab samples were not analyzed for any analytes except total fecal coliform; therefore, additional samples are needed to comply with the LDR treatment standards. LDR limits, as defined in 40 CFR 268, are used to determine restrictions on land disposal options for waste streams. In order to fill these data gaps, discrete grab samples will be collected and analyzed for acetone, benzene, methanol, and toluene, the parameters associated with the waste codes for which Emerald's IWBS were designated as listed waste. For the purpose of this evaluation, the LDR limits will be a secondary standard after analytes are compared to the PDLs. The LDR limits for the selected analytes are presented in Table 6, which also shows the analytical results for the composite PGG samples.

The PGG report and its associated results are still valid as each of the storage units has been non-operational since the 2014 investigation. No new waste was added to any storage unit and no active treatment was applied. In addition, the methods used by PGG for sample analysis are consistent with WAC 173-202-110(3)(c).

## 1.6 Selection of Analytes

Analytes to be tested were selected based on evaluation of the results provided in the PGG report (PGG 2014a) with the LDRs and the Hazardous Waste Delisting Risk Assessment Software (DRAS) generated preliminary delisting levels (PDLs) as both maximum allowable total concentrations, and the maximum allowable TCLP concentrations for each of the three storage units. Recommendations for analysis of previously non-detect analytes were made on the basis of a review of PGG data relative to these threshold concentrations. Analytes with a reporting limit (RL) in the PGG report that exceeded the PDL or TCLP-PDL x 20 are discussed below. Analytical results from the PGG investigation and RLs for non-detected analytes are shown in Tables 2-4.

### 1.6.1 Metals

Based on a comparison of the 2014 PGG data to the TCLP-PDL x 20 thresholds, four metals of potential concern were identified (i.e., where one or more maximum detected values or the RLs of non-detected chemicals exceeded the TCLP-PDL x 20 threshold): antimony (Burnt Ridge and Newaukum Prairie only), arsenic, cobalt, and thallium. Although antimony, arsenic, and thallium were not detected in samples from any of the three storage facilities, the RL for one of three composite samples from Burnt Ridge and the RLs for the composite samples from Newaukum Prairie exceed the antimony TCLP-PDLs x 20; the RLs for the composite samples from Big Hanaford do not exceed the antimony TCLP-PDL x 20. The RLs for the composite samples from Burnt Ridge, Newaukum Prairie, and Big Hanaford exceed the arsenic and thallium TCLP-PDLs x 20.

Cobalt was the only one of these metals detected in the mixed material. The Targeted National Sewage Sludge Survey Sampling and Analysis Technical Report (EPA 2009) was reviewed in order to determine the expected range of these metals in municipal biosolids. A comparison of the data is provided in Table 7. The cobalt concentrations measured in the three storage units were all within the range established during the EPA survey and are similar to those found in soil (ATSDR 2004). The cobalt concentrations in the Burnt Ridge and Newaukum Prairie storage units were only 16 and 30 percent of the maximum value reported in the EPA report. The mixed materials in the Burnt Ridge and Newaukum Prairie storage units are homogenous, and the probability that additional samples would return a significantly different total cobalt concentration is low. However, because only a fraction of the cobalt in the mixed material is leachable, samples from each of these two storage units were collected, composited into one sample for each storage unit, and analyzed for total and TCLP cobalt prior to the waste characterization sampling described in this plan. The TCLP cobalt concentrations from these analyses were below the TCLP PDLs. The analytical results are presented in Table 5 and the report is included in Appendix C.

Although the maximum cobalt concentration measured in the Big Hanaford storage unit was below the maximum value reported in the EPA study; the material in the storage unit is heterogeneous. Therefore, the probability that additional samples collected from the storage unit could exceed the reported range for cobalt is significant. To address this potential concern, the 18 grab samples collected from the Big Hanaford facility will be analyzed for cobalt. If the results from one or more samples exceed the TCLP-PDL x 20, the sample with the highest concentration will be analyzed for cobalt in TCLP extract as described in Section 3.0.

Antimony, arsenic, and thallium will not be added to the list of analytes. The RLs and corresponding Targeted National Sewage Sludge Survey (TNSSS) concentrations are presented in Table 7.

Antimony was not detected in the mixed material; RLs are provided in Table 7. Based on generator knowledge and the known uses of antimony, the metal is not present in the IWBS. Antimony is not used in any of the chemical manufacturing processes, is not a contaminant in any of the catalysts, nor is it used in any of the metal alloys present on the site. The concentration of antimony in biosolids has been documented by the EPA in the TNSSS report (Table 7). Based on the available information, it is not likely that the mixed material contains concentrations of antimony that would pose a risk to human health and the environment.

Arsenic was not detected in the mixed material; RLs are provided in Table 7. TCLP-prepared extracts of the IWBS have been analyzed for arsenic and the results have been below the RL, which is below the PDLs (Table 12). The concentration of arsenic in biosolids has been documented by the EPA in the TNSSS report (Table 7). Based on the available information, it is not likely that the mixed material contains concentrations of arsenic that would pose a risk to human health and the environment.

Thallium was not detected in the mixed material (RLs provided in Table 7) and is only used in a limited number of applications. For example, thallium sulfide is used in some photovoltaic cells to achieve greater efficiency in converting infrared radiation into electricity. There are no manufacturers of photovoltaic cells in any of the municipalities that have contributed biosolids or other material to the FMF storage units. Based on generator knowledge and the known uses of thallium, the metal is not present in the IWBS. Thallium is not used in any of the chemical manufacturing processes, is not a contaminant in any of the catalysts, nor is it used in any of the metal alloys present on the site. The concentration of thallium in biosolids has been documented by the EPA in the TNSSS report (Table 7). Because of the rarity, and limited application of thallium, this chemical is not likely to be present in the mixed material at concentrations that would pose a risk to human health or the environment.

### 1.6.2 Polychlorinated Biphenyls

The concentrations of PCBs detected in the mixed material are less than the respective PDLs. PCBs have not been manufactured or used in the United States since the 1979 ban. PCBs had been used in a wide variety of applications and are long-lived molecules; therefore, these chemicals are ubiquitous in the environment. The Association of Metropolitan Sewerage Agencies conducted a study analyzing 200 publicly owned treatment works (POTW) biosolids samples from 31 states and determined that the concentration of PCBs ranged from 0.06 to 261 micrograms per kilogram (μg/kg) (AMSA 2001). The concentration of PCBs from each of the storage units and the respective PDLs are presented in Table 8.

Three samples from the 18 proposed at the Big Hanaford facility will be analyzed for PCBs. The three samples will be selected from among the 18 analyzed for volatiles, semivolatiles, and metals. Additional sample volume will be collected and stored for all 18 samples. The three samples to be analyzed for total PCBs will be selected by Ecology and EPA based on the results for other analytes.

Samples of mixed material from the Burnt Ridge and Newaukum Prairie storage units will not be analyzed for PCBs. The maximum measured concentrations in the storage units (2014 PGG data) are below the corresponding PDLs and within the measured range of PCBs determined to be in biosolids. The Burnt Ridge and Newaukum Prairie storage units are well mixed (based on the limited variation in concentration between PGG samples and the mixing operations described by FMF) and therefore the PCB concentrations are representative of the mixed material. PCBs have not been detected, nor are they expected to be present at any concentration above background levels in the Emerald IWBS.

### 1.6.3 Toxaphene

Toxaphene is a mixture of more than 600 congeners produced via reaction of camphene (terpene) and chlorine. Toxaphene was used as a pesticide in the United States until it was conditionally banned in 1982, and completely banned in 1990. Considered as a group, the congeners have a half-life in soil as long as 14 years. The predominant use of toxaphene was to control insects on cotton and other crops in the southern United States. All states with toxaphene warnings are located in the southern United States (ATSDR 2014). According to the EPA, the atmosphere is the most important environmental medium for the transport of toxaphene. Toxaphene binds strongly to soil/sediment particles; therefore, it is unlikely to contaminate groundwater (EPA 1999).

Toxaphene was not detected in any of the FMF samples collected by PGG; however, the RLs were all greater than the PDL. The RL and PDL concentrations are provided in Table 9.

No additional sampling for toxaphene is proposed. Toxaphene is not present in Emerald IWBS, nor is it expected to be present in the biosolids or other sources of the mixed material. Toxaphene has not been used in the United States for 16 years and none of the POTW sources of biosolids that comprise the mixed material originate from areas where toxaphene use was prevalent. Therefore; toxaphene is not expected to be present at concentrations that pose a risk to human health or the environment.

### 1.6.4 Dioxin

Dioxin, reported as a 2,3,7,8-TCDD TEQ, was not detected in any of the samples collected and analyzed by PGG; however, the RL for the Newaukum Prairie storage unit was greater than the corresponding PDL. 2,3,7,8-TCDD TEQ is appropriate to use for comparison with the PDLs because it is a weighted quantity measure based on the toxicity of each member of the dioxin and dioxin-like compounds category relative to the toxicity of 2,3,7,8-TCDD, widely accepted as the most toxic in the group of congeners collectively known as polychlorinated dibenzodioxins, or simply dioxins. Dioxins are not commercially manufactured chemicals, but are produced as byproducts from the combustion of certain types of materials and during the production of some organic chemicals. The Association of Metropolitan Sewerage Agencies conducted a study analyzing 200 POTW biosolids samples from 31 states and determined that the concentration of dioxin ranged from 0.10 to 291 µg/kg (AMSA 2001). The dioxin RLs for each of the storage units and the respective PDLs are presented in Table 10.

No additional analyses for dioxin are proposed. Dioxins are not present in the Emerald IWBS because none of the chemical manufacturing processes use chlorine, which is required to produce this class of chemicals. Considering the dioxin concentration range reported by the Association of Metropolitan Sewerage Agencies (AMSA), the RLs from the PGG study, and the PDLs; dioxins are not likely to be present at concentrations that pose a risk to human health or the environment.

### 1.6.5 N-Nitrosodimethylamine and N-Nitroso-Di-N-Propylamine

N-nitrosodimethylamine and N-nitroso-di-n-propylamine were not detected in the mixed material. The RLs were greater than the TCLP-PDL x 20; however, these nitrosamine compounds will not be added to the analyte list. This class of chemicals is produced as byproducts in some industrial and natural processes. These chemicals can be found in some foods, especially cured and smoked meats, and malt beverages, at low concentration, typically in the part per billion range (NTP 2016). Tobacco smoke, some rubber compounds, cosmetics, and toiletries contain nitrosamine compounds. Emerald's IWBS do not contain these chemicals, because none of the chemical manufacturing processes create this class of chemicals. The concentrations of these chemicals present in the materials and products that might be sent to a municipal WWTP are likely to already be below the PDLs. Therefore, the concentrations of these chemicals would be even lower in the municipal biosolids and the other sources of the mixed material. For this reason, the mixed material is not expected to contain concentrations of these chemicals that would pose a risk to human health or the environment.

### 1.6.6 Pentachlorophenol

Pentachlorophenol was not detected in the mixed material. The RLs for the Newaukum Prairie and Big Hanaford storage units were greater than the TCLP-PDL x 20; however, pentachlorophenol will not be added to the analyte list. The RLs and the TCLP-PDL x 20 for pentachlorophenol are within the same order of magnitude. Emerald's IWBS do not contain pentachlorophenol. Pentachlorophenol is used in treatment of utility poles and rail ties and is unlikely to be present in municipal wastewater entering a POTW. Neither the biosolids nor the other sources of the mixed material are expected to contain concentrations of pentachlorophenol that would pose a risk to human health or the environment.

### 1.6.7 Acrylonitrile; Naphthalene; 2,4-Dinitrotoluene; and 2,6-Dinitrotoluene

Acrylonitrile; naphthalene; 2,4-dinitrotoluene; and 2,6-dinitrotoluene were not detected in the mixed material. However, the RLs for the Big Hanaford storage unit were greater than the TCLP-PDL x 20 for these chemicals. These four chemicals will be added to the analyte list for the Big Hanaford storage unit, only. If the results from one or more samples exceed the TCLP-PDL x 20 for one or more of these analytes, the sample with the highest concentration of that analyte will be analyzed in TCLP extract as described in Section 3.0.

### 1.6.8 4-Methylphenol

4-Methylphenol was detected in the mixed material at concentrations within the same order of magnitude, but greater than the TCLP-PDL x 20 in the Big Hanaford storage unit. The 18 samples collected from the Big Hanaford storage unit will be analyzed for 4-methylphenol. If the results from one or more samples exceed the TCLP-PDL x 20, the sample with the highest concentration will be analyzed for 4-methylphenol in TCLP extract as described in Section 3.0.

## 1.7 Evaluation of Dangerous Waste Criteria

The data from the prior PGG report and known process knowledge were used to determine that no additional samples are required to further designate the mixed material. The sections below provide a discussion on each of the federal hazardous waste and Washington State dangerous waste criteria in comparison to the mixed materials.

### 1.7.1 Ignitability, Corrosivity, Reactivity

The mixed material is a combination of Emerald's IWBS, municipal wastewater treatment plant biosolids, and wastewater-generated material from other sources as described in Section 1.0. The mixed material is comprised of the dead and decaying bodies of the microorganisms used to digest and thereby chemically transform the undesirable components present in the wastewater into benign, and in many cases useful, compounds. During the wastewater treatment process, biosolids/IWBS are separated from the supernatant and allowed to fill transportable bins. Unless additional dewatering processes are implemented, the resulting biosolids/IWBS are about 10 percent solids and 90 percent water.

Neither the source material, nor the mixed material exhibit the characteristic of ignitability as defined in WAC 173-303-090(5). The mixed material in both the Burnt Ridge and Newaukum Prairie facilities has been kept in storage units that are open and exposed to precipitation. The mixed material has undergone additional degradation and is completely saturated with water. Although the Big Hanaford storage unit is covered to prevent the intrusion of precipitation, the mixed material still contains about 85 percent water. Since water will not ignite, and there are only a handful of organic chemicals present in the mixed material in the parts per million (ppm) range; it is physically impossible for the mixed material to burn.

The pH of the biosolids/IWBS varies depending upon the WWTP of origin, the method of pH adjustment, and whether alkaline chemicals were added to reduce pathogen concentrations and odor; however, the pH must be close to neutral because the microorganisms within the WWTPs would not survive, as is the case with Emerald's IWBS. The pH values reported by PGG for the three storage units were 7.38, 7.91, and 7.43 for the Newaukum Prairie, Big Hanaford, and Burnt Ridge facilities, respectively (PGG 2014a). As these pH values are greater than 2 and less than 12.5, the mixed material does not exhibit the characteristic of corrosivity as defined in WAC 173-303-090(6).

The mixed material does not exhibit any of the characteristics that define “reactive” as listed in WAC 173-303-090(7). The mixed material is completely benign, can be handled without any special precautions, and does not present any danger to human health or the environment.

### 1.7.2 Toxicity

A comparison of the PGG data with the Toxicity Characteristics List (TCLP list) from WAC 173-303-090(8) indicates that the mixed material does not exhibit the characteristic of toxicity. The PGG analyses did not include a TCLP test. Therefore, as directed by Ecology, the values in the TCLP list were multiplied by a factor of 20 to allow for comparison with the total concentrations reported in the PGG study. The PGG data and the TCLP list are compared in Table 11.

The TCLP list contains 41 analytes (including heptachlor epoxide) and the PGG analyses included 31 of those 41 chemicals listed. There were seven chemicals from the TCLP list detected in the PGG study. The concentrations of all seven of these chemicals were below the threshold concentrations provided in the TCLP list. There were four chemicals included in the PGG study that had RLs that were greater than the threshold concentrations provided in the TCLP list. 2,4-Dinitrotoluene; heptachlor epoxide; and selenium all had RLs within the same order of magnitude as the TCLP list thresholds. The RLs for chlordane were an order of magnitude greater than the TCLP list threshold concentration. The 10 chemicals that were not included in the PGG analyses all have relatively high concentration thresholds and only cresols, pyridine, and methyl ethyl ketone can be produced through processes other than specific chemical synthesis.

The origin of the mixed material is known to be biosolids from several municipal WWTPs, IWBS from Emerald’s WWTP, cow manure, SWTS from Darigold, WTSS from the Port of Longview, and biosolids from Bio Recycling. Emerald has analyzed the IWBS for toxicity in accordance with WAC 173-303-090(8), most recently in July 2014. None of the 41 chemicals on the TCLP list were detected in the IWBS. A fish bioassay performed on the IWBS also determined the material was not toxic. This data is presented in Table 12. It is logical to conclude that since the toxicity of the municipal WWTP biosolids and the other four sources of mixed material is not in question; and the IWBS have been proven not to be toxic; and the 31 of the possible 41 chemicals in the TCLP list were not detected in the mixed material, or were detected but had concentrations below the thresholds in the mixed material; the mixed material does not exhibit the characteristic of toxicity.

### 1.7.3 Toxicity (Washington State)

The PGG Report used the book designation procedure in WAC 173-303-100(5)(b) to calculate the toxicity equivalent concentrations (EC) of the mixed material in the Burnt Ridge, Newaukum Prairie, and Big Hanaford storage units as 0.577%, 0.568%, and 0.729%, respectively. These EC values were calculated using incorrect toxic categories and assumed all chemicals that were included in the analyses were present at the RLs. Emerald repeated the book designations using the correct toxicity categories and determined that none of the mixed material is a toxic dangerous waste (all three ECs < 0.001).

The toxicity category for nickel that PGG used in the book designation process was incorrect. PGG performed the book designation with nickel categorized as "X." This category treats nickel as more toxic than both arsenic (category C) and mercury (category B), which is not accurate. A query of the EPA ECOTOX database returned four and five day LC50 concentrations for rainbow trout ranging between 15 and 56 milligrams per liter (mg/L). The lower concentration of 15 mg/L would put nickel into the "D" category.

The PGG report made a similar error for toluene. PGG performed the book designation with toluene categorized as "A." This category treats toluene as more toxic than benzene (category D), which is not accurate. The EPA ECOTOX database returned four and five day LC50 concentrations for rainbow trout ranging between 5.8 and 24 mg/L. The lower concentration of 5.8 mg/L would put toluene into the "C" category.

The PGG book designation used the RL for all non-detected analytes in the toxicity calculation. Because the analyte list for the mixed material was large, and EC calculation included non-detected chemicals, the results were skewed toward the high end of the range. The EC calculation must be based only on the concentrations of the chemicals detected as stated in WAC 173-303-100(5)(b)(i), which states that "A person must determine the toxic category for each known constituent." The inclusion of RLs for chemicals not detected in a substrate creates uncertainty because the size of the analyte list can become more important to the EC value than the chemicals actually present.

Emerald performed the book designation for toxicity EC using the maximum detected concentrations for all chemicals with toxicity data, and using the correct toxicity categories for nickel and toluene. The resulting ECs for the mixed material in the Burnt Ridge, Newaukum Prairie, and Big Hanaford storage units were 0.00065, 0.000077, and 0.00076, respectively. All of the mixed material should be considered "not a toxic dangerous waste." This conclusion is consistent with the sources and nature of the material known to be present in the storage units.

### 1.7.4 Persistence (Washington State)

PGG used the RL for all non-detected analytes in the persistence calculations. Because the analyte list for the mixed material was large, and persistence calculations included non-detected chemicals, the results were skewed toward the high end of the range. The persistence calculations must be based only on the concentrations of the chemicals detected as stated in WAC 173-303-100(6)(b), which states that "When a waste contains one or more halogenated organic compounds (HOC) for which the concentrations are known, the total halogenated organic compound concentration must be determined by summing the concentration percentages for all of the halogenated organic compounds for which the concentration is known." And (c), which states "A person whose waste contains polycyclic aromatic hydrocarbons (PAH) as defined in WAC 173-303-040, must determine the total PAH concentration by summing the concentration percentages of each of the polycyclic aromatic hydrocarbons for which they know the concentration." The inclusion of RLs for chemicals not detected in a substrate creates uncertainty because the size of the analyte list can become more important to the persistence value than the chemicals actually present.

Emerald performed the persistence calculations using the maximum detected concentrations for all halogenated and polycyclic aromatic hydrocarbon species (Table 13). The resulting persistence values were all several orders of magnitude below the threshold of 0.01 percent, thus none of the mixed material should be considered "persistent dangerous waste." This conclusion is consistent with the sources and nature of the material known to be present in the storage units.

PGG sampled and analyzed the samples using Methods 8260 and 8270 for volatile and semivolatile compounds, respectively. These methods are specified by EPA for halogenated volatile/semivolatile, and PAH species that are used by Washington State to evaluate the persistence criteria.

# 2.0 FIELD INVESTIGATION

A field investigation will be conducted to collect samples that will provide additional information to support the delisting petitions for the mixed material. Grab samples will be collected and analyzed for the constituents identified in Sections 1.5 and 1.6.

The field investigation will consist of an initial reconnaissance site visit and the sampling event at each storage unit.

## 2.1 Initial Reconnaissance Site Visit

On November 9, 2016, representatives from FMF, Emerald, and LAI performed an initial site visit to each of the three locations: Big Hanaford, Burnt Ridge and Newaukum Prairie. The purpose of the site visit was to perform reconnaissance for the sampling methodology and observe the onsite conditions of each site. At the Burnt Ridge and Newaukum Prairie locations, each storage unit was found to have an adequate location to launch and recover a sampling boat. At Burnt Ridge, there was a grassy berm on the west end of the storage unit that a boat could be launched from; however, there was not a constructed boat launch area. A concrete-lined ramp in the northeast corner of the Newaukum Prairie storage unit was found to be adequate for launching and recovering a sampling boat. Both storage units at the time of the site visit appeared to have a sufficient water cap to allow for sampling boat access.

Onsite field staff also assessed the Big Hanaford storage unit for access, sampling methodology, and safety. Based on surficial probing and discussions with FMF, it appears that samples may be collected from a plywood sampling platform placed on top of the mixed material surface of the storage unit. The surficial solids appeared saturated and stiff; however, they showed signs of liquid deformation when disturbed. Due to the height of the storage unit (11-12 ft above the ground surface) and limited access locations (only accessible from the southern access ramp), a sampling platform of plywood could be constructed on the inside perimeter approximately 4 ft from the outside edge of the wall to provide safe access for sampling. It did not appear that fall protection tie-offs would be required if such a sampling platform was constructed.

## 2.2 Mixed Material Sampling

Mixed material sample locations and sample collection procedures for the Burnt Ridge, Newaukum Prairie, and Big Hanaford storage units are described in the sections below.

### 2.2.1 Sample Locations

Sample locations will be determined generally based on the simple random sampling strategy for the Burnt Ridge and Newaukum Prairie storage units (EPA 2015) and the systematic non-random sampling strategy for the Big Hanaford storage unit as adapted from EPA guidance (EPA 1993). The sample location selection procedure for each of the storage units is described in the sections below.

#### 2.2.1.1 Burnt Ridge and Newaukum Prairie

According to an onsite interview with Robert Thode on November 9, 2016, the waste was placed into the storage units from the west weir dumping location at Newaukum Prairie and from the south weir dumping location at Burnt Ridge. The units were mixed at least annually utilizing two propeller-driven mixers and a recirculation pump. Prior to 2014, liquid and mixed material was pumped annually from each unit following the mixing operation. The liquid and mixed material was used as liquid fertilizer on nearby agricultural fields. Operations ceased and no additional material was placed in the Burnt Ridge storage unit after 2013. Material was placed in Newaukum Prairie until Ecology told FMF to cease accepting biosolids in 2014.

Sample locations for the Burnt Ridge and Newaukum Prairie storage units were determined using the simple random sampling strategy described in EPA's guidance document (EPA 2015) as described below and identified in Table 2-4 of the EPA guidance. This sampling strategy was selected based on the premise that the aerated units were well mixed during operations and the mixed material is likely homogeneous. Although the mixed material came from a variety of sources, Table 2-4 of the EPA guidance document suggests that a simple random sampling strategy is most appropriate where little to no information is available concerning the distribution of hazardous constituents. In this case the hazardous constituents of interest are associated with IWBS which, based on the aeration of the units, were likely spatially well mixed.

Each storage unit was divided into 25 ft by 25 ft grids. The grids were overlain on an aerial photograph of the storage unit to determine the sample locations. The x-axis was assigned a letter and the y-axis was assigned a number as shown on Figures 2 and 5. This resulted in 36 possible sample grid squares at each storage unit in which a random sample may be collected. The grid squares from which samples will be collected were selected using the random number generator function in Microsoft Excel. A column (core) of the total recoverable sludge depth will be collected from each randomly selected grid.

The number of random samples that will be collected in each storage unit has been selected with the goal of characterizing the spatial constituent variability in the sludge, in accordance with the EPA guidance document (EPA 2015). The proposed number of samples has been identified based on the total estimated volume of mixed material in each of the storage units, and is sufficient to represent the quantity and spatial variability of the mixed material. Based on an estimated *in situ* mixed material volume of approximately 2,350 cy in the Burnt Ridge storage unit, 11 random samples will be collected. Based on an estimated *in situ* mixed material volume of 5,200 cy at the Newaukum Prairie storage unit, 17 random samples will be collected. Although Ecology's Guidance for Remediation of Petroleum Contaminated Sites (Ecology 2016c) is not applicable to the sampling described in this plan, the numbers of planned samples are consistent with the number of samples identified in the guidance for characterizing stockpiled soil. The randomly selected sample locations for each of the storage units are identified in Table 14 as well as on Figures 2 and 5.

#### 2.2.1.2 Big Hanaford

According to an onsite interview with Robert Thode on November 9, 2016, the Big Hanaford storage unit received solids from the same sources as the Newaukum Prairie and Burnt Ridge storage units, including biosolids from municipalities and IWBS from Emerald. The mixed material was placed in the storage unit in uncompacted lifts. Material was trucked to the storage unit and end-dumped from the truck ramp on the south side of the storage unit. Material was laterally spread throughout the storage unit in lifts using a long-reach backhoe. The material was not mixed or removed after placement and no compaction was performed.

Sample locations for the Big Hanaford storage unit were determined using the systematic non-random sampling strategy (EPA 2015) as described below and identified in Table 2-4 of the Ecology guidance document. This sampling strategy was selected to spatially characterize the material that was likely not well mixed after placement in the storage unit. The variance in the PGG 2014 composite sample results for some parameters suggests that the concentrations of at least some parameters may vary spatially. Based on the EPA guidance document (EPA 2015), a systematic non-random sampling strategy is appropriate for modestly heterogeneous waste streams, which appears to best fit known information about the placed material.

The Big Hanaford storage unit was divided into grids measuring 8 cells by 3 cells (with grid dimensions approximately 10.5 ft by 18.5 ft). The grid was overlain on an aerial photograph of the storage unit to determine the sample locations. The x-axis was assigned a letter and the y-axis was assigned a number as shown on Figure 8. No samples will be collected from the center of the storage unit so that samples can be collected safely, and the grid locations in the center of the storage unit will not be included in the systematic non-random sample location selection. This will result in 18 possible sample grid rectangles in which a sample may be collected. In this approach, three depth ranges (depths) were identified in each grid. The A1 grid was selected for the first sample location; in the first grid the top depth will each be sampled. Moving clockwise from the A1 grid, the next grid will be sampled from the middle depth. Continuing on with this pattern, every grid will be sampled in the top, middle, or bottom depth. Figure 8 shows the sampling pattern and grid demarcation for sampling. Table 14 additionally lists the sample depth for each sampling grid.

The three depths will be defined by the depth of mixed material in the storage unit and will consist of the top, middle, and bottom vertical delineations within the mixed material. Based on measurements taken during the initial reconnaissance trip on November 9, 2016, the mixed material depth ranged from 10 to 11 ft in vertical depth. The top depth will be sampled from approximately 0-3.5 ft in depth from the surface of the mixed material, the middle depth will be sampled from approximately 3.5-7 ft in depth from the surface of the mixed material, and the bottom depth will be sampled from approximately 7-10 ft in depth from the surface of the mixed material. The depth divisions of each sample interval may be adjusted or revised based on field conditions observed during sampling; these adjustments will not impact the total number of samples planned in each of the depth intervals.

The number of samples that will be collected in each of the depths was selected to characterize the spatial constituent variability in the mixed material and evaluate the degree of heterogeneity. The systematic approach, which is similar to the sampling strategy discussed in EPA's Petitions to Delist Hazardous Wastes: A Guidance Manual (Second Edition) (EPA 1993), was selected to adequately characterize variability. If the sampling results identify hot spots, further sampling may be required to further delineate the area.

### 2.2.2 Sampling Methodology

Sample methodology for collection of the mixed material samples at the Burnt Ridge, Newaukum Prairie, and Big Hanaford storage units is described in the sections below. During all field sample activities, field staff will follow the site-specific health and safety plan (HASP), included in Appendix D, while on site and will place priority on safety around and on the storage units. If a sample cannot be collected safely, either it will be collected at another time when it can be collected safely or a sample will be collected from a different location where it can be collected safely. Deviations from the planned sampling locations will be documented in the sampling report described in Section 6.0.

#### 2.2.2.1 Burnt Ridge and Newaukum Prairie

The proposed sample collection methodology requires that the mixed material is covered by a minimum of 1 ft of free water. If the minimum water cover is not present, representative mixed material samples may not be recoverable because a sampling boat will not be able to navigate the storage unit. If there is not sufficient water overlying the mixed material at a planned sampling location, the sample location will be moved to the nearest location where a minimum 1 ft depth of free water is present on top of the mixed material and a sample can be safely collected. If there is not enough water in the storage unit to safely launch a boat and collect samples, sampling will be postponed until sufficient water is present in the storage unit.

A 25-ft by 25-ft x-y grid will be staked out along the perimeter of each storage unit in order to help identify the location of each sample. The x-axis of the grid (north-south axis) will be lettered and the y-axis of the grid (east-west axis) will be numbered as described in Section 2.2.1.1 above. Figures 2 and 5 show the orientation and labeling of the grid system.

Following the demarcation of the sampling locations, a 12-ft aluminum row boat, or similar non-motorized water craft, will be used to access the sample locations listed in Table 14 and depicted on Figures 2 and 5. Samples will be collected from any accessible location within the 25-ft by 25-ft grid. The boat will be propelled by hand with oars and held in place at the sampling location with ropes secured to the bank. Efforts will be made to move the boat slowly through the water to minimize disturbance to settled mixed material.

Field staff will record the thickness of the water cap and the thickness of the mixed material at each location. If less than 2 ft of total depth of mixed material is found in a sampling grid, the sample location will be moved to the nearest sampling grid with mixed material depth of greater than 2 ft. The location will be recorded using a handheld global positioning system (GPS) device. Field staff will also record observable and notable water or mixed material characteristics encountered in the field including but not limited to: density, viscosity, color, odor, and debris.

Mixed material sample columns (cores) will be collected using a 1.5-inch-diameter Sludge Judge with a ball valve attached or similar equipment with the same or larger diameter. If mixed material samples are unrecoverable with the Sludge Judge, a 2-inch-diameter AMS Multi-Stage Sludge Sampler with flapper valve and core catcher or Eckman Grab Sampler may be used. Field staff will utilize the design drawings (Figures 3 and 6) to estimate the depth to the liner (which in the case of Burnt Ridge includes a 1 ft clay layer). Field staff will not advance sampling equipment to within 1 ft of the estimated liner depth.

Multiple discrete cores may need to be collected from each sample location to provide adequate sample volume. Sample jars will be filled to minimize headspace in the container.

Mixed material samples will be analyzed for the analytes listed in Table 15 for Burnt Ridge and Table 16 for Newaukum Prairie. One duplicate sample will be collected from each storage unit.

Mixed material sample containers to be submitted for the analysis of VOCs will be filled first to minimize disturbance to the sample. Appropriate sample containers for each of the required analyses listed above are provided in Table 15 (Burnt Ridge) and Table 16 (Newaukum Prairie). Samples will be placed in a shipping cooler and will be stored at less than 6 degrees Celsius (°C). Samples will be transported to the laboratory within 6 days of sample collection, and will be stored at the laboratory at less than 6°C.

#### 2.2.2.2 Big Hanaford

The Big Hanaford storage unit is approximately 100 ft long by 60 ft wide and the vertical concrete side panels that make up the walls of the storage unit are approximately 11.5 ft in height. There is approximately 8 ft of headspace between the top of the wall panels and the eaves of the roof. There is approximately 1 ft of freeboard from the top of the mixed material to the top of the concrete wall panels. An access abutment that is approximately 20 ft in width exists on the south side of the storage unit. A wooden gate exists on the west side of the storage unit but this does not currently provide an access point. The top thickness of each of the wall panels is approximately 8 inches.

Because of the restricted access to the storage unit, samples will be taken from a sampling platform secured to the side wall of the unit. The sampling platform will be placed on top of the mixed material. Field staff will access the sampling platform with a ladder where appropriate. This access restriction limits sample collection to locations near the side walls of the storage unit as described in Section 2.2.1.2 above. At no time will field staff walk directly on the accumulated mixed material. Field staff will utilize safety restraints and harnesses as fall protection in accordance with the HASP. If samples cannot be collected safely from a certain location, samples will instead be collected at a different time or from a different location so they can be collected safely.

Samples will be collected below the mixed material surface. The mixed material will be sampled by fitting a disposable slip cap to the end of a section of PVC pipe and pushing the pipe by hand to the desired sampling depth. A narrow diameter hand auger will then be lowered through the PVC pipe and used to displace the slip cap and collect the sample from that depth. Sample locations and depths are identified in Table 14; grids are identified on Figure 8. All samples will be grab samples. The coordinates and position of each sample location will be determined using a combination of a handheld GPS[1] and hand measurements, as appropriate.

Field staff will also record observable and notable mixed material characteristics encountered in the field including but not limited to: density, viscosity, color, odor, and debris. Mixed material sample cores will be collected in the hand auger. Multiple, discrete cores may need to be collected from each sample location to provide adequate sample volume. Sample jars will be filled to minimize headspace in the container.

Mixed material samples will be analyzed for the analytes listed in Table 17 for Big Hanaford. One duplicate sample will be collected.

Additional sample containers will be collected and archived by the laboratory for the PCB analysis and potentially the TCLP analysis for cobalt; acrylonitrile; naphthalene; 2,4-dinitrotoluene; 2,6-dinitrotoluene; and 4-methylphenol, if needed. Mixed material samples to be submitted for the analysis of VOCs will be collected and preserved in accordance with EPA Method 5035A. Appropriate sample containers for each of the required analyses listed above are provided in Table 17. Samples will be placed in a shipping cooler and stored at less than 6°C. Samples will be transported to the laboratory within 6 days of sample collection, and will be stored at the laboratory at less than 6°C.

### 2.2.3 Equipment Decontamination

All non-dedicated field sampling equipment (e.g., stainless-steel bowls and spoons, buckets, mixed material samplers, augers, etc.) will be decontaminated between sampling locations in the following manner:

- Rinsed with clean water,
- Scrubbed with Alconox and water solution, and
- Rinsed with tap water.

[1] Handheld GPS unit will provide horizontal accuracy to within approximately 3 meters.

### 2.2.4 Sample Documentation and Handling

Samples will be transported to an analytical laboratory within 6 days of sample collection to meet the holding times provided in Tables 15-17. The transportation and handling of samples will be accomplished in a manner that not only protects the integrity of the sample, but also prevents any detrimental effects due to the release of samples. Samples will be logged on a chain-of-custody form and will be kept in coolers on ice, and maintained at less than 6°C until delivery to the analytical laboratory. The chain-of-custody form will accompany each shipment of samples to the laboratory.

A complete record of field activities will be maintained. Documentation necessary to meet quality assurance objectives for this project is described in Section 5.3 of the QAPP (Appendix E) and includes: field notes and sampling forms, sample container labels, and sample chain-of-custody forms. Original documentation will be kept in LAI's project files, and sampling documentation and other project records will be safeguarded to prevent loss, damage, or alteration.

If an error is made on a document, corrections will be made by drawing a single line through the error and entering the correct information. The erroneous information will not be obliterated. Corrections will be initialed and dated, and, if necessary, a footnote explaining the correction will be added. Errors will be corrected by the person who made the entry, whenever possible. Documentation will include:

- Recordkeeping by field personnel of primary field activities
- Recordkeeping of all samples collected for analysis
- Use of sample labels and chain-of-custody tracking forms for all samples collected for analysis.

Field report forms will provide descriptions of pertinent sampling activities, sampling personnel, weather conditions, and a record of any modifications to the procedures and plans identified in this plan. The field report forms are intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the sampling period.

After sample collection, the following information will be recorded on the field log sheet:

- Sample identification
- Date and time of sample collection
- Name of person collecting the sample
- Sample grid location and GPS coordinates
- Physical observations (including color, apparent grain size, presence of debris [e.g., wood debris], presence of sheen or other visible contamination, and odor).

Sample nomenclature will provide information regarding the facility (BR for the Burnt Ridge storage unit, NP for Newaukum Prairie storage unit, BH for the Big Hanaford storage unit); sample type (G-mixed material grab); sample grid location letter (A, B, C consistent with grid layout presented on Figures 2, 5, and 8) and sample grid location number; and the sample depth range for the Big

Hanaford samples (TP-top, MD-middle, BT-bottom). Blind field duplicates will be labeled with a Dup and a number instead of the sampling grid. For example:

- NP-G-A2: Newaukum Prairie storage unit, mixed material grab, sample grid A2.
- NP-G-Dup1: Newaukum Prairie storage unit, mixed material grab, blind field duplicate sample 1.
- BH-G-C8TP: Big Hanaford storage unit, mixed material grab, sample grid C8, top depth interval.

# 3.0 SAMPLE ANALYSIS

Samples will be analyzed for the analytes listed in Tables 15, 16, and 17 by an Ecology-accredited analytical laboratory by the analytical methods listed in the table. Results will be reported on an as-received basis in accordance with section 8.2 of the EPA Delisting Guidance (EPA 1993). Analytes were selected based on comparison of the results from the PGG report (PGG 2014a) with the PDLs and TCLP-PDLs x 20. Tables 2-4 present the results from the PGG sample analysis. The selected analytes based on the PGG report include: acrylonitrile; cobalt; 2,4-dinitrotoluene; 2,6-dinitrotoluene; naphthalene; and 4-methylphenol at the Big Hanaford storage unit, as described in sections 1.5 and 1.6. Samples from Burnt Ridge and Newaukum Prairie were collected and analyzed for cobalt in order to determine the concentration of cobalt in the leachate. The results of the TCLP analyses indicated that cobalt is below the TCLP PDL and therefore no additional analyses for these two storage units is warranted, as discussed previously in this plan.

If the maximum total concentration of acrylonitrile; cobalt; 2,4-dinitrotoluene; 2,6-dinitrotoluene; naphthalene; or 4-methylphenol in a sample collected from the Big Hanaford storage unit exceeds the TCLP-PDL x 20; then a TCLP extraction will be performed on an archived sample and the extract will be analyzed for the exceeding analyte. The analysis will be performed using the laboratory method listed in Table 17. If more than one sample exceeds the TCLP-PDL x 20 for any one analyte, the sample with the highest total concentration will be selected. If the TCLP concentration of acrylonitrile; cobalt; 2,4-dinitrotoluene; 2,6-dinitrotoluene; naphthalene; or 4-methylphenol exceeds the TCLP-PDL, Emerald and FMF will consult with Ecology and EPA regarding TCLP analysis of applicable additional archived samples. Ecology and EPA have agreed that, due to the length of time the mixed material has been in the storage unit, samples held longer than the method holding time will be considered valid in all respects as long as they were stored in the appropriate containers at the required temperature.

Three samples from Big Hanaford will be selected by Ecology and EPA based on the results for other analytes for analysis of PCBs. Ecology and EPA have agreed that, due to the length of time the mixed material has been in the storage unit, samples held longer than the method holding time will be considered valid in all respects as long as they were stored in the appropriate containers at the required temperature.

All samples will be analyzed for F003 (acetone), U019 (benzene), U154 (methanol), and U220 (toluene) in order to demonstrate compliance with the LDRs. All of the samples will be analyzed for total acetone, benzene, methanol, and toluene. Although the methanol LDR is reported as a TCLP concentration; analytical limitations will produce an RL greater than the LDR limit. The total methanol concentration will be compared to the TCLP LDR using the rule of 20. If the sample exceeds the LDR using the rule of 20, Emerald and FMF will consult with Ecology and the EPA to determine further actions.

# 4.0 QUALITY ASSURANCE/QUALITY CONTROL

The Quality Assurance Project Plan is provided in Appendix E.

# 5.0 SCHEDULE

According to the Agreement, this plan is to be implemented within 30 days of Ecology approval. As discussed with Ecology, the schedule for implementation may be impacted by inclement weather. Sampling is planned to be completed by the end of fall 2017 or within 30 days of Ecology approval of the plan, whichever is later.

# 6.0 REPORTING

Upon completion of the sampling event and the receipt and validation of the laboratory results, a report will be prepared and submitted to Ecology and EPA. This report will detail sampling procedures, field observations, deviations from this plan, and the results of the sampling event. The report will include a discussion of the waste characterization. The analytical results will be summarized, compared to the PDLs and TCLP-PDLs (either by direct comparison in the event of a TCLP extraction or by the rule of 20 if no TCLP extraction was performed).

In addition, the concentrations of acetone, benzene, and toluene will be compared directly to the LDRs. The concentration of methanol will be compared to the LDR using the rule of 20.

A brief discussion of any additional sampling or hot spot delineation that may be appropriate may also be included in the final report. No additional sampling or hot spot delineation will occur without approval from Ecology and the EPA.

# 7.0 REFERENCES

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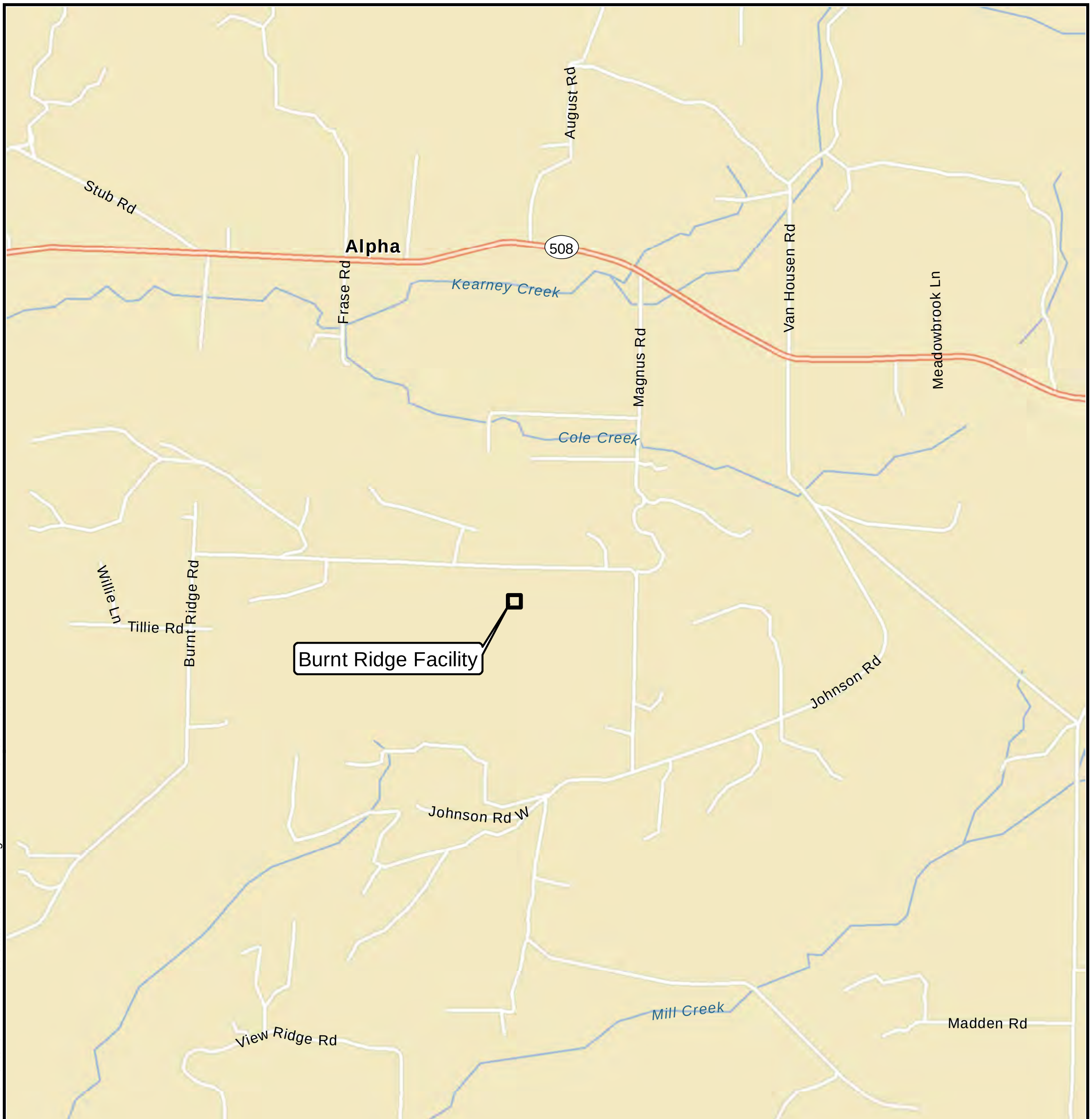


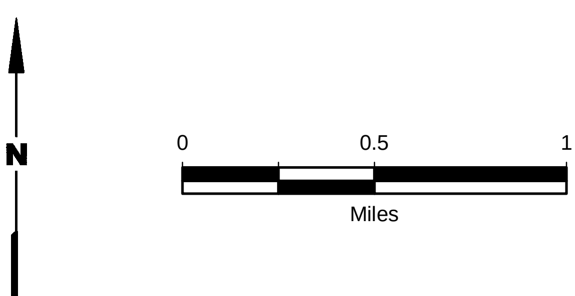



Data Source: Esri 2012

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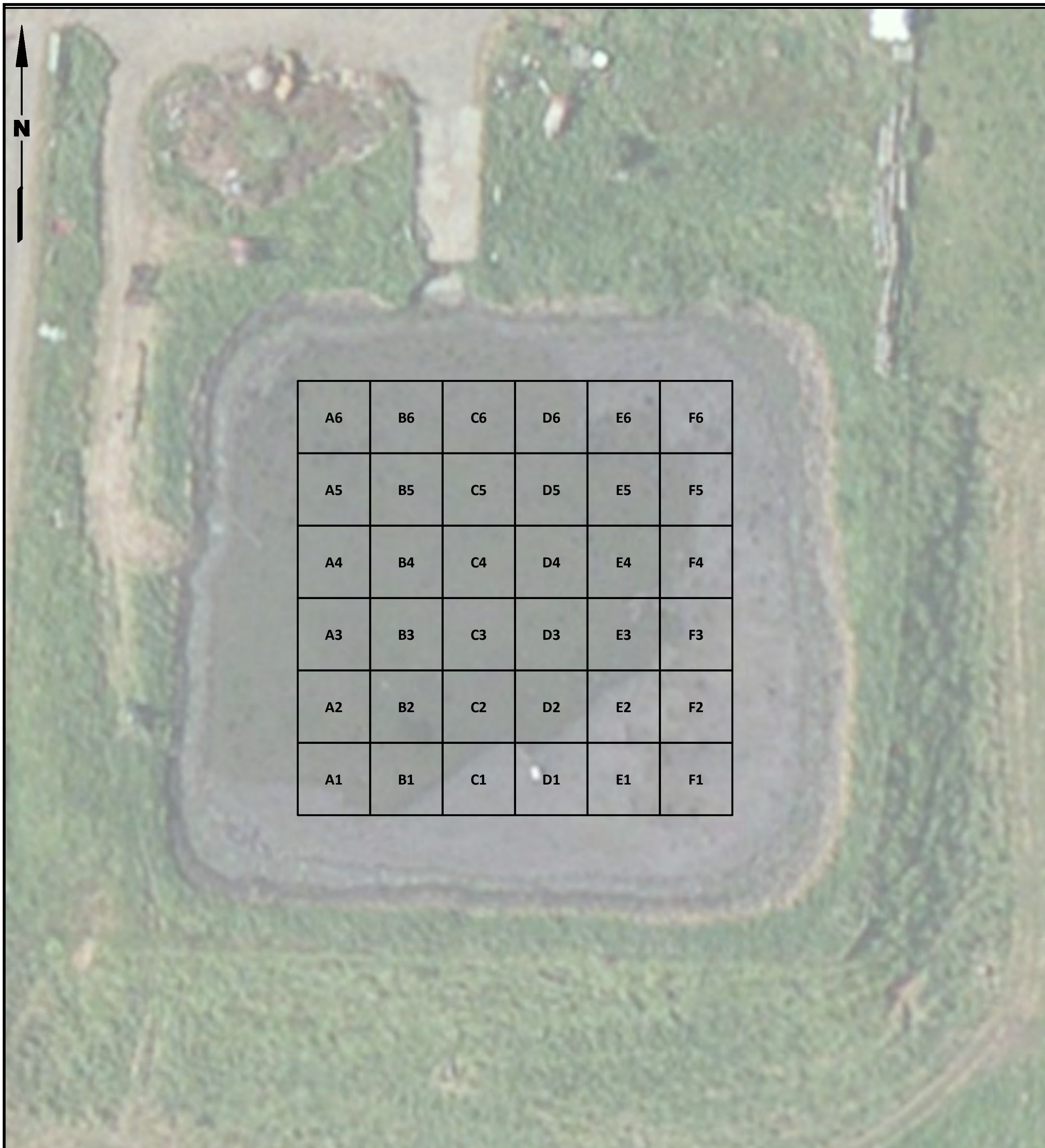
Landau Associates

| Emerald Kalama<br>Waste Characterization Plan<br>Fire Mountain Farms Storage Units | **Burnt Ridge Vicinity Map** | Figure<br>1 |
|---|---|---|




Legend

A1 Sampling Grid

0 50 100

Feet

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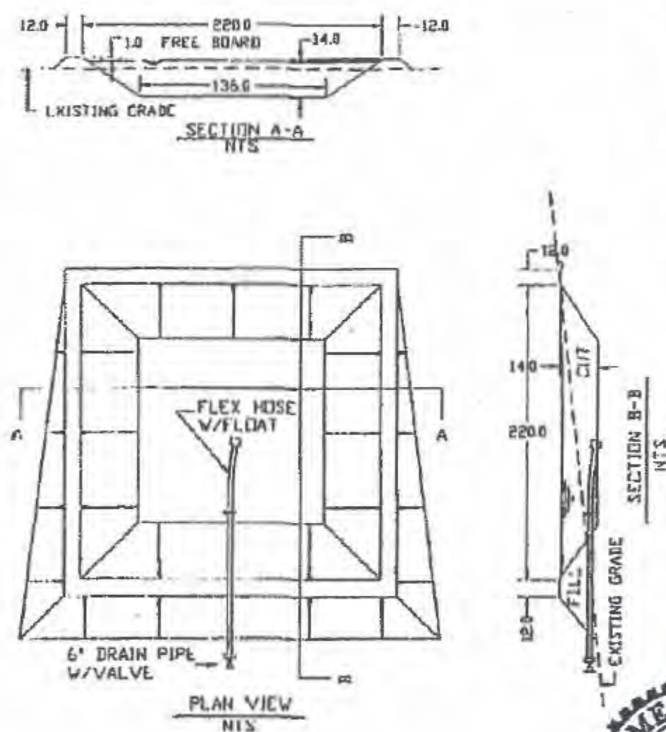
Data Source: Esri 2012; Esri World Imagery

Landau Associates

| Emerald Kalama<br>Waste Characterization Plan<br>Fire Mountain Farms Storage Units | **Burnt Ridge Storage Unit**<br>**Grid Locations** | Figure<br>2 |
|---|---|---|

# Burnt Ridge Lagoon




NOTES

1. Slopes are 3:1 inside and 2:1 outside.
2. Fill material shall be placed in accordance with SCS construction specification CS-15.
3. Approximate excavation is 8,940 CY and fill is 7,800 CY. Excess soil may be placed on the outside of dikes.
4. Drain pipe shall be 6" SCH 40 steel with flanged ends.
5. The lagoon shall be sealed using Claymax 600CL geosynthetic clay liner manufactured by Colloid Environmental Technologies Company.
6. Installation of the sealing material shall be in accordance with the manufacturer recommendations.
7. The CSC Technician shall be notified at least 24 hrs prior to placement of the sealing material.
8. The top 6" of soil shall be striped prior to starting of cut and fill operations.
9. All disturbed and fill areas shall be seeded to grass upon the completion of construction.
10. Warning signs shall be placed on all sides on the lagoon.
11. Storage volume is 3,027,500 gal.

JAMES L. THODE, STATE OF WASHINGTON, 24357, REGISTERED PROFESSIONAL ENGINEER

FIRE MOUNTIAN FARMS
BURNT RIDGE LAGOON
856 BURNT RIDGE RD.
CINEBAR, WA
AUGUST 1998

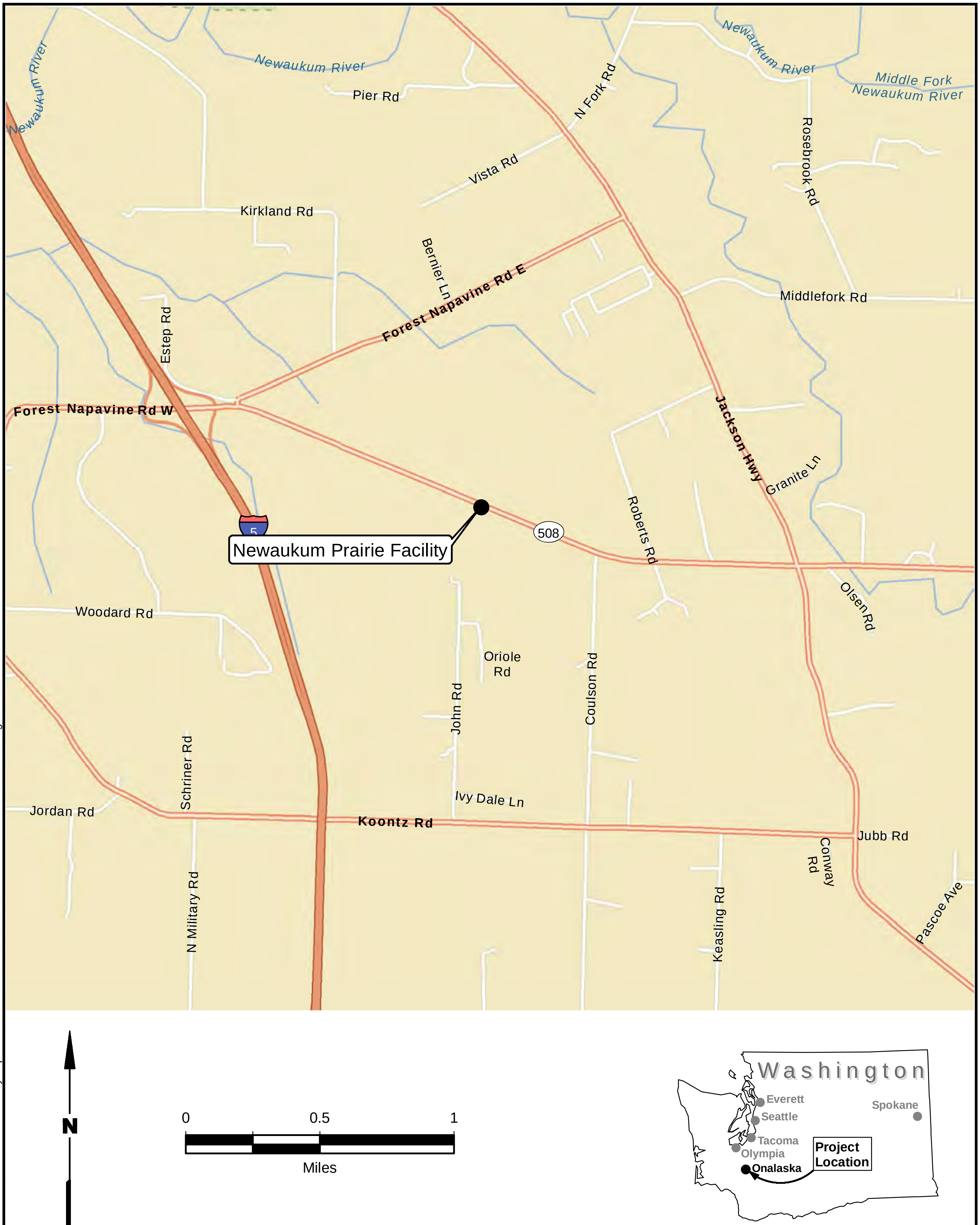
159

Emerald Kalama
Waste Characterization Plan
Fire Mountain Farms Storage Units

**Burnt Ridge Storage Unit Design**

Figure 3

LANDAU ASSOCIATES




Data Source: Esri 2012

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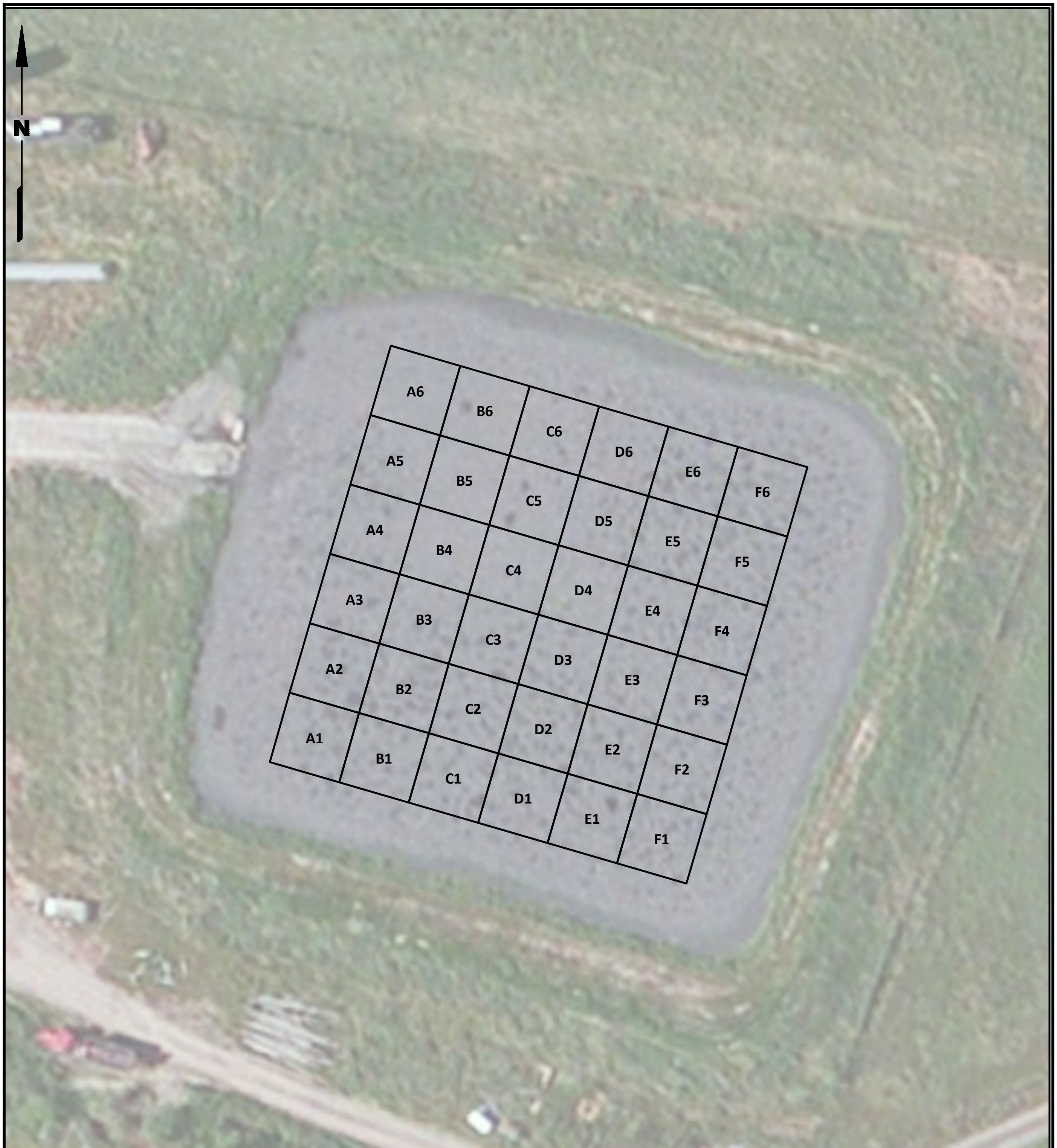
LANDAU ASSOCIATES

| Emerald Kalama<br>Waste Characterization Plan<br>Fire Mountain Farms Storage Units | **Newaukum Prairie<br>Vicinity Map** | Figure<br>4 |
|---|---|---|




Legend

A1 Sampling Grid

0 50 100

Feet

Data Source: Esri 2012; Esri World Imagery

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Landau Associates

| Emerald Kalama<br>Waste Characterization Plan<br>Fire Mountain Farms Storage Units | **Newaukum Prairie<br>Storage Unit<br>Grid Locations** | Figure<br>5 |
|---|---|---|

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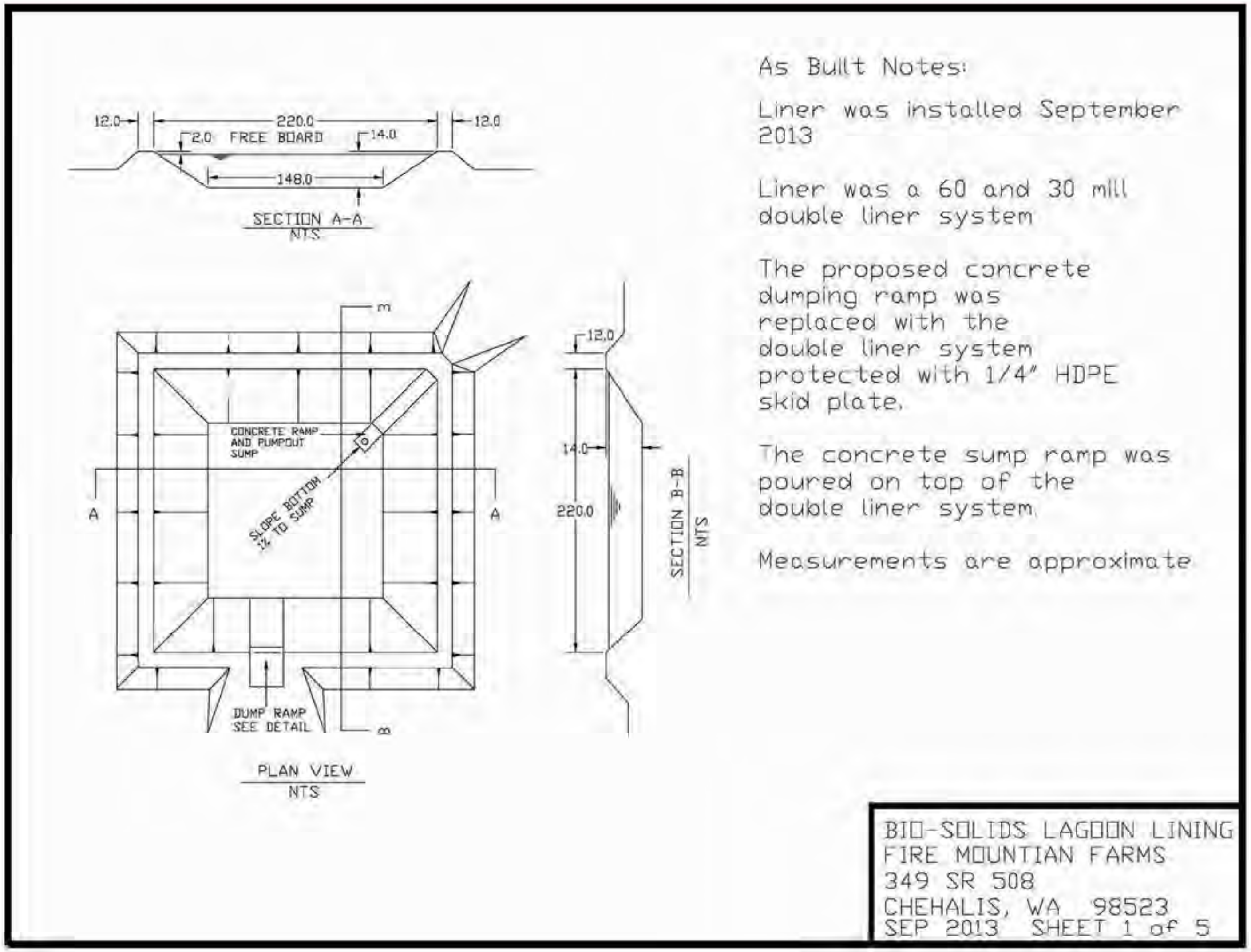
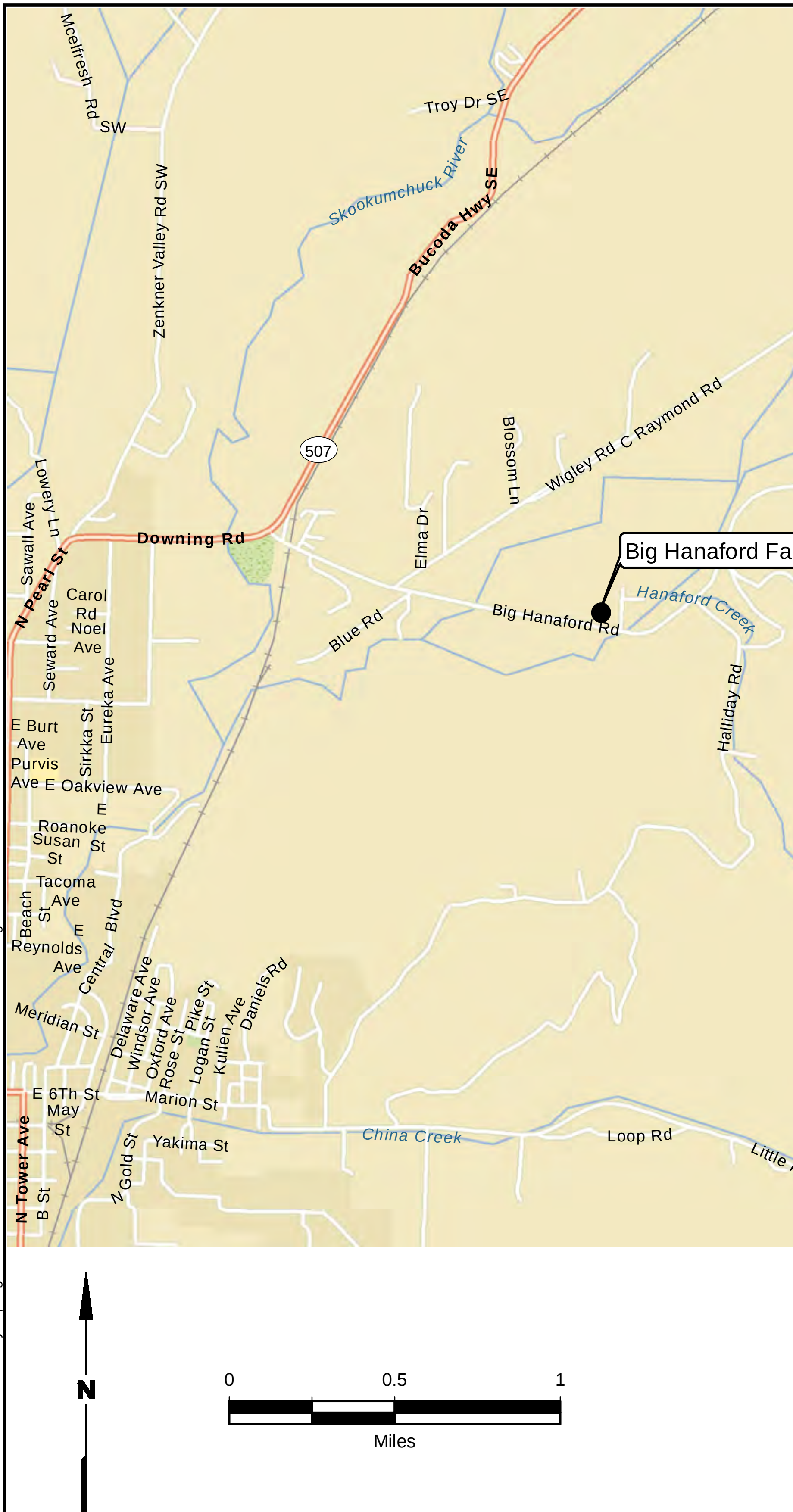



LANDAU ASSOCIATES

Emerald Kalama
Waste Characterization Plan
Fire Mountain Farms Storage Units

**Newaukum Prairie Storage Unit Design**

Figure 6





Data Source: Esri 2012

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LANDAU ASSOCIATES

| | | |
|---|---|---|
| Emerald Kalama<br>Waste Characterization Plan<br>Fire Mountain Farms Storage Units | **Big Hanaford Vicinity Map** | Figure 7 |


Legend

A1 Sampling Grid

Top Sample Depth (0 - 3.5 ft)

Middle Sample Depth (3.5 - 7 ft)

Bottom Sample Depth (7 - 10 ft)

0 50 100

Feet

Data Source: Google Earth Pro, 2014.

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LANDAU ASSOCIATES

Emerald Kalama
Waste Characterization Plan
Fire Mountain Farms Storage Units

**Big Hanaford Storage Unit**
**Grid Locations**

Figure
8

# Table 1
## Mixed Material Sources
## Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units
## Lewis County, Washington

| Biosolids Source | Big Hanaford (tons) | Newaukum Prairie (tons) | Burnt Ridge (tons) |
|---|---|---|---|
| Emerald Kalama Chemical, LLC | 18.8 | 24.7 | 9.8 |
| Kitsap Municipal Wastewater Treatment Plant | 94.1 | 66.7 | 26.5 |
| Castle Rock Municipal Wastewater Treatment Plant | 3.5 | 2.1 | 0.8 |
| West Sound Utility District Wastewater Treatment Plant | 49.1 | 42.8 | 17.0 |
| Camas Municipal Wastewater Treatment Plant | 17.3 | 20.4 | 8.1 |
| McCleary Municipal Wastewater Treatment Plant | 3.7 | 3.0 | 1.2 |
| Aberdeen Municipal Wastewater Treatment Plant | 38.8 | 49.7 | 19.7 |
| Kalama Municipal Wastewater Treatment Plant | 4.5 | 2.1 | 0.8 |
| Gig Harbor Municipal Wastewater Treatment Plant | 38.3 | 34.8 | 13.8 |
| Grand Mound Municipal Wastewater Treatment Plant | | 8.0 | 3.2 |
| Darigold - Wastewater Treatment Plant | | 21.1 | 8.4 |
| Ocean Shores Municipal Wastewater Treatment Plant | | 30.9 | 12.3 |
| Lacey Olympia Tumwater Thurston County Wastewater Treatment Plant | 33.0 | 31.2 | |
| Bio Recycling - Private Wastewater Treatment Plant | 63.5 | | |
| Port of Longview - Catch Basin Solids | | 1.1 | |
| Lewis County Water Sewer District 6 Municipal Wastewater Treatment Plant | 5.1 | 1.3 | 0.5 |
| Cow Manure (Fire Mountain Farms water runoff from barn lot) | | | 3.8 |
| **Total** | 369.7 | 340.0 | 126.0 |

**Table 2**
**Prior Sampling Results**
**Fire Mountain Farms Burnt Ridge Storage Unit**
**Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units**
**Lewis County, Washington**

| Analyte | CAS No. | Preliminary Delisting Level (a) | TCLP-PDL X 20 (b) | Sample ID and Sample Date | | |
|---|---|---|---|---|---|---|
| | | | | BR-Comp-1 7/9/2014 | BR-Comp-2 7/9/2014 | BR-Comp-3 7/9/2014 |
| **Volatiles (ug/kg; EPA Method 8260C)** | | | | | | |
| 1,1,1-Trichloroethane | 71-55-6 | 2.45E+11 | 1.40E+10 | 2.3U | 2U | 1.8U |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 1.88E+08 | 5.54E+06 | 2.3U | 2U | 1.8U |
| 1,1,2-Trichloroethane | 79-00-5 | 5.25E+08 | 2.32E+04 | 2.3U | 2U | 1.8U |
| 1,1-Dichloroethane | 75-34-3 | 1.88E+10 | 6.36E+06 | 2.3U | 2U | 1.8U |
| 1,1-Dichloroethene | 75-35-4 | 2.88E+09 | 1.29E+05 | 2.3U | 2U | 1.8U |
| 1,2,4-Trichlorobenzene | 120-82-1 | 2.49E+10 | 1.19E+05 | 12U | 10U | 9U |
| 1,2-Dichlorobenzene | 95-50-1 | 2.19E+10 | 2.76E+06 | 2.3U | 2U | 1.8U |
| 1,2-Dichloroethane | 107-06-2 | 8.25E+07 | 1.26E+04 | 2.3U | 2U | 1.8U |
| 1,2-Dichloropropane | 78-87-5 | 7.06E+08 | 4.06E+04 | 2.3U | 2U | 1.8U |
| 1,3-Dichlorobenzene | 541-73-1 | --- | --- | 2.3U | 2U | 1.8U |
| 1,4-Dichlorobenzene | 106-46-7 | 2.50E+08 | 5.70E+04 | **48** | **26** | **32** |
| 2-Chloroethylvinylether | 110-75-8 | --- | --- | 12U | 10U | 9U |
| Acrolein | 107-02-8 | 7.68E+05 | 6.04E+31 | 120U | 100U | 90U |
| Acrylonitrile | 107-13-1 | 2.75E+07 | 2.74E+03 | 12U | 10U | 9U |
| Benzene | 71-43-2 | 2.51E+08 | 2.46E+04 | 2.3U | 2U | 1.8U |
| Bromodichloromethane | 75-27-4 | 2.51E+08 | 1.63E+04 | 2.3U | 2U | 1.8U |
| Bromoform | 75-25-2 | 4.68E+09 | 1.82E+05 | 2.3U | 2U | 1.8U |
| Bromomethane | 74-83-9 | 2.78E+07 | 1.32E+27 | 2.3U | 2U | 1.8U |
| Carbon Tetrachloride | 56-23-5 | 1.37E+08 | 1.70E+04 | 2.3U | 2U | 1.8U |
| Chlorobenzene | 108-90-7 | 1.37E+10 | 5.54E+05 | 2.3U | 2U | 1.8U |
| Chloroethane | 75-00-3 | 6.33E+08 | 2.78E+07 | 2.3U | 2U | 1.8U |
| Chloroform | 67-66-3 | 4.35E+07 | 9.62E+03 | 2.3U | 2U | 1.8U |
| Chloromethane | 74-87-3 | 2.02E+08 | 7.28E+05 | 2.3U | 2U | 1.8U |
| cis-1,3-Dichloropropene | 10061-01-5 | 6.70E+08 | 8.78E+32 | 2.3U | 2U | 1.8U |
| Dibromochloromethane | 124-48-1 | 6.70E+08 | 1.67E+04 | 2.3U | 2U | 1.8U |
| Ethylbenzene | 100-41-4 | 3.98E+10 | 5.10E+06 | 2.3U | 2U | 1.8U |
| Hexachlorobutadiene | 87-68-3 | 3.11E+06 | 9.82E+03 | 12U | 10U | 9U |
| Methylene Chloride | 75-09-2 | 9.90E+08 | 9.48E+04 | 4.6U | 4U | 3.6U |
| Naphthalene | 91-20-3 | 1.43E+09 | 3.92E+03 | 12U | 10U | 9U |
| Tetrachloroethene | 127-18-4 | 1.19E+07 | 2.46E+03 | 2.3U | 2U | 1.8U |
| Toluene | 108-88-3 | 6.64E+10 | 5.44E+06 | **20** | **35** | **19** |
| trans-1,2-Dichloroethene | 156-60-5 | 1.36E+09 | 3.08E+05 | 2.3U | 2U | 1.8U |
| trans-1,3-Dichloropropene | 10061-02-6 | 7.06E+08 | 8.78E+32 | 2.3U | 2U | 1.8U |
| Trichloroethene | 79-01-6 | 4.28E+08 | 1.36E+04 | 2.3U | 2U | 1.8U |
| Vinyl Chloride | 75-01-4 | 7.44E+06 | 9.66E+02 | 2.3U | 2U | 1.8U |
| **Metals (mg/kg; EPA Method 6010C/7471A)** | | | | | | |
| Antimony | 7440-36-0 | 5.80E+05 | 3.24E+01 | 40U | 30U | 30U |
| Arsenic | 7440-38-2 | 8.48E+03 | 1.01E+00 | 40U | 30U | 30U |
| Beryllium | 7440-41-7 | 5.94E+04 | 9.14E+01 | 0.7U | 0.7U | 0.6U |
| Cadmium | 7440-43-9 | 3.20E+04 | 4.12E+01 | **3** | **3** | **3** |
| Chromium | 7440-47-3 | 1.19E+04 | 2.54E+02 | **31** | **45** | **35** |
| Cobalt | 7440-48-4 | 1.59E+04 | 2.54E+01 | **43** | **48** | **37** |
| Copper | 7440-50-8 | 3.27E+06 | 3.34E+03 | **379** | **417** | **358** |
| Lead | 7439-92-1 | 1.36E+07 | 6.24E+02 | **40** | **30** | **30** |
| Molybdenum | 7439-98-7 | 1.93E+07 | 3.94E+02 | **14** | **16** | **16** |
| Nickel | 7440-02-0 | 5.94E+05 | 1.60E+03 | **28** | **45** | **31** |
| Selenium | 7782-49-2 | 2.25E+06 | 3.96E+02 | 40U | 30U | 30U |
| Silver | 7440-22-4 | 3.31E+06 | 9.24E+02 | **5** | **5** | **6** |
| Thallium | 7440-28-0 | 3.83E+02 | 5.44E+00 | 40U | 30U | 30U |
| Zinc | 7440-66-6 | 8.46E+06 | 2.40E+04 | **886** | **969** | **876** |
| Mercury | 7439-97-6 | 1.16E+06 | 8.16E+00 | **1** | **1.9** | **1.8** |
| **Semivolatiles (ug/kg; EPA Method 8270D)** | | | | | | |
| 1,2,4-Trichlorobenzene | 120-82-1 | 2.49E+10 | 1.19E+05 | 260U | 310U | 260U |
| 1,2-Dichlorobenzene | 95-50-1 | 2.19E+10 | 2.76E+06 | 260U | 310U | 260U |
| 1,2-Diphenylhydrazine | 122-66-7 | 1.80E+07 | 1.67E+03 | 260U | 310U | 260U |
| 1,3-Dichlorobenzene | 541-73-1 | --- | --- | 260U | 310U | 260U |
| 1,4-Dichlorobenzene | 106-46-7 | 2.50E+08 | 5.70E+04 | **480** | **540** | 260U |
| 2,2'-Oxybis(1-Chloropropane) | 108-60-1 | --- | --- | 260U | 310U | 260U |
| 2,4,6-Trichlorophenol | 88-06-2 | 1.55E+08 | 3.82E+04 | 1,300U | 1,500U | 1,300U |
| 2,4-Dichlorophenol | 120-83-2 | 1.40E+09 | 2.04E+05 | 1,300U | 1,500U | 1,300U |
| 2,4-Dimethylphenol | 105-67-9 | 3.52E+10 | 1.36E+06 | 260U | 310U | 260U |
| 2,4-Dinitrophenol | 51-28-5 | 7.72E+09 | 1.39E+05 | 2,600U | 3,100U | 2,600U |
| 2,4-Dinitrotoluene | 121-14-2 | 3.60E+08 | 1.99E+03 | 1,300U | 1,500U | 1,300U |
| 2,6-Dinitrotoluene | 606-20-2 | 3.60E+08 | 1.99E+03 | 1,300U | 1,500U | 1,300U |
| 2-Chloronaphthalene | 91-58-7 | 4.08E+09 | 1.23E+06 | 260U | 310U | 260U |
| 2-Chlorophenol | 95-57-8 | 1.14E+10 | 3.48E+05 | 260U | 310U | 260U |
| 2-Nitrophenol | 88-75-5 | --- | --- | 260U | 310U | 260U |
| 3,3'-Dichlorobenzidine | 91-94-1 | 1.18E+07 | 3.04E+03 | 1,300U | 1,500U | 1,300U |
| 4,6-Dinitro-2-Methylphenol | 534-52-1 | 3.86E+08 | 6.98E+03 | 2,600U | 3,100U | 2,600U |
| 4-Bromophenyl-phenylether | 101-55-3 | --- | --- | 260U | 310U | 260U |
| 4-Chlorophenyl-phenylether | 7005-72-3 | --- | --- | 260U | 310U | 260U |
| 4-Methylphenol | 106-44-5 | 1.65E+10 | 3.48E+05 | **1,100** | **450** | **460** |
| 4-Nitrophenol | 100-02-7 | --- | --- | 1,300U | 1,500U | 1,300U |
| Acenaphthene | 83-32-9 | 6.23E+09 | 1.28E+06 | 260U | 310U | 260U |
| Acenaphthylene | 208-96-8 | --- | --- | 260U | 310U | 260U |
| Anthracene | 120-12-7 | 7.06E+09 | 3.12E+06 | 260U | 310U | 260U |
| Azobenzene | 103-33-3 | --- | --- | 260U | 310U | 260U |
| Benzo(a)anthracene | 56-55-3 | 4.65E+05 | 8.42E+03 | 260U | 310U | 260U |
| Benzo(a)pyrene | 50-32-8 | 3.45E+04 | 3.16E+06 | 260U | 310U | 260U |
| Benzo(b)fluoranthene | 205-99-2 | 2.72E+05 | 2.70E+07 | **330M** | 310U | **380M** |
| Benzo(g,h,i)perylene | 191-24-2 | --- | --- | 260U | 310U | 260U |
| Benzo(k)fluoranthene | 207-08-9 | 3.22E+06 | 8.02E+22 | **330M** | 310U | **360M** |
| bis(2-Chloroethoxy) Methane | 111-91-1 | 1.16E+10 | 2.04E+05 | 260U | 310U | 260U |
| Bis-(2-Chloroethyl) Ether | 111-44-4 | 2.34E+08 | 1.33E+04 | 260U | 310U | 260U |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | 2.44E+10 | 3.86E+33 | **10,000** | **12,000** | **9,100** |
| Butylbenzylphthalate | 85-68-7 | 2.06E+09 | 4.80E+06 | 260U | 310U | 260U |
| Chrysene | 218-01-9 | 4.57E+07 | 8.42E+05 | 260U | 310U | 260U |
| Dibenz(a,h)anthracene | 53-70-3 | 3.63E+04 | 4.44E+16 | 260U | 310U | 260U |
| Diethylphthalate | 84-66-2 | 1.14E+12 | 1.20E+08 | 260U | 310U | 260U |
| Dimethylphthalate | 131-11-3 | 3.86E+13 | 6.94E+08 | 260U | 310U | 260U |
| Di-n-Butylphthalate | 84-74-2 | 2.12E+09 | 2.96E+06 | 260U | 310U | 260U |

**Table 2**
**Prior Sampling Results**
**Fire Mountain Farms Burnt Ridge Storage Unit**
**Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units**
**Lewis County, Washington**

| Analyte | CAS No. | Preliminary Delisting Level (a) | TCLP-PDL X 20 (b) | Sample ID and Sample Date | | |
|---|---|---|---|---|---|---|
| | | | | BR-Comp-1 7/9/2014 | BR-Comp-2 7/9/2014 | BR-Comp-3 7/9/2014 |
| Di-n-Octyl phthalate | 117-84-0 | 4.18E+10 | 3.12E+32 | 260U | 310U | 260U |
| Fluoranthene | 206-44-0 | 1.17E+08 | 2.96E+05 | **360** | **390** | **450** |
| Fluorene | 86-73-7 | 1.91E+09 | 5.90E+05 | 260U | 310U | 260U |
| Hexachlorobenzene | 118-74-1 | 1.74E+04 | 1.08E+04 | 260U | 310U | 260U |
| Hexachlorobutadiene | 87-68-3 | 3.11E+06 | 9.82E+03 | 260U | 310U | 260U |
| Hexachlorocyclopentadiene | 77-47-4 | 7.08E+08 | 1.50E+32 | 1,300U | 1,500U | 1,300U |
| Hexachloroethane | 67-72-1 | 5.10E+07 | 3.30E+04 | 260U | 310U | 260U |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 8.57E+05 | 2.96E+14 | 260U | 310U | **400** |
| Isophorone | 78-59-1 | 1.26E+11 | 1.35E+06 | 260U | 310U | 260U |
| Naphthalene | 91-20-3 | 1.43E+09 | 3.92E+03 | 260U | 310U | 260U |
| Nitrobenzene | 98-95-3 | 1.93E+09 | 3.48E+04 | 260U | 310U | 260U |
| N-Nitrosodimethylamine | 62-75-9 | 2.83E+06 | 2.66E+01 | 1,300U | 1,500U | 1,300U |
| N-Nitroso-Di-N-Propylamine | 621-64-7 | 3.26E+07 | 1.93E+02 | 260U | 310U | 260U |
| N-Nitrosodiphenylamine | 86-30-6 | 2.10E+09 | 2.72E+05 | 260U | 310U | 260U |
| Pentachlorophenol | 87-86-5 | 3.05E+07 | 2.90E+03 | 1,300U | 1,500U | 1,300U |
| Phenanthrene | 85-01-8 | --- | --- | 260U | 310U | 260U |
| Phenol | 108-95-2 | 1.16E+12 | 2.08E+07 | 260U | 310U | 260U |
| Pyrene | 129-00-0 | 2.10E+08 | 5.34E+05 | **390** | **310** | **270** |
| Total Benzofluoranthenes | TOTBFA | --- | --- | **350M** | 310U | **400M** |
| **PCBs (ug/kg; EPA Method 8082A)** | | | | | | |
| Aroclor 1016 | 12674-11-2 | --- | --- | 9.8U | NA | NA |
| Aroclor 1221 | 11104-28-2 | --- | --- | 9.8U | NA | NA |
| Aroclor 1232 | 11141-16-5 | --- | --- | 9.8U | NA | NA |
| Aroclor 1242 | 53469-21-9 | --- | --- | 9.8U | NA | NA |
| Aroclor 1248 | 12672-29-6 | --- | --- | 98U | NA | NA |
| Aroclor 1254 | 11097-69-1 | --- | --- | 150U | NA | NA |
| Aroclor 1260 | 11096-82-5 | --- | --- | **61** | NA | NA |
| Total PCBs (c) | 1336-36-3 | 1.12E+02 | 2.40E+13 | **61** | NA | NA |
| **Pesticides (ug/kg; EPA Method 8081B)** | | | | | | |
| 4,4'-DDD | 72-54-8 | 1.59E+04 | 2.64E+31 | 16U | NA | NA |
| 4,4'-DDE | 72-55-9 | 8.21E+03 | 1.95E+22 | 16U | NA | NA |
| 4,4'-DDT | 50-29-3 | 2.33E+03 | 1.17E+31 | 16U | NA | NA |
| Aldrin | 309-00-2 | 6.70E+01 | 5.98E+12 | 8.2U | NA | NA |
| alpha-BHC | 319-84-6 | 5.07E+05 | 1.26E+25 | 8.2U | NA | NA |
| beta-BHC | 319-85-7 | 7.09E+05 | 7.60E+02 | 8.2U | NA | NA |
| cis-Chlordane | 5103-71-9 | --- | --- | 19U | NA | NA |
| delta-BHC | 319-86-8 | --- | --- | 110U | NA | NA |
| Dieldrin | | --- | --- | 57U | NA | NA |
| Endosulfan I | 959-98-8 | --- | --- | 14U | NA | NA |
| Endosulfan II | 33213-65-9 | --- | --- | 16U | NA | NA |
| Endosulfan Sulfate | 1031-07-8 | --- | --- | 72U | NA | NA |
| Endrin | 72-20-8 | 8.73E+06 | 9.26E+15 | 25U | NA | NA |
| Endrin Aldehyde | 7421-93-4 | --- | --- | 16U | NA | NA |
| gamma BHC (Lindane) | 58-89-9 | 2.83E+06 | 1.23E+23 | 8.2U | NA | NA |
| Heptachlor | 76-44-8 | 6.40E+02 | 1.57E+30 | 8.2U | NA | NA |
| Heptachlor Epoxide | 1024-57-3 | 2.22E+04 | 6.74E+30 | 8.2U | NA | NA |
| Toxaphene | 8001-35-2 | 7.50E+02 | 3.98E+10 | 820U | NA | NA |
| trans-Chlordane | 5103-74-2 | --- | --- | 1,100U | NA | NA |
| **Dioxins/Furans (pg/g; EPA Method 1613B)** | | | | | | |
| 2,3,7,8-TCDD | 1746-01-6 | 9.90E+00 | 4.84E+09 | 2.35UJ | NA | NA |
| **Inorganic Parameters** | | | | | | |
| N-Nitrate (mg-N/kg; Calculated) | NITRATE | --- | --- | 0.6U | NA | NA |
| N-Ammonia (mg-N/kg; EPA 350.1M) | AMMONIA | --- | --- | **7,600** | NA | NA |
| Total Kjeldahl Nitrogen (mg-N/kg; EPA 351.2) | KJELDHAL-N | --- | --- | **33,700** | NA | NA |
| Nitrate+Nitrite (NO3+NO2) (mg-N/kg; EPA 353.2) | NITRATE-NITRITE | --- | --- | **0.60** | NA | NA |
| N-Nitrite (mg-N/kg; EPA 353.2) | NITRITE | --- | --- | **0.72** | NA | NA |
| Total Solids (%; SM2540G) | TS104 | --- | --- | **15.06** | **13.40** | **15.91** |
| Total Cyanide (mg/kg; EPA 335.4) | 57-12-5 | 1.83E+06 | 1.39E+03 | **1.05** | **1.42** | **1.08** |
| pH (Std units; SM9045) | PH | --- | --- | **7.43** | NA | NA |

(a) Preliminary Delisting Level calculated using EPA's Hazardous Waste Delisting Risk Assessment Software, as identified by the Washington State Department of Ecology (September 23, 2016 letter to Mr. Jarrod Kocin, Emerald Kalama Chemical, LLC, re: EPA and Ecology Comments to Waste Characterization Plan).
(b) TCLP-PDL x 20 represents the TCLP Preliminary Delisiting Level calculated using EPA's Hazardous Waste Delisting Risk Assessment Software, the resulting outputs were multiplied by 20 to be compared to the total analysis.
(c) Total PCBs is the sum of detected aroclors.
M = Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match.
U = Indicates the compound was not detected at the reported concentration.

**Bold** = Detected concentration.
Box = Exceedance of Preliminary Delisting Level.
(green shading) = Exceedance of TCLP-PDL X 20.
(gray shading) = Reporting limit is greater than Preliminary Delisting Level or TCLP-PDL X 20.
(blue shading) = Reporting limit is within one order of magnitude greater than either the Preliminary Delisting Level or TCLP-PDL X 20.
NA = Not Applicable.
--- = screening level not available

EPA = US Environmental Protection Agency
ID = identification
ug/kg = micrograms per kilogram
mg-N/kg = milligrams Nitrogen per kilogram
mg/kg = milligrams per kilogram
pg/g = picogram per gram

**Table 3**
**Prior Sampling Results**
**Fire Mountain Farms Newaukum Prairie Storage Unit**
**Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units**
**Lewis County, Washington**

| Analyte | CAS No. | Preliminary Delisting Levels (a) | TCLP-PDL X 20 (b) | Sample ID and Sample Date | | |
|---|---|---|---|---|---|---|
| | | | | NP-Comp-1 7/7/2014 | NP-Comp-2 7/7/2014 | NP-Comp-3 7/7/2014 |
| **Volatiles (ug/kg; EPA Method 8260C)** | | | | | | |
| 1,1,1-Trichloroethane | 71-55-6 | 1.46E+11 | 6.42E+09 | 3.9U | 3.7U | 3.2U |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 9.60E+07 | 2.54E+06 | 3.9U | 3.7U | 3.2U |
| 1,1,2-Trichloroethane | 79-00-5 | 3.12E+08 | 1.06E+04 | 3.9U | 3.7U | 3.2U |
| 1,1-Dichloroethane | 75-34-3 | 1.12E+10 | 2.92E+06 | 3.9U | 3.7U | 3.2U |
| 1,1-Dichloroethene | 75-35-4 | 1.71E+09 | 5.94E+04 | 3.9U | 3.7U | 3.2U |
| 1,2,4-Trichlorobenzene | 120-82-1 | 1.37E+10 | 5.46E+04 | 19U | 19U | 16U |
| 1,2-Dichlorobenzene | 95-50-1 | 1.12E+10 | 1.27E+06 | 3.9U | 3.7U | 3.2U |
| 1,2-Dichloroethane | 107-06-2 | 4.91E+07 | 5.80E+03 | 3.9U | 3.7U | 3.2U |
| 1,2-Dichloropropane | 78-87-5 | 3.61E+08 | 1.86E+04 | 3.9U | 3.7U | 3.2U |
| 1,3-Dichlorobenzene | 541-73-1 | --- | --- | 3.9U | 3.7U | 3.2U |
| 1,4-Dichlorobenzene | 106-46-7 | 1.27E+08 | 2.62E+04 | **91** | **120** | **97** |
| 2-Chloroethylvinylether | 110-75-8 | --- | --- | 19U | 19U | 16U |
| Acrolein | 107-02-8 | 4.57E+05 | 2.78E+31 | 190U | 190U | 160U |
| Acrylonitrile | 107-13-1 | 1.63E+07 | 1.25E+03 | 19U | 19U | 16U |
| Benzene | 71-43-2 | 1.50E+08 | 1.13E+04 | 3.9U | 3.7U | 3.2U |
| Bromodichloromethane | 75-27-4 | 1.49E+08 | 7.48E+03 | 3.9U | 3.7U | 3.2U |
| Bromoform | 75-25-2 | 2.39E+09 | 8.38E+04 | 3.9U | 3.7U | 3.2U |
| Bromomethane | 74-83-9 | 1.65E+07 | 6.06E+26 | 3.9U | 3.7U | 3.2U |
| Carbon Tetrachloride | 56-23-5 | 8.14E+07 | 7.78E+03 | 3.9U | 3.7U | 3.2U |
| Chlorobenzene | 108-90-7 | 6.99E+09 | 2.54E+05 | 3.9U | 3.7U | 3.2U |
| Chloroethane | 75-00-3 | 3.76E+08 | 1.28E+07 | 3.9U | 3.7U | 3.2U |
| Chloroform | 67-66-3 | 2.59E+07 | 4.42E+03 | 3.9U | 3.7U | 3.2U |
| Chloromethane | 74-87-3 | 1.20E+08 | 3.34E+05 | 3.9U | 3.7U | 3.2U |
| cis-1,3-Dichloropropene | 10061-01-5 | 3.42E+08 | 4.04E+32 | 3.9U | 3.7U | 3.2U |
| Dibromochloromethane | 124-48-1 | 3.42E+08 | 7.68E+03 | 3.9U | 3.7U | 3.2U |
| Ethylbenzene | 100-41-4 | 2.03E+10 | 2.34E+06 | 3.9U | **4.60** | **3.50** |
| Hexachlorobutadiene | 87-68-3 | 1.59E+06 | 4.50E+03 | 19U | 19U | 16U |
| Methylene Chloride | 75-09-2 | 5.89E+08 | 4.36E+04 | 7.8U | 7.5U | 6.5U |
| Naphthalene | 91-20-3 | 7.84E+08 | 1.80E+03 | 19U | 19U | 16U |
| Tetrachloroethene | 127-18-4 | 6.07E+06 | 1.13E+03 | 3.9U | 3.7U | 3.2U |
| Toluene | 108-88-3 | 3.39E+10 | 2.50E+06 | **140,000** | **150,000** | **130,000** |
| trans-1,2-Dichloroethene | 156-60-5 | 8.08E+08 | 1.42E+05 | 3.9U | 3.7U | 3.2U |
| trans-1,3-Dichloropropene | 10061-02-6 | 3.60E+08 | 4.04E+32 | 3.9U | 3.7U | 3.2U |
| Trichloroethene | 79-01-6 | 2.19E+08 | 6.24E+03 | 3.9U | 3.7U | 3.2U |
| Vinyl Chloride | 75-01-4 | 4.42E+06 | 4.44E+02 | 3.9U | 3.7U | 3.2U |
| **Metals (mg/kg; EPA Method 6010C/7471A)** | | | | | | |
| Antimony | 7440-36-0 | 2.96E+05 | 1.50E+01 | 70U | 80U | 80U |
| Arsenic | 7440-38-2 | 4.33E+03 | 4.66E-01 | 70U | 80U | 80U |
| Beryllium | 7440-41-7 | 3.27E+04 | 4.30E+01 | 1U | 2U | 2U |
| Cadmium | 7440-43-9 | 1.63E+04 | 1.88E+01 | 3U | 3U | 3U |
| Chromium | 7440-47-4 | 6.53E+03 | 1.23E+02 | **24** | **26** | **27** |
| Cobalt | 7440-48-4 | 8.71E+03 | 1.18E+01 | **76** | **87** | **89** |
| Copper | 7440-50-8 | 1.67E+06 | 1.56E+03 | **440** | **493** | **503** |
| Lead | 7439-92-1 | 7.48E+06 | 2.90E+02 | 30U | 30U | 30U |
| Molybdenum | 7439-98-7 | 1.07E+07 | 1.80E+02 | **12** | **13** | **14** |
| Nickel | 7440-02-0 | 3.27E+05 | 7.46E+02 | **30** | **30** | **30** |
| Selenium | 7782-49-2 | 1.15E+06 | 1.86E+02 | 70U | 80U | 80U |
| Silver | 7440-22-4 | 1.69E+06 | 4.64E+02 | 4U | 5U | 5U |
| Thallium | 7440-28-0 | 1.96E+02 | 2.50E+00 | 70U | 80U | 80U |
| Zinc | 7440-66-6 | 4.32E+06 | 1.10E+04 | **950** | **1,060** | **1,060** |
| Mercury | 7439-97-6 | 6.42E+05 | 3.74E+00 | **1.2** | **0.9** | **1.2** |
| **Semivolatiles (ug/kg; EPA Method 8270D)** | | | | | | |
| 1,2,4-Trichlorobenzene | 120-82-1 | 1.37E+10 | 5.46E+04 | 420U | 380U | 300U |
| 1,2-Dichlorobenzene | 95-50-1 | 1.12E+10 | 1.27E+06 | 420U | 380U | 300U |
| 1,2-Diphenylhydrazine | 122-66-7 | 9.17E+06 | 7.66E+02 | 420U | 380U | 300U |
| 1,3-Dichlorobenzene | 541-73-1 | --- | --- | 420U | 380U | 300U |
| 1,4-Dichlorobenzene | 106-46-7 | 1.27E+08 | 2.62E+04 | **700** | **730** | **750** |
| 2,2'-Oxybis(1-Chloropropane) | 108-60-1 | --- | --- | 420U | 380U | 300U |
| 2,4,6-Trichlorophenol | 88-06-2 | 7.90E+07 | 1.76E+04 | 2,100U | 1,900U | 1,500U |
| 2,4-Dichlorophenol | 120-83-2 | 7.13E+08 | 9.38E+04 | 2,100U | 1,900U | 1,500U |
| 2,4-Dimethylphenol | 105-67-9 | 1.80E+10 | 6.26E+05 | 420U | 380U | 300U |
| 2,4-Dinitrophenol | 51-28-5 | 4.28E+09 | 6.38E+04 | 4,200U | 3,800U | 3,000U |
| 2,4-Dinitrotoluene | 121-14-2 | 1.84E+08 | 9.14E+02 | 2,100U | 1,900U | 1,500U |
| 2,6-Dinitrotoluene | 606-20-2 | 1.84E+08 | 9.14E+02 | 2,100U | 1,900U | 1,500U |
| 2-Chloronaphthalene | 91-58-7 | 2.09E+09 | 5.64E+05 | 420U | 380U | 300U |
| 2-Chlorophenol | 95-57-8 | 5.85E+09 | 1.59E+05 | 420U | 380U | 300U |
| 2-Nitrophenol | 88-75-5 | --- | --- | 420U | 380U | 300U |
| 3,3'-Dichlorobenzidine | 91-94-1 | 6.01E+06 | 1.40E+03 | 2,100U | 1,900U | 1,500U |
| 4,6-Dinitro-2-Methylphenol | 534-52-1 | 2.14E+08 | 3.22E+03 | 4,200U | 3,800U | 3,000U |
| 4-Bromophenyl-phenylether | 101-55-3 | --- | --- | 420U | 380U | 300U |
| 4-Chlorophenyl-phenylether | 7005-72-3 | --- | --- | 420U | 380U | 300U |
| 4-Methylphenol | 106-44-5 | 8.44E+09 | 1.59E+05 | **2,400** | **2,400** | **2,600** |
| 4-Nitrophenol | 100-02-7 | --- | --- | 2,100U | 1,900U | 1,500U |
| Acenaphthene | 83-32-9 | 3.18E+09 | 5.86E+05 | 420U | 380U | 300U |
| Acenaphthylene | 208-96-8 | --- | --- | 420U | 380U | 300U |
| Anthracene | 120-12-7 | 3.60E+09 | 1.43E+06 | 420U | 380U | 300U |
| Azobenzene | 103-33-3 | --- | --- | 420U | 380U | 300U |
| Benzo(a)anthracene | 56-55-3 | 2.38E+05 | 3.86E+03 | 420U | 380U | 300U |
| Benzo(a)pyrene | 50-32-8 | 1.76E+04 | 1.45E+06 | 420U | 380U | 300U |
| Benzo(b)fluoranthene | 205-99-2 | 1.39E+05 | 1.24E+07 | 420U | 380U | **360M** |
| Benzo(g,h,i)perylene | 191-24-2 | --- | --- | 420U | 380U | 300U |
| Benzo(k)fluoranthene | 207-08-9 | 1.64E+06 | 3.68E+22 | 420U | 380U | **340M** |
| bis(2-Chloroethoxy) Methane | 111-91-1 | 6.42E+09 | 9.38E+04 | 420U | 380U | 300U |
| Bis-(2-Chloroethyl) Ether | 111-44-4 | 1.20E+08 | 6.12E+03 | 420U | 380U | 300U |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | 1.35E+10 | 1.77E+33 | **19,000** | **20,000** | **19,000** |
| Butylbenzylphthalate | 85-68-7 | 1.05E+09 | 2.20E+06 | 420U | 380U | 300U |
| Chrysene | 218-01-9 | 2.33E+07 | 3.86E+05 | 420U | 380U | 300U |
| Dibenz(a,h)anthracene | 53-70-3 | 1.86E+04 | 2.04E+16 | 420U | 380U | 300U |
| Diethylphthalate | 84-66-2 | 5.83E+11 | 5.52E+07 | 420U | 380U | 300U |
| Dimethylphthalate | 131-11-3 | 2.14E+13 | 3.18E+08 | 420U | 380U | 300U |
| Di-n-Butylphthalate | 84-74-2 | 1.08E+09 | 1.36E+06 | 420U | 380U | 300U |

**Table 3**
**Prior Sampling Results**
**Fire Mountain Farms Newaukum Prairie Storage Unit**
**Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units**
**Lewis County, Washington**

| Analyte | CAS No. | Preliminary Delisting Levels (a) | TCLP-PDL X 20 (b) | Sample ID and Sample Date NP-Comp-1 7/7/2014 | NP-Comp-2 7/7/2014 | NP-Comp-3 7/7/2014 |
|---|---|---|---|---|---|---|
| Di-n-Octyl phthalate | 117-84-0 | 2.13E+10 | 1.43E+32 | 420U | 380U | 300U |
| Fluoranthene | 206-44-0 | 5.97E+07 | 1.36E+05 | **560** | **530** | **550** |
| Fluorene | 86-73-7 | 9.77E+08 | 2.70E+05 | 420U | 380U | 300U |
| Hexachlorobenzene | 118-74-1 | 8.89E+03 | 4.96E+03 | 420U | 380U | 300U |
| Hexachlorobutadiene | 87-68-3 | 1.59E+06 | 4.50E+03 | 420U | 380U | 300U |
| Hexachlorocyclopentadiene | 77-47-4 | 3.62E+08 | 6.90E+31 | 2,100U | 1,900U | 1,500U |
| Hexachloroethane | 67-72-1 | 2.60E+07 | 1.51E+04 | 420U | 380U | 300U |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 4.38E+05 | 1.36E+14 | **450M** | **470M** | **450M** |
| Isophorone | 78-59-1 | 6.44E+10 | 6.22E+05 | 420U | 380U | 300U |
| Naphthalene | 91-20-3 | 7.84E+08 | 1.80E+03 | 420U | 380U | 300U |
| Nitrobenzene | 98-95-3 | 1.07E+09 | 1.59E+04 | 420U | 380U | 300U |
| N-Nitrosodimethylamine | 62-75-9 | 1.68E+06 | 1.22E+01 | 2,100U | 1,900U | 1,500U |
| N-Nitroso-Di-N-Propylamine | 621-64-7 | 1.66E+07 | 8.88E+01 | 420U | 380U | 300U |
| N-Nitrosodiphenylamine | 86-30-6 | 1.07E+09 | 1.25E+05 | 420U | 380U | 300U |
| Pentachlorophenol | 87-86-5 | 1.56E+07 | 1.33E+03 | 2,100U | 1,900U | 1,500U |
| Phenanthrene | 85-01-8 | --- | --- | 420U | **440** | **360** |
| Phenol | 108-95-2 | 6.42E+11 | 9.56E+06 | **520** | **630** | **410** |
| Pyrene | 129-00-0 | 1.07E+08 | 2.46E+05 | **450** | **420** | **450** |
| Total Benzofluoranthenes | TOTBFA | --- | --- | 420U | 380U | **380M** |
| **PCBs (ug/kg; EPA Method 8082A)** | | | | | | |
| Aroclor 1016 | 12674-11-2 | --- | --- | 9.8U | 9.9U | NA |
| Aroclor 1221 | 11104-28-2 | --- | --- | 9.8U | 9.9U | NA |
| Aroclor 1232 | 11141-16-5 | --- | --- | 9.8U | 9.9U | NA |
| Aroclor 1242 | 53469-21-9 | --- | --- | 9.8U | 9.9U | NA |
| Aroclor 1248 | 12672-29-6 | --- | --- | 49U | 99U | NA |
| Aroclor 1254 | 11097-69-1 | --- | --- | 150U | 150U | NA |
| Aroclor 1260 | 11096-82-5 | --- | --- | **33** | **40** | NA |
| Total PCBs (c) | 1336-36-3 | 5.72E+01 | 1.10E+13 | **33** | **40** | NA |
| **Pesticides (ug/kg; EPA Method 8081B)** | | | | | | |
| 4,4'-DDD | 72-54-8 | 8.10E+03 | 1.22E+31 | 17U | 17U | NA |
| 4,4'-DDE | 72-55-9 | 4.20E+03 | 8.94E+21 | 17U | 27U | NA |
| 4,4'-DDT | 50-29-3 | 1.19E+03 | 5.36E+30 | 170U | 100U | NA |
| Aldrin | 309-00-2 | 3.42E+01 | 2.74E+12 | 8.3U | 8.3U | NA |
| alpha-BHC | 319-84-6 | 2.59E+05 | 5.78E+24 | 8.3U | 13U | NA |
| beta-BHC | 319-85-7 | 3.62E+05 | 3.50E+02 | 22U | 8.3U | NA |
| cis-Chlordane | 5103-71-9 | --- | --- | 40U | 33U | NA |
| delta-BHC | 319-86-8 | --- | --- | 180U | 200U | NA |
| Dieldrin | | --- | --- | NA | NA | NA |
| Endosulfan I | 959-98-8 | --- | --- | 8.3U | 21U | NA |
| Endosulfan II | 33213-65-9 | --- | --- | 17U | 17U | NA |
| Endosulfan Sulfate | 1031-07-8 | --- | --- | 140U | 120U | NA |
| Endrin | 72-20-8 | 4.46E+06 | 4.26E+15 | 17U | 17U | NA |
| Endrin Aldehyde | 7421-93-4 | --- | --- | 17U | 17U | NA |
| gamma BHC (Lindane) | 58-89-9 | 1.45E+06 | 5.64E+22 | 8.3U | 8.3U | NA |
| Heptachlor | 76-44-8 | 3.27E+02 | 7.22E+29 | 8.3U | 8.3U | NA |
| Heptachlor Epoxide | 1024-57-3 | 1.14E+04 | 3.10E+30 | 340U | 280U | NA |
| Toxaphene | 8001-35-2 | 3.83E+02 | 1.83E+10 | 830U | 830U | NA |
| trans-Chlordane | 5103-74-2 | --- | --- | 1,300U | 1,400U | NA |
| **Dioxins/Furans (pg/g; EPA Method 1613B)** | | | | | | |
| 2,3,7,8-TCDD | 1746-01-6 | 5.06E+00 | 2.22E+09 | 11.5U | 11.2U | NA |
| **Inorganic Parameters** | | | | | | |
| N-Nitrate (mg-N/kg; Calculated) | NITRATE | --- | --- | 1.48U | NA | NA |
| N-Ammonia (mg-N/kg; EPA 350.1M) | AMMONIA | --- | --- | **21,400** | NA | NA |
| Total Kjeldahl Nitrogen (mg-N/kg; EPA 351.2) | KJELDHAL-N | --- | --- | **71,400** | NA | NA |
| Nitrate+Nitrite (NO3+NO2) (mg-N/kg; EPA 353.2) | NITRATE-NITRITE | --- | --- | **4.01** | NA | NA |
| N-Nitrite (mg-N/kg; EPA 353.2) | NITRITE | --- | --- | **6.09** | NA | NA |
| Total Solids (%; SM2540G) | TS104 | --- | --- | **6.43** | **6.51** | **6.69** |
| Total Cyanide (mg/kg; EPA 335.4) | 57-12-5 | 9.36E+05 | 6.38E+02 | **1.73** | **1.69** | **1.87** |
| pH (Std units; SM9045) | PH | --- | --- | **7.38** | NA | NA |

(a) Preliminary Delisting Level calculated using EPA's Hazardous Waste Delisting Risk Assessment Software, as identified by the Washington State Department of Ecology (September 23, 2016 letter to Mr. Jarrod Kocin, Emerald Kalama Chemical, LLC, re: EPA and Ecology Comments to Waste Characterization Plan).
(b) TCLP-PDL x 20 represents the TCLP Preliminary Delisiting Level calculated using EPA's Hazardous Waste Delisting Risk Assessment Software, the resulting outputs were multiplied by 20 to be compared to the total analysis.
(c) Total PCBs is the sum of detected aroclors.
M = Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match.
U = Indicates the compound was not detected at the reported concentration.

| | |
|---|---|
| **Bold** | = Detected concentration. |
| Box | = Exceedance of Preliminary Delisting Level. |
| (green) | = Exceedance of TCLP-PDL X 20. |
| (gray) | = Reporting limit is greater than Preliminary Delisting Level or TCLP-PDL X 20. |
| (blue) | = Reporting limit is within one order of magnitude greater than either the Preliminary Delisting Level or TCLP-PDL X 20. |
| NA | = Not Applicable. |
| --- | = screening level not available |
| EPA | = US Environmental Protection Agency |
| ID | = identification |
| ug/kg | = micrograms per kilogram |
| mg-N/kg | = milligrams Nitrogen per kilogram |
| mg/kg | = milligrams per kilogram |
| pg/g | = picogram per gram |

**Table 4**
**Prior Sampling Results**
**Fire Mountain Farms Big Hanaford Storage Unit**
**Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units**
**Lewis County, Washington**

| Analyte | CAS No. | Preliminary Delisting Levels (a) | TCLP-PDL X 20 (b) | Sample ID and Sample Date | | |
|---|---|---|---|---|---|---|
| | | | | BH-Comp-1 7/8/2014 | BH-Comp-2 7/8/2014 | BH-Comp-3 7/8/2014 |
| **Volatiles (ug/kg; EPA Method 8260C)** | | | | | | |
| 1,1,1-Trichloroethane | 71-55-6 | 2.35E+11 | 1.31E+10 | 780U | 800U | 860U |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 1.78E+08 | 5.20E+06 | 780U | 800U | 860U |
| 1,1,2-Trichloroethane | 79-00-5 | 5.04E+08 | 2.18E+04 | 780U | 800U | 860U |
| 1,1-Dichloroethane | 75-34-3 | 1.81E+10 | 5.98E+06 | 780U | 800U | 860U |
| 1,1-Dichloroethene | 75-35-4 | 2.77E+09 | 1.22E+05 | 780U | 800U | 860U |
| 1,2,4-Trichlorobenzene | 120-82-1 | 2.38E+10 | 1.12E+05 | 3,900U | 4,000U | 4,300U |
| 1,2-Dichlorobenzene | 95-50-1 | 2.08E+10 | 2.60E+06 | 780U | 800U | 860U |
| 1,2-Dichloroethane | 107-06-2 | 7.92E+07 | 1.19E+04 | 780U | 800U | 860U |
| 1,2-Dichloropropane | 78-87-5 | 6.70E+08 | 3.82E+04 | 780U | 800U | 860U |
| 1,3-Dichlorobenzene | 541-73-1 | --- | --- | 780U | 800U | 860U |
| 1,4-Dichlorobenzene | 106-46-7 | 2.37E+08 | 5.38E+04 | **1,000** | **1,300** | **1,000** |
| 2-Chloroethylvinylether | 110-75-8 | --- | --- | 3,900U | 4,000U | 4,300U |
| Acrolein | 107-02-8 | 7.37E+05 | 5.70E+31 | 39,000U | 40,000U | 43,000U |
| Acrylonitrile | 107-13-1 | 2.64E+07 | 2.58E+03 | 3,900U | 4,000U | 4,300U |
| Benzene | 71-43-2 | 2.41E+08 | 2.32E+04 | 780U | 800U | 860U |
| Bromodichloromethane | 75-27-4 | 2.41E+08 | 1.53E+04 | 780U | 800U | 860U |
| Bromoform | 75-25-2 | 4.44E+09 | 1.72E+05 | 780U | 800U | 860U |
| Bromomethane | 74-83-9 | 2.67E+07 | 1.24E+27 | 780U | 800U | 860U |
| Carbon Tetrachloride | 56-23-5 | 1.31E+08 | 1.60E+04 | 780U | 800U | 860U |
| Chlorobenzene | 108-90-7 | 1.30E+10 | 5.20E+05 | 780U | 800U | 860U |
| Chloroethane | 75-00-3 | 6.08E+08 | 2.62E+07 | 780U | 800U | 860U |
| Chloroform | 67-66-3 | 4.18E+07 | 9.04E+03 | 780U | 800U | 860U |
| Chloromethane | 74-87-3 | 1.94E+08 | 6.84E+05 | 780U | 800U | 860U |
| cis-1,3-Dichloropropene | 10061-01-5 | 6.36E+08 | 8.26E+32 | 780U | 800U | 860U |
| Dibromochloromethane | 124-48-1 | 6.35E+08 | 1.57E+04 | 780U | 800U | 860U |
| Ethylbenzene | 100-41-4 | 3.77E+10 | 4.80E+06 | 780U | 800U | 860U |
| Hexachlorobutadiene | 87-68-3 | 2.95E+06 | 9.24E+03 | 3,900U | 4,000U | 4,300U |
| Methylene Chloride | 75-09-2 | 9.50E+08 | 8.94E+04 | 1,600U | 1,600U | 1,700U |
| Naphthalene | 91-20-3 | 1.36E+09 | 3.70E+03 | 3,900U | 4,000U | 4,300U |
| Tetrachloroethene | 127-18-4 | 1.13E+07 | 2.32E+03 | 780U | 800U | 860U |
| Toluene | 108-88-3 | 6.30E+10 | 5.12E+06 | **8,300** | **120,000** | **82,000** |
| trans-1,2-Dichloroethene | 156-60-5 | 1.30E+09 | 2.90E+05 | 780U | 800U | 860U |
| trans-1,3-Dichloropropene | 10061-02-6 | 6.70E+08 | 8.26E+32 | 780U | 800U | 860U |
| Trichloroethene | 79-01-6 | 4.06E+08 | 1.28E+04 | 780U | 800U | 860U |
| Vinyl Chloride | 75-01-4 | 7.14E+06 | 9.08E+02 | 780U | 800U | 860U |
| **Metals (mg/kg; EPA Method 6010C/7471A)** | | | | | | |
| Antimony | 7440-36-0 | 5.51E+05 | 3.04E+01 | 30U | 30U | 30U |
| Arsenic | 7440-38-2 | 8.05E+03 | 9.54E-01 | 30U | 30U | 30U |
| Beryllium | 7440-41-7 | 5.69E+04 | 8.66E+01 | 0.6U | 0.6U | 0.7U |
| Cadmium | 7440-43-9 | 3.04E+04 | 3.88E+01 | **2** | **2** | **2** |
| Chromium | 7440-47-3 | 1.14E+04 | 2.40E+02 | **25** | **29** | **28** |
| Cobalt | 7440-48-4 | 1.52E+04 | 2.40E+01 | **15** | **64** | **165** |
| Copper | 7440-50-8 | 3.10E+06 | 3.16E+03 | **473** | **485** | **521** |
| Lead | 7439-92-1 | 1.30E+07 | 5.88E+02 | **30** | **20** | **20** |
| Molybdenum | 7439-98-7 | 1.85E+07 | 3.70E+02 | **12** | **15** | **13** |
| Nickel | 7440-02-0 | 5.69E+05 | 1.51E+03 | **27** | **38** | **42** |
| Selenium | 7782-49-2 | 2.13E+06 | 3.74E+02 | 30U | 30U | 30U |
| Silver | 7440-22-4 | 3.14E+06 | 8.74E+02 | **6** | **4** | **4** |
| Thallium | 7440-28-0 | 3.64E+02 | 5.12E+00 | 30U | 30U | 30U |
| Zinc | 7440-66-6 | 8.03E+06 | 2.26E+04 | **1,030** | **1,100** | **1,070** |
| Mercury | 7439-97-6 | 1.11E+06 | 7.68E+00 | **1** | **1.2** | **3** |
| **Semivolatiles (ug/kg; EPA Method 8270D)** | | | | | | |
| 1,2,4-Trichlorobenzene | 120-82-1 | 2.38E+10 | 1.12E+05 | 580U | 600U | 720U |
| 1,2-Dichlorobenzene | 95-50-1 | 2.08E+10 | 2.60E+06 | 580U | 600U | 720U |
| 1,2-Diphenylhydrazine | 122-66-7 | 1.70E+07 | 1.57E+03 | 570U | 600U | 710U |
| 1,3-Dichlorobenzene | 541-73-1 | --- | --- | 580U | 600U | 720U |
| 1,4-Dichlorobenzene | 106-46-7 | 2.37E+08 | 5.38E+04 | **860** | **750** | 720U |
| 2,2'-Oxybis(1-Chloropropane) | 108-60-1 | --- | --- | 580U | 600U | 720U |
| 2,4,6-Trichlorophenol | 88-06-2 | 1.47E+08 | 3.60E+04 | 2,800U | 3,000U | 3,500U |
| 2,4-Dichlorophenol | 120-83-2 | 1.33E+09 | 1.92E+05 | 2,800U | 3,000U | 3,500U |
| 2,4-Dimethylphenol | 105-67-9 | 3.34E+10 | 1.28E+06 | 580U | 600U | 720U |
| 2,4-Dinitrophenol | 51-28-5 | 7.39E+09 | 1.31E+05 | 5,800U | 6,000U | 7,200U |
| 2,4-Dinitrotoluene | 121-14-2 | 3.42E+08 | 1.87E+03 | 2,800U | 3,000U | 3,500U |
| 2,6-Dinitrotoluene | 606-20-2 | 3.42E+08 | 1.87E+03 | 2,800U | 3,000U | 3,500U |
| 2-Chloronaphthalene | 91-58-7 | 3.87E+09 | 1.16E+06 | 580U | 600U | 720U |
| 2-Chlorophenol | 95-57-8 | 1.09E+10 | 3.26E+05 | 580U | 600U | 720U |
| 2-Nitrophenol | 88-75-5 | --- | --- | 580U | 600U | 720U |
| 3,3'-Dichlorobenzidine | 91-94-1 | 1.12E+07 | 2.86E+03 | 2,800U | 3,000U | 3,500U |
| 4,6-Dinitro-2-Methylphenol | 534-52-1 | 3.70E+08 | 6.58E+03 | 5,800U | 6,000U | 7,200U |
| 4-Bromophenyl-phenylether | 101-55-3 | --- | --- | 580U | 600U | 720U |
| 4-Chlorophenyl-phenylether | 7005-72-3 | --- | --- | 580U | 600U | 720U |
| 4-Methylphenol | 106-44-5 | 1.57E+10 | 3.26E+05 | **480,000** | **720,000** | **540,000** |
| 4-Nitrophenol | 100-02-7 | --- | --- | 2,800U | 3,000U | 3,500U |
| Acenaphthene | 83-32-9 | 5.91E+09 | 1.20E+06 | 580U | 600U | 720U |
| Acenaphthylene | 208-96-8 | --- | --- | 580U | 600U | 720U |
| Anthracene | 120-12-7 | 6.70E+09 | 2.92E+06 | 580U | 600U | 720U |
| Azobenzene | 103-33-3 | --- | --- | 580U | 600U | 720U |
| Benzo(a)anthracene | 56-55-3 | 4.42E+05 | 7.92E+03 | 580U | 600U | 720U |
| Benzo(a)pyrene | 50-32-8 | 3.27E+04 | 2.98E+06 | 580U | 600U | 720U |
| Benzo(b)fluoranthene | 205-99-2 | 2.58E+05 | 2.54E+07 | 570U | 600U | 710U |
| Benzo(g,h,i)perylene | 191-24-2 | --- | --- | 580U | 600U | 720U |
| Benzo(k)fluoranthene | 207-08-9 | 3.06E+06 | 7.56E+22 | 570U | 600U | 710U |
| bis(2-Chloroethoxy) Methane | 111-91-1 | 1.11E+10 | 1.92E+05 | 580U | 600U | 720U |
| Bis-(2-Chloroethyl) Ether | 111-44-4 | 2.22E+08 | 1.25E+04 | 580U | 600U | 720U |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | 2.34E+10 | 3.62E+33 | **25,000** | **25,000** | **24,000** |
| Butylbenzylphthalate | 85-68-7 | 1.96E+09 | 4.52E+06 | 580U | 600U | 720U |
| Chrysene | 218-01-9 | 4.33E+07 | 7.92E+05 | 580U | 600U | 720U |
| Dibenz(a,h)anthracene | 53-70-3 | 3.45E+04 | 4.18E+16 | 580U | 600U | 720U |
| Diethylphthalate | 84-66-2 | 1.08E+12 | 1.13E+08 | 580U | 600U | 720U |
| Dimethylphthalate | 131-11-3 | 3.70E+13 | 6.54E+08 | 580U | 600U | 720U |
| Di-n-Butylphthalate | 84-74-2 | 2.01E+09 | 2.78E+06 | 580U | 600U | 720U |

**Table 4**
**Prior Sampling Results**
**Fire Mountain Farms Big Hanaford Storage Unit**
**Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units**
**Lewis County, Washington**

| Analyte | CAS No. | Preliminary Delisting Levels (a) | TCLP-PDL X 20 (b) | Sample ID and Sample Date BH-Comp-1 7/8/2014 | BH-Comp-2 7/8/2014 | BH-Comp-3 7/8/2014 |
|---|---|---|---|---|---|---|
| Di-n-Octyl phthalate | 117-84-0 | 3.96E+10 | 2.92E+32 | 580U | 600U | 720U |
| Fluoranthene | 206-44-0 | 1.11E+08 | 2.78E+05 | **640** | 600U | 720U |
| Fluorene | 86-73-7 | 1.82E+09 | 5.54E+05 | 580U | 600U | 720U |
| Hexachlorobenzene | 118-74-1 | 1.65E+04 | 1.02E+04 | 580U | 600U | 720U |
| Hexachlorobutadiene | 87-68-3 | 2.95E+06 | 9.24E+03 | 580U | 600U | 720U |
| Hexachlorocyclopentadiene | 77-47-4 | 6.72E+08 | 1.41E+32 | 2,800U | 3,000U | 3,500U |
| Hexachloroethane | 67-72-1 | 4.84E+07 | 3.10E+04 | 580U | 600U | 720U |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 8.14E+05 | 2.78E+14 | 580U | 600U | 720U |
| Isophorone | 78-59-1 | 1.20E+11 | 1.27E+06 | 580U | 600U | 720U |
| Naphthalene | 91-20-3 | 1.36E+09 | 3.70E+03 | 580U | 600U | 720U |
| Nitrobenzene | 98-95-3 | 1.85E+09 | 3.26E+04 | 580U | 600U | 720U |
| N-Nitrosodimethylamine | 62-75-9 | 2.72E+06 | 2.50E+01 | 2,800U | 3,000U | 3,500U |
| N-Nitroso-Di-N-Propylamine | 621-64-7 | 3.09E+07 | 1.82E+02 | 580U | 600U | 720U |
| N-Nitrosodiphenylamine | 86-30-6 | 1.99E+09 | 2.56E+05 | **1,200M** | **1,100M** | **1,400M** |
| Pentachlorophenol | 87-86-5 | 2.89E+07 | 2.74E+03 | 2,800U | 3,000U | 3,500U |
| Phenanthrene | 85-01-8 | --- | --- | 580U | 600U | 720U |
| Phenol | 108-95-2 | 1.11E+12 | 1.96E+07 | **14,000** | **23,000** | **16,000** |
| Pyrene | 129-00-0 | 1.99E+08 | 5.02E+05 | 580U | 600U | 720U |
| Total Benzofluoranthenes | TOTBFA | --- | --- | 580U | 600U | 720U |
| **PCBs (ug/kg; EPA Method 8082A)** | | | | | | |
| Aroclor 1016 | 12674-11-2 | --- | --- | 9.9U | NA | NA |
| Aroclor 1221 | 11104-28-2 | --- | --- | 9.9U | NA | NA |
| Aroclor 1232 | 11141-16-5 | --- | --- | 9.9U | NA | NA |
| Aroclor 1242 | 53469-21-9 | --- | --- | 9.9U | NA | NA |
| Aroclor 1248 | 12672-29-6 | --- | --- | 99U | NA | NA |
| Aroclor 1254 | 11097-69-1 | --- | --- | 150U | NA | NA |
| Aroclor 1260 | 11096-82-5 | --- | --- | **35** | NA | NA |
| Total PCBs (b) | 1336-36-3 | 1.06E+02 | 2.26E+13 | **35** | NA | NA |
| **Pesticides (ug/kg; EPA Method 8081B)** | | | | | | |
| 4,4'-DDD | 72-54-8 | 1.51E+04 | 2.50E+31 | 17U | NA | NA |
| 4,4'-DDE | 72-55-9 | 7.80E+03 | 1.83E+22 | 17U | NA | NA |
| 4,4'-DDT | 50-29-3 | 2.21E+03 | 1.10E+31 | 120U | NA | NA |
| Aldrin | 309-00-2 | 6.36E+01 | 5.64E+12 | 8.3U | NA | NA |
| alpha-BHC | 319-84-6 | 4.81E+05 | 1.18E+25 | 8.3U | NA | NA |
| beta-BHC | 319-85-7 | 6.73E+05 | 7.16E+02 | 8.3U | NA | NA |
| cis-Chlordane | 5103-71-9 | --- | --- | 34U | NA | NA |
| delta-BHC | 319-86-8 | --- | --- | 180U | NA | NA |
| Dieldrin | | --- | --- | 39U | NA | NA |
| Endosulfan I | 959-98-8 | --- | --- | 22U | NA | NA |
| Endosulfan II | 33213-65-9 | --- | --- | 17U | NA | NA |
| Endosulfan Sulfate | 1031-07-8 | --- | --- | 17U | NA | NA |
| Endrin | 72-20-8 | 8.28E+06 | 8.72E+15 | 49U | NA | NA |
| Endrin Aldehyde | 7421-93-4 | --- | --- | 77U | NA | NA |
| gamma BHC (Lindane) | 58-89-9 | 2.69E+06 | 1.16E+23 | 25U | NA | NA |
| Heptachlor | 76-44-8 | 6.08E+02 | 1.48E+30 | 8.3U | NA | NA |
| Heptachlor Epoxide | 1024-57-3 | 2.11E+04 | 6.34E+30 | 690U | NA | NA |
| Toxaphene | 8001-35-2 | 7.12E+02 | 3.74E+10 | 830U | NA | NA |
| trans-Chlordane | 5103-74-2 | --- | --- | 1,200U | NA | NA |
| **Dioxins/Furans (pg/g; EPA Method 1613B)** | | | | | | |
| 2,3,7,8-TCDD | 1746-01-6 | 9.39E+00 | 4.56E+09 | 5.71U | NA | NA |
| **Inorganic Parameters** | | | | | | |
| N-Nitrate (mg-N/kg; Calculated) | NITRATE | --- | --- | 0.57U | NA | NA |
| N-Ammonia (mg-N/kg; EPA 350.1M) | AMMONIA | --- | --- | **24,800** | NA | NA |
| Total Kjeldahl Nitrogen (mg-N/kg; EPA 351.2) | KJELDHAL-N | --- | --- | **76,800** | NA | NA |
| Nitrate+Nitrite (NO3+NO2) (mg-N/kg; EPA 353.2) | NITRATE-NITRITE | --- | --- | **7.01** | NA | NA |
| N-Nitrite (mg-N/kg; EPA 353.2) | NITRITE | --- | --- | **7.86** | NA | NA |
| Total Solids (%; SM2540G) | TS104 | --- | --- | **16.33** | **17.04** | **15.16** |
| Total Cyanide (mg/kg; EPA 335.4) | 57-12-5 | 1.74E+06 | 1.31E+03 | **1.60** | **2.39** | **1.77** |
| pH (Std units; SM9045) | PH | --- | --- | **7.91** | NA | NA |

(a) Preliminary Delisting Level calculated using EPA's Hazardous Waste Delisting Risk Assessment Software, as identified by the Washington State Department of Ecology (September 23, 2016 letter to Mr. Jarrod Kocin, Emerald Kalama Chemical, LLC, re: EPA and Ecology Comments to Waste Characterization Plan).
(b) TCLP-PDL x 20 represents the TCLP Preliminary Delisiting Level calculated using EPA's Hazardous Waste Delisting Risk Assessment Software, the resulting outputs were multiplied by 20 to be compared to the total analysis.
(c) Total PCBs is the sum of detected aroclors.
M = Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match.
U = Indicates the compound was not detected at the reported concentration.

| | |
|---|---|
| **Bold** | = Detected concentration. |
| Box | = Exceedance of Preliminary Delisting Level. |
| (green shading) | = Exceedance of TCLP-PDL X 20. |
| (gray shading) | = Reporting limit is greater than Preliminary Delisting Level or TCLP-PDL X 20. |
| (blue shading) | = Reporting limit is within one order of magnitude greater than either the Preliminary Delisting Level or TCLP-PDL X 20. |
| NA | = Not Applicable. |
| --- | = screening level not available |
| EPA | = US Environmental Protection Agency |
| ID | = identification |
| ug/kg | = micrograms per kilogram |
| mg-N/kg | = milligrams Nitrogen per kilogram |
| mg/kg | = milligrams per kilogram |
| pg/g | = picogram per gram |

# Table 5
## Cobalt Characterization Results
## Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units
## Lewis County, Washington

### Newaukum Prairie Storage Unit

| Analyte | CAS No. | Preliminary Delisting Level (a) | TCLP-Preliminary Delisting Level (a) | Newaukum Prairie Sample ID and Sample Date | | | |
|---|---|---|---|---|---|---|---|
| | | | | NP-Comp-1<br>7/7/2014 | NP-Comp-2<br>7/7/2014 | NP-Comp-3<br>7/7/2014 | FMF_Newsed<br>5/1/2017 |
| **Metals (mg/kg; EPA Method 6010C)** | | | | | | | |
| Cobalt | 7440-48-4 | **8710** | -- | **76** | **87** | **89** | **78.1** |
| | | | | | | | |
| **TCLP Metals (mg/L; EPA Method 6010C)** | | | | | | | |
| Cobalt | 7440-48-4 | -- | **0.59** | NA | NA | NA | **0.184** |

### Burnt Ridge Storage Unit

| Analyte | CAS No. | Preliminary Delisting Level (a) | TCLP-Preliminary Delisting Level (a) | Burnt Ridge Sample ID and Sample Date | | | |
|---|---|---|---|---|---|---|---|
| | | | | BR-Comp-1<br>7/9/2014 | BR-Comp-2<br>7/9/2014 | BR-Comp-3<br>7/9/2014 | FMF_Burntsed<br>5/1/2017 |
| **Metals (mg/kg; EPA Method 6010C)** | | | | | | | |
| Cobalt | 7440-48-4 | **15900** | -- | **43** | **48** | **37** | **28.3** |
| | | | | | | | |
| **TCLP Metals (mg/L; EPA Method 6010C)** | | | | | | | |
| Cobalt | 7440-48-4 | -- | **1.27** | NA | NA | NA | **0.108** |

(a) Preliminary Delisting Level calculated using EPA's Hazardous Waste Delisting Risk Assessment Software, as identified by the Washington State Department of Ecology (September 23, 2016 letter to Mr. Jarrod Kocin, Emerald Kalama Chemical, LLC, re: EPA and Ecology Comments to Waste Characterization Plan).

**Bold** = Detected concentration.
NA = Not Analyzed.
--- = screening level not available

EPA = US Environmental Protection Agency
ID = identification
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
TCLP = Toxicity Characteristic Leaching Procedure

# Table 6
## Land Disposal Restriction Evaluation
## Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units
## Lewis County, Washington

| Analyte | CAS No. | Land Disposal Restriction Level (non-wastewater) | Units | Facility Name, Sample ID, and Sample Date | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Burnt Ridge | | | Newaukum Prairie | | | Big Hanaford | | |
| | | | | BR-Comp-1 7/9/2014 | BR-Comp-2 7/9/2014 | BR-Comp-3 7/9/2014 | NP-Comp-1 7/7/2014 | NP-Comp-2 7/7/2014 | NP-Comp-3 7/7/2014 | BH-Comp-1 7/8/2014 | BH-Comp-2 7/8/2014 | BH-Comp-3 7/8/2014 |
| Acetone | 67-64-1 | 160,000 | ug/kg | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzene | 71-43-2 | 10,000 | ug/kg | 2.3U | 2U | 1.8U | 3.9U | 3.7U | 3.2U | 780U | 800U | 860U |
| Methanol (a) | 67-56-1 | 0.75 | mg/L | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Toluene | 108-88-3 | 10,000 | ug/kg | **20** | **35** | **19** | **140,000** | **150,000** | **130,000** | **8,300** | **120,000** | **82,000** |

(a) This LDR is a TCLP level.

NA = Indicates no past anaylsis was performed.

U = Indicates the compound was not detected at the reported concentration.

**Bold** = Detected concentration

NA = not applicable

[green shading] = Detected analyte with concentration greater than the LDR Level.

EPA = US Environmental Protection Agency

ID = identification

ug/kg = micrograms per kilogram

mg/L = milligrams per liter

**Table 7**
**Comparison of Metal Concentrations in the Mixed Material with EPA Sewage Sludge Data**
**Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units**
**Lewis County, Washington**

| Metal | TNSSS Value (mg/kg) | PGG Maximum Detected Concentration or RL, mg/kg | | |
|---|---|---|---|---|
| | Minimum - Maximum | Burnt Ridge | Newaukum Prairie | Big Hanaford |
| Antimony | 0.45 – 26.6 | 40 U | 80 U | 30 U |
| Arsenic | 1.18 – 49.2 | 40 U | 80 U | 30 U |
| Cobalt | 0.87 – 290 | 48 | 89 | 165 |
| Thallium | 0.02 – 1.7 | 40 U | 80 U | 30 U |

**Notes:**
U = The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.
**Abbreviations and Acronyms:**
EPA = US Environmental Protection Agency
mg/kg = milligrams per kilogram
PGG = Pacific Groundwater Group
RL = reporting limit
TNSSS = Targeted National Sewage Sludge Survey

**Table 8**
**PCB Concentrations in Mixed Material**
**Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units**
**Lewis County, Washington**

| | PCB Concentration, µg/kg | | |
|---|---|---|---|
| | Burnt Ridge | Newaukum Prairie | Big Hanaford |
| PGG Maximum Measured Concentration | 61 | 40 | 35 |
| DRAS Preliminary Delisting Level | 112 | 57.2 | 106 |

**Abbreviations and Acronyms:**
DRAS = Delisting Risk Assessment Software
µg/kg = micrograms per kilogram
PGG = Pacific Groundwater Group
PCB = polychlorinated biphenyl

**Table 9**
**Toxaphene Reporting Limits and Preliminary Delisting Levels**
**Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units**
**Lewis County, Washington**

| | Toxaphene Concentrations, µg/kg | | |
|---|---|---|---|
| | Burnt Ridge | Newaukum Prairie | Big Hanaford |
| PGG Reporting Limit | 820 U | 830 U | 830 U |
| DRAS Preliminary Delisting Level | 750 | 383 | 712 |

**Notes:**
U = The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.
**Abbreviations and Acronyms:**
DRAS = Delisting Risk Assessment Software
µg/kg = micrograms per kilogram
PGG = Pacific Groundwater Group

**Table 10**
**Dioxin Reporting Limits and Preliminary Delisting Levels**
**Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units**
**Lewis County, Washington**

| | Dioxin Concentrations, µg/kg | | |
|---|---|---|---|
| | Burnt Ridge | Newaukum Prairie | Big Hanaford |
| PGG Reporting Limit | 2.35 U | 11.5 U | 5.71 U |
| DRAS Preliminary Delisting Level | 9.9 | 5.06 | 9.39 |

**Notes:**
U = The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.
**Abbreviations and Acronyms:**
DRAS = Delisting Risk Assessment Software
µg/kg = micrograms per kilogram
PGG = Pacific Groundwater Group

# Table 11
## Chemical Concentrations in the Mixed Material for Comparison with the Toxicity Characteristics List
## Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units
## Lewis County, Washington

| Analyte | Toxicity Characteristics List (WAC 173-303-090) | | Facility Name, Sample ID, Sample Date, and Results | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Newaukum Prairie | | | Big Hanaford | | | Burnt Ridge | | |
| | | | NP-Comp-1 | NP-Comp-2 | NP-Comp-3 | BH-Comp-1 | BH-Comp-2 | BH-Comp-3 | BR-Comp-1 | BR-Comp-2 | BR-Comp-3 |
| | | | 7/7/2014 | 7/7/2014 | 7/7/2014 | 7/8/2014 | 7/8/2014 | 7/8/2014 | 7/9/2014 | 7/9/2014 | 7/9/2014 |
| | **TCLP value x factor of 20** | **TCLP Units** | | | | | | | | | |
| Arsenic | 100 | mg/L | 70U | 80U | 80U | 30U | 30U | 30U | 40U | 30U | 30U |
| Barium | 2,000 | mg/L | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzene | 10,000 | ug/L | 3.9U | 3.7U | 3.2U | 780U | 800U | 860U | NA | NA | NA |
| **Cadmium** | 20 | mg/L | 3U | 3U | 3U | **2** | **2** | **2** | **3** | **3** | **3** |
| Carbon Tetrachloride | 10,000 | ug/L | 3.9U | 3.7U | 3.2U | 780U | 800U | 860U | 2.3U | 2U | 1.8U |
| Chlordane | 600 | ug/L | 1,300U | 1,400U | NA | 1,200U | NA | NA | 1,100U | NA | NA |
| Chlorobenzene | 2,000,000 | ug/L | 3.9U | 3.7U | 3.2U | 780U | 800U | 860U | 2.3U | 2U | 1.8U |
| Chloroform | 120,000 | ug/L | 3.9U | 3.7U | 3.2U | 780U | 800U | 860U | 2.3U | 2U | 1.8U |
| **Chromium** | 100 | mg/L | **24** | **26** | **27** | **25** | **29** | **28** | **31** | **45** | **35** |
| 2-Methylphenol (o-Cresol) | 4,000,000 | ug/L | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 3-Methylphenol (m-Cresol) | 4,000,000 | ug/L | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **4-Methylphenol (p-Cresol)** | 4,000,000 | ug/L | **2,400** | **2,400** | **2,600** | **480,000** | **720,000** | **540,000** | **1,100** | **450** | **460** |
| Methylphenol (Cresol) | 4,000,000 | ug/L | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4-D | 200,000 | ug/L | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **1,4-Dichlorobenzene** | 150,000 | ug/L | **700** | **730** | **750** | **860** | **750** | 720U | **480** | **540** | 260U |
| 1,2-Dichloroethane | 10,000 | ug/L | 3.9U | 3.7U | 3.2U | 780U | 800U | 860U | 2.3U | 2U | 1.8U |
| 1,1-Dichloroethene | 14,000 | ug/L | 3.9U | 3.7U | 3.2U | 780U | 800U | 860U | 2.3U | 2U | 1.8U |
| 2,4-Dinitrotoluene | 2,600 | ug/L | 2,100U | 1,900U | 1,500U | 2,800U | 3,000U | 3,500U | 1,300U | 1,500U | 1,300U |
| Endrin | 400 | ug/L | 17U | 17U | NA | 49U | NA | NA | 25U | NA | NA |
| Heptachlor | 160 | ug/L | 8.3U | 8.3U | NA | 8.3U | NA | NA | 8.2U | NA | NA |
| Heptachlor Epoxide | 160 | ug/L | 340U | 280U | NA | 690U | NA | NA | 8.2U | NA | NA |
| Hexachlorobenzene | 2,600 | ug/L | 420U | 380U | 300U | 580U | 600U | 720U | 260U | 310U | 260U |
| Hexachlorobutadiene | 10,000 | ug/L | 420U | 380U | 300U | 580U | 600U | 720U | 260U | 310U | 260U |
| Hexachloroethane | 60,000 | ug/L | 420U | 380U | 300U | 580U | 600U | 720U | 260U | 310U | 260U |
| **Lead** | 100 | mg/L | 30U | 30U | 30U | **30** | **20** | **20** | **40** | **30** | **30** |
| gamma BHC (Lindane) | 8,000 | ug/L | 8.3U | 8.3U | NA | 25U | NA | NA | 8.2U | NA | NA |
| **Mercury** | 4 | mg/L | **1.2** | **0.9** | **1.2** | **1** | **1.2** | **3** | **1** | **1.9** | **1.8** |
| Methoxychlor | 200,000 | ug/L | NA | NA | NA | NA | NA | NA | NA | NA | NA |

**Table 11**
**Chemical Concentrations in the Mixed Material for Comparison with the Toxicity Characteristics List**
**Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units**
**Lewis County, Washington**

| Analyte | Toxicity Characteristics List (WAC 173-303-090) | | Facility Name, Sample ID, Sample Date, and Results | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Newaukum Prairie | | | Big Hanaford | | | Burnt Ridge | | |
| | | | NP-Comp-1 7/7/2014 | NP-Comp-2 7/7/2014 | NP-Comp-3 7/7/2014 | BH-Comp-1 7/8/2014 | BH-Comp-2 7/8/2014 | BH-Comp-3 7/8/2014 | BR-Comp-1 7/9/2014 | BR-Comp-2 7/9/2014 | BR-Comp-3 7/9/2014 |
| | **TCLP value x factor of 20** | **TCLP Units** | | | | | | | | | |
| 2-Butanone (MEK) | 4,000,000 | ug/L | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Nitrobenzene | 40,000 | ug/L | 420U | 380U | 300U | 580U | 600U | 720U | 260U | 310U | 260U |
| Pentachlorophenol | 2,000,000 | ug/L | 2,100U | 1,900U | 1,500U | 2,800U | 3,000U | 3,500U | 1,300U | 1,500U | 1,300U |
| Pyridine | 100,000 | ug/L | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Selenium | 20 | mg/L | 70U | 80U | 80U | 30U | 30U | 30U | 40U | 30U | 30U |
| **Silver** | 100 | mg/L | 4U | 5U | 5U | **6** | **4** | **4** | **5** | **5** | **6** |
| Tetrachloroethene | 14,000 | ug/L | 3.9U | 3.7U | 3.2U | 780U | 800U | 860U | 2.3U | 2U | 1.8U |
| Toxaphene | 10,000 | ug/L | 830U | 830U | NA | 830U | NA | NA | 820U | NA | NA |
| Trichloroethene | 10,000 | ug/L | 3.9U | 3.7U | 3.2U | 780U | 800U | 860U | 2.3U | 2U | 1.8U |
| 2,4,5-Trichlorophenol | 8,000,000 | ug/L | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4,6-Trichlorophenol | 40,000 | ug/L | 2,100U | 1,900U | 1,500U | 2,800U | 3,000U | 3,500U | NA | NA | NA |
| 2,4,5-TP (Silvex) | 20,000 | ug/L | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Vinyl Chloride | 4,000 | ug/L | 3.9U | 3.7U | 3.2U | 780U | 800U | 860U | NA | NA | NA |

Concentrations of organic chemicals in FMF samples are reported as ug/kg
Concentrations of metals in FMF samples are reported as mg/kg
**Bold** Detected
(light orange shading) Not detected, but RL above threshold
(orange shading) Not included in the analyses

**Table 12**
**Chemical Composition of Emerald IWBS Compared with the Toxicity Characteristics List**
**Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units**
**Lewis County, Washington**

| Analyte | Reporting Limit (mg/L) | Toxicity Characteristics List Concentration Thresholds (mg/L) |
|---|---|---|
| Arsenic | 0.05 U | 5 |
| Barium | 1 U | 100 |
| Benzene | 0.2 U | 0.5 |
| Cadmium | 0.05 U | 1 |
| Carbon Tetrachloride | 0.2 U | 0.5 |
| Chlordane | 0.005 U | 0.03 |
| Chlorobenzene | 0.2 U | 100 |
| Chloroform | 0.2 U | 6 |
| Chromium | 0.05 U | 5 |
| 2-Methylphenol (o-Cresol) | 0.1 U | 200 |
| 3-Methylphenol (m-Cresol) | 0.1 U | 200 |
| 4-Methylphenol (p-Cresol) | 0.1 U | 200 |
| Methylphenol (Cresol) | 0.1 U | 200 |
| 2,4-D | 0.1 U | 10 |
| 1,4-Dichlorobenzene | 0.2 U | 7.5 |
| 1,2-Dichloroethane | 0.2 U | 0.5 |
| 1,1-Dichloroethene | 0.7 U | 0.7 |
| 2,4-Dinitrotoluene | 0.1 U | 0.13 |
| Endrin | 0.0005 U | 0.02 |
| Heptachlor | 0.0005 U | 0.008 |
| Heptachlor epoxide | 0.0005 U | 0.008 |
| Hexachlorobenzene | 0.1 U | 0.13 |
| Hexachlorobutadiene | 0.1 U | 0.5 |
| Hexachloroethane | 0.1 U | 3 |
| Lead | 0.05 U | 5 |
| Gamma BHC (Lindane) | 0.0005 U | 0.4 |
| Mercury | 0.001 U | 0.2 |
| Methoxychlor | 0.001 U | 10 |
| 2-Butanone (MEK) | 8 U | 200 |
| Nitrobenzene | 0.1 U | 2 |
| Pentachlorophenol | 0.25 U | 100 |
| Pyridine | 0.5 U | 5 |
| Selenium | 0.1 U | 1 |
| Silver | 0.1 U | 5 |
| Tetrachloroethene | 0.2 U | 0.7 |
| Toxaphene | 0.01 U | 0.5 |
| Trichloroethene | 0.2 U | 0.5 |
| 2,4,5-Trichlorophenol | 0.1 U | 400 |
| 2,4,6-Trichlorophenol | 0.1 U | 2 |
| 2,4,5-TP | 0.02 U | 1 |
| Vinyl Chloride | 0.08 U | 0.2 |

**Notes:**
U = The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

**Abbreviations and Acronyms:**
IWBS = industrial wastewater treatment biological solids
mg/L = milligrams per liter

**Table 13**
**Dangerous Waste Criteria – Persistence Values for the Mixed Material**
**Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units**
**Lewis County, Washington**

| Persistence | Burnt Ridge | Newaukum Prairie | Big Hanaford |
|---|---|---|---|
| Halogenated Organics | 0.0000601 | 0.000016 | 0.0001335 |
| Polycyclic Aromatic Hydrocarbons | 0.000122 | 0.000262 | 0.000064 |

**Notes:**
All values are expressed as total concentration percentage as described in the Washington State Department of Ecology persistence criteria using waste knowledge method (WAC 173-303-100[6]).

**Table 14**
**Sampling Locations, Fire Mountain Farms Mixed Material Storage Units**
**Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units**
**Lewis County, Washington**

| Storage Unit Name | Grid Letter | Grid Number | Depth |
|---|---|---|---|
| Newaukum Prairie | C | 6 | N/A |
| Newaukum Prairie | E | 2 | N/A |
| Newaukum Prairie | E | 4 | N/A |
| Newaukum Prairie | A | 2 | N/A |
| Newaukum Prairie | C | 2 | N/A |
| Newaukum Prairie | C | 5 | N/A |
| Newaukum Prairie | F | 3 | N/A |
| Newaukum Prairie | B | 2 | N/A |
| Newaukum Prairie | D | 2 | N/A |
| Newaukum Prairie | F | 5 | N/A |
| Newaukum Prairie | C | 4 | N/A |
| Newaukum Prairie | E | 6 | N/A |
| Newaukum Prairie | D | 5 | N/A |
| Newaukum Prairie | B | 3 | N/A |
| Newaukum Prairie | D | 4 | N/A |
| Newaukum Prairie | E | 1 | N/A |
| Newaukum Prairie | B | 6 | N/A |
| Burnt Ridge | C | 2 | N/A |
| Burnt Ridge | E | 4 | N/A |
| Burnt Ridge | D | 4 | N/A |
| Burnt Ridge | A | 2 | N/A |
| Burnt Ridge | D | 5 | N/A |
| Burnt Ridge | B | 1 | N/A |
| Burnt Ridge | E | 6 | N/A |
| Burnt Ridge | E | 2 | N/A |
| Burnt Ridge | B | 3 | N/A |
| Burnt Ridge | A | 1 | N/A |
| Burnt Ridge | E | 5 | N/A |
| Big Hanaford | A | 1 | Top |
| Big Hanaford | A | 2 | Middle |
| Big Hanaford | A | 3 | Bottom |
| Big Hanaford | A | 4 | Middle |
| Big Hanaford | A | 5 | Top |
| Big Hanaford | A | 6 | Middle |
| Big Hanaford | A | 7 | Bottom |
| Big Hanaford | A | 8 | Middle |
| Big Hanaford | B | 1 | Middle |
| Big Hanaford | B | 8 | Top |
| Big Hanaford | C | 1 | Bottom |
| Big Hanaford | C | 2 | Middle |
| Big Hanaford | C | 3 | Top |
| Big Hanaford | C | 4 | Middle |
| Big Hanaford | C | 5 | Bottom |
| Big Hanaford | C | 6 | Middle |
| Big Hanaford | C | 7 | Top |
| Big Hanaford | C | 8 | Middle |

(a) Top sampling depth is approximately 0-3.5 ft, middle sample depth is approximately 3.5-7 ft, and bottom depth is approximately 7-10 ft.
All depths are measured from the surface of the mixed material.

# Table 15
## Planned Analyses
## Burnt Ridge Mixed Material Storage Unit
## Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units
## Lewis County, Washington

| Analysis | Analytes to be Reported | CAS No. | Laboratory Method | Containers | Hold Time | Preservation |
|---|---|---|---|---|---|---|
| **Volatiles** | | | SW-846 8260C | 2- 2 ounce jars with septa lid | 14 days | <6 degrees C |
| | Toluene[1] | 108-88-3 | | | | |
| | Benzene[1] | 71-43-2 | | | | |
| | Acetone[1] | 67-64-1 | | | | |
| **Methanol** | | 67-56-1 | SW-846 8015C | 1-2 ounce jar with septa lid | 14 days | <6 degrees C |
| **Total Solids** | | | SM2540G | 4 ounce jar | N/A | N/A |
| **pH** | | | SM9045 | Shared with total solids sample | 14 days | <6 degrees C |

[1] Sample result to be compared to Land Disposal Restriction criterion.

CAS = Chemical Abstracts Service

N/A = not applicable

# Table 16
## Planned Analyses
## Newaukum Prairie Mixed Material Storage Unit
## Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units
## Lewis County, Washington

| Analysis | Analytes to be Reported | CAS No. | Laboratory Method | Containers | Hold Time | Preservation |
|---|---|---|---|---|---|---|
| **Volatiles** | | | SW-846 8260C | 2- 2 ounce jars with septa lid | 14 days | <6 degrees C |
| | Toluene[1] | 108-88-3 | | | | |
| | Benzene[1] | 71-43-2 | | | | |
| | Acetone[1] | 67-64-1 | | | | |
| **Methanol** | | 67-56-1 | SW-846 8015C | 1-2 ounce jar with septa lid | 14 days | <6 degrees C |
| **Total Solids** | | | SM2540G | 4 ounce jar | N/A | N/A |
| **pH** | | | SM9045 | Shared with total solids sample | 14 days | <6 degrees C |

[1] Sample result to be compared to Land Disposal Restriction criterion.

CAS = Chemical Abstracts Service

N/A = not applicable

TCLP = toxicity characteristic leaching procedure

# Table 17
## Planned Analyses
## Big Hanaford Mixed Material Storage Unit
## Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units
## Lewis County, Washington

| Analysis | Analytes to be Reported | CAS No. | Laboratory Method | Containers | Hold Time | Preservation |
|---|---|---|---|---|---|---|
| **Volatiles** | | | SW-846 8260C | 2- 2 ounce jars with septa lid | 14 days | <6 degrees C |
| | Toluene[1] | 108-88-3 | | | | |
| | Benzene[1] | 71-43-2 | | | | |
| | Acetone[1] | 67-64-1 | | | | |
| | Acrylonitrile[2,3] | 107-13-1 | | | | |
| **Methanol[2]** | | 67-56-1 | SW-846 8015C | 1-2 ounce jar with septa lid | 14 days | <6 degrees C |
| **Total Metals[3]** | | | SW-846 6010C | 1-8-ounce jar | 6 months | <6 degrees C |
| | Cobalt[2] | 7440-48-4 | | | | |
| **Semivolatiles[3]** | | | SW-846 8270D | 2-8-oz jars | 14 days | <6 degrees C |
| | 4-Methylphenol[2] | 106-44-5 | | | | |
| | 2,4-Dinitrotoluene[2] | 121-14-2 | | | | |
| | 2,6-Dinitrotoluene[2] | 606-20-2 | | | | |
| | Naphthalene[2] | 91-20-3 | | | | |
| **PCBs[4]** | | | SW-846 8082A | 1-8-ounce jar | N/A | <6 degrees C |
| **Total Solids** | | | SM2540G | 4 ounce jar | N/A | N/A |
| **pH** | | | SM9045 | Shared with total solids sample | 14 days | <6 degrees C |

[1] Sample result to be compared to Land Disposal Restriction criterion.

[2] Sample result to be compared to Preliminary Delisting Levels (PDL, TCLP-PDLx20, and, if TCLP samples are analyzed, TCLP-PDL).

[3] This includes additional sample collection for TCLP analysis that may be required upon receipt of results.

[4] This analysis will only be run on three of the collected samples; the samples selected for PCB analysis will be determined by Ecology and EPA after receipt of the initial sampling results, and results will be compared to the Preliminary Delisting Level.

CAS = Chemical Abstracts Service

N/A = not applicable

TCLP = toxicity characteristic leaching procedure

APPENDIX A

# Pacific Groundwater Group Report: Results of Investigation of Sludge at Three Storage Sites

# FIRE MOUNTAIN FARMS, INC.
# RESULTS OF INVESTIGATION OF SLUDGE AT THREE STORAGE SITES

**September 2014**

# FIRE MOUNTAIN FARMS, INC.
# RESULTS OF INVESTIGATION OF SLUDGE AT THREE STORAGE SITES

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*September 11, 2014*
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*FMF_SludgeReport_V4_rev091114_EcologyReview.docx*

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## SIGNATURE

This report, and Pacific Groundwater Group's work contributing to this report, were reviewed by the undersigned and approved for release.


**Janet Knox**
Principal Geochemist
Washington State Geologist No. 413

# 1.0 EXECUTIVE SUMMARY

This report documents the results of extensive sampling and analytical testing of biosolids (mixed sludge waste from various sources) currently being stored at three facilities operated by Fire Mountains Farms, Inc. (FMF) in Lewis County, Washington (Newaukum Prairie Impoundment, Burnt Ridge Lagoon, and Big Hanaford Bunker). Sludge samples were collected in July 2014 from each site and were analyzed for a comprehensive list of chemical compounds, including the full US Environmental Protection Agency (U.S. EPA) priority pollutant list for at least one composite sample at each site. A liquid sample was also collected from the water cap at the Burnt Ridge Lagoon.

Evaluation of the analytical results under the Washington State land disposal restriction for dangerous waste Chapter 173-303 of the Washington Administrative Code (WAC) indicate the sludge currently stored at all three facilities do not likely designate as wastes that would be restricted from land disposal (Section 6.1).

Evaluation of the analytical results under the Washington State Biosolids Management Rule (WAC 173-308) indicate the concentration of regulated pollutants in the FMF sludge are all below regulatory limits (WAC 173-308-160) and total fecal coliform concentrations meet the pathogen reduction requirements for Class B biosolids (WAC 173-308-170) (Section 6.3).

Comparison of the analytical results to mean sewage sludge concentrations from the U.S. EPA 1988 National Sewage Sludge Survey (NSSS) indicate chemical concentrations in the FMF sludge is either similar to or less than the mean concentrations calculated from the NSSS dataset except for the following chemicals (in order from highest to lowest exceedance of the NSSS dataset) (Section 6.2):

- Cobalt at all three sites
- 4-Methylphenol at Big Hanaford
- Toluene at Newaukum Prairie and Big Hanaford
- Phenol at Big Hanaford
- Molybdenum at all three sites

Although molybdenum concentrations exceeded the mean concentration in the NSSS dataset, they are below the ceiling limit for molybdenum in the State Biosolids Rule (WAC 173-308-160). Pollutant limits are not set for toluene, cobalt, 4-methylphenol, and phenol in the State Biosolids Rule.

Toluene was detected in four discrete liquid samples collected from each quadrant of the Burnt Ridge water cap at concentrations well below the Federal Maximum Contaminant Level (MCL) for drinking water. No other organic chemicals were detected in the water cap samples.

Seven metals were detected in the composite liquid sample from the Burnt Ridge water cap (all measured as totals): chromium, cobalt, copper, molybdenum, nickel, zinc, and mercury. The concentrations of chromium, copper, and mercury were all below the Federal MCL and the Washington State Standards for Groundwater (WAC 173-200). There is no state or federal standard for cobalt, molybdenum, or nickel.

# 2.0 INTRODUCTION

The purpose of this report is to document the investigation of biosolids (sludge waste) currently stored at three facilities operated by Fire Mountain Farms, Inc. in Lewis County, Washington. Pacific Groundwater Group (PGG) performed the investigation and prepared this report for Fire Mountain Farms, Inc. (FMF) to meet the requirements of an Administrative Order (Docket #10721) issued by the Washington Department of Ecology (Ecology) on June 2, 2014.

The purpose of the investigation was to conduct a rigorous characterization of the chemical composition of sludge waste being stored at the three facilities. The analytical results were then evaluated under the Land Disposal Restrictions under the Washington Dangerous Waste Regulations (Washington Administrative Code [WAC] 173-303-140) and Biosolids Management Code (WAC 173-308). Analytical results were also compared to the mean sewage sludge concentrations from the U.S. EPA 1988 National Sewage Sludge Survey (NSSS).

This work was performed, our findings obtained, and this report prepared, using generally accepted environmental investigation practices used at this time and in this vicinity, for exclusive application to the Fire Mountain Farm, Inc. sludge investigation, and for the exclusive use of Fire Mountain Farms, Inc. This is in lieu of other warranties, expressed or implied.

# 3.0 BACKGROUND

Fire Mountain Farms, Inc. (FMF) operates several facilities in Lewis County where biosolids are applied to fields as fertilizer under the Washington State General Permit for Biosolids Management. On June 2, 2014, FMF was issued an Administrative Order (AO), Docket #10721 by the Washington Department of Ecology (Ecology). Under the directive of the AO, Ecology required FMF to undergo a rigorous investigation to sample and characterize sludge currently stored at three of its facilities: Newaukum Prairie, Big Hanaford, and Burnt Ridge (Figure 1).

### 1. Newaukum Prairie Surface Impoundment

The Newaukum Prairie surface impoundment (Figure 2) was recently re-constructed and lined in 2013. The lagoon does not have a water cap. The dimensions of the sludge in July 2014 were estimated to be 8 to 9 feet thick, measuring roughly 100 feet by 100 feet at the bottom and 170 feet by 170 feet at the surface.

### 2. Big Hanaford Bunker

The Big Hanaford Bunker (Figure 3) is a covered concrete structure measuring approximately 100 feet by 60 feet in dimension and stores sludge estimated to be about 10 feet deep[1].

### 3. Burnt Ridge Surface Lagoon

The Burnt Ridge Lagoon (Figure 4) has a water cap approximately 14 feet deep above sludge and solids stored at the bottom. The surface water dimensions of the lagoon were measured by FMF personnel on June 25, 2014 to be 215 feet by 205 feet. The lagoon's sloped interior sides extend about 50 feet from the edge indicating the bottom area of the lagoon is about 115 feet by 105 feet. Limited sludge material is currently stored at the bottom of Burnt Ridge Lagoon. The sludge material is estimated to currently be 3 feet thick or less.

As stated in the AO, the investigative work was required to follow an Ecology-approved Quality Assurance Project Plan (QAPP) specifying a rigorous method of sampling (gridding, randomized sampling, compositing, etc.) to address the heterogeneity of the materials stored at the three sites. The QAPP was prepared by Pacific Groundwater Group in accordance with Ecology guidelines (Publication No. 04-03-030 July 2004) and was submitted to and approved by Ecology in July 2014 (PGG, 2014).

During conversations with Ecology while developing the QAPP, it was also agreed that the water cap at the Burnt Ridge Lagoon and groundwater monitoring wells downgradient of the Newaukum Prairie and Burnt Ridge storage site would also be sampled as part of this investigation.

## 4.0 INVESTIGATIVE WORK PERFORMED

This section summarizes the field investigative work performed to meet the requirements of the AO. Field investigative work included sampling of sludge wastes stored at three of the Fire Mountain Farms sites: Burnt Ridge, Newaukum Prairie, and Big Hanaford (Figure 1). The Burnt Ridge Lagoon water cap was also sampled as part of the investigation. Although not required by the AO, existing downgradient groundwater monitoring wells were sampled at the Newaukum Prairie and Big Hanaford sites; however, the results of the groundwater investigation will be summarized in a separate addendum to this report.

Results of this investigative work are summarized in Section 5 (Analytical Results).

## 4.1 FIELD INVESTIGATION

Samples were collected from the three storage sites (Burnt Ridge, Newaukum Prairie, and Big Hanaford) following the procedures outlined in the QAPP (PGG, 2014); field conditions required exceptions to the QAPP that were approved by Ecology and are described

[1] The concrete segments used to construct the bunker are 11.5 feet tall with a 6 inch thick poured concrete slab floor, making an effective depth of 11 feet. The top of the biosolids is 6 to 12 inches from the top of the bunker - for a total biosolids thickness of 10 to 10.5 feet.

below. At each site, several grab samples ("subsamples") were systematically collected by FMF personnel using various coring devices at prescribed horizontal spacing and random vertical depths. An x-y grid was staked out along the perimeter of each storage site to guide sample locations as specified in the QAPP (PGG, 2014). Sludge sample depths varied from near the surface to the bottom of the sludge material and were randomly selected in the field using a pre-generated table of random numbers in MS-Excel.

Three composited sludge samples from each storage site were submitted for laboratory analysis. Each composite consisted of up to nine discrete grab samples composited in the field (except for samples analyzed for volatile organic compounds (VOCs), which were composited by the lab in order to minimize volatilization to air). A composite liquid sample was also collected from the water cap at the Burnt Ridge Lagoon. Field compositing of grab samples was conducted by PGG personnel and followed the procedures documented in the QAPP (2014). Decontamination of sampling and compositing equipment also followed the procedures documented in the QAPP.

In accordance with the QAPP, the sludge samples were analyzed for a comprehensive list of chemical compounds, including the full US Environmental Protection Agency (USEPA) priority pollutants for at least one composited sludge sample collected from each site.

The water cap liquid sample collected at the Burnt Ridge site was analyzed for VOCs, Semi-VOCs, metals, nitrate, and total cyanide. The water cap sample was not analyzed for the full priority pollutants as stated in Section 4.7 of the QAPP (PGG, 2014). This deviation is due to Table 6 in the QAPP, which indicates sample parameters for the water cap were to be the same as the sample parameters for groundwater (VOCs, Semi-VOCs, metals, nitrate, and total cyanide).

Finally, in accordance with the pathogen reduction requirements in the State's Biosolids Management Rule (Chapter WAC 173-308-170) discrete grab samples of sludge from each site were submitted for Total Coliform analysis.

All samples were analyzed by Analytical Resources Inc. in Tukwila, Washington except for Total Coliform which was analyzed by Water Management Laboratories in Tacoma, Washington. The analytical methods were as specified in the QAPP and are shown with the analytical results in Tables 3, 4, 5, 6, and 7.

Details of the sampling conducted at each site are described below.

### 4.1.1 Newaukum Prairie Lagoon Field Investigation

Sludge grab samples at the Newaukum Prairie site were collected by FMF personnel on July 7, 2014 using a 1.5 inch sludge judge with a flapper valve. The location of each grab sample is shown in Figure 2. Depths are noted in Table 2. Three composited sludge samples were prepared by PGG personnel and submitted for laboratory analysis (NP-Comp-1, NP-Comp-2, and NP-Comp-3 in Table 1), except for VOC samples, which were composited by the lab to minimize volatilization. Nine individual grab samples comprised each composited sludge sample (Figure 2 and Table 2). In accordance with the QAPP, fourteen individual grab samples were submitted for Total Coliform analysis. All samples were placed in iced coolers and delivered to the lab on the same day (July 7, 2014).

### 4.1.2 Big Hanford Bunker Field Investigation

Sludge grab samples at the Big Hanaford site were collected by FMF personnel on July 8, 2014 using a 1.5 inch PVC casing pipe driven to the desired depth and samples collected from the final depth of casing using a 1 inch stainless steel, solid stem, hand auger. The PVC pipe was hand driven into the material allowing accessing for sample collection at depth with the hand auger. FMF personnel verified the sludge material was pushed to the outside of the PVC pipe by measuring depth inside the PVC pipe. If any sludge material were encountered inside the PVC pipe, FMF personnel used the hand auger to clean out materials to achieve sample depth, decontaminated the hand auger, and collected the sample. Sludge samples were obtained by "peeling" the material from the threads on the auger head.

The location of each grab sample is shown in Figure 3. Sample depths are noted in Table 2. Three composited sludge samples were prepared by PGG personnel and submitted for laboratory analysis (BH-Comp-1, BH-Comp-2, and BH-Comp-3 in Table 1), except for VOC samples, which were composited by the lab to minimize volatilization. Six individual grab samples comprised each composited sludge sample (Figure 3 and Table 2). In accordance with the QAPP, seven individual grab samples were submitted for Total Coliform analysis. All samples were placed in iced coolers and delivered to the lab on the same day (July 8, 2014).

### 4.1.3 Burnt Ridge Lagoon Field Investigation

Sludge grab samples at the Burnt Ridge Lagoon site were collected by FMF personnel on July 9, 2014 using a 1.5 inch sludge judge with a flapper valve. The location of each grab sample is shown in Figure 4. Sample depths are noted in Table 2. Three composited sludge samples were prepared by PGG personnel and submitted for laboratory analysis (BR-Comp-1, BR-Comp-2, and BR-Comp-3 in Table 1), except for VOC samples, which were composited by the lab to minimize volatilization. Nine individual grab samples comprised each composited sludge sample (Figure 4 and Table 2). In accordance with the QAPP, seven individual grab samples were submitted for Total Coliform analysis. All samples were placed in iced coolers and delivered to the lab on the same day (July 9, 2014).

The Burnt Ridge water cap was sampled on July 17, 2014. In accordance with the QAPP, water cap sample depths were not random as they were for the sludge samples, but instead targeted the lower part of the water column where chemical partitioning from the sludge and minimal volatilization to the atmosphere would likely results in the highest concentrations in the water. Except for the analysis of VOCs, one composited water sample was prepared in the field by PGG personnel from four individual grab samples collected at each quadrant of the lagoon (Figure 5 and Table 2). Four individual grab samples collected at each quadrant of the lagoon were submitted for VOC analysis. Samples collected for VOC analysis could not be filled directly from the sludge judge sampler into 40 mL laboratory vials as specified in the QAPP. Instead, water samples were emptied from the sludge judge into 32 oz glass jars and immediately provided to PGG personnel at the shoreline. PGG personnel then filled the 40 mL laboratory vials. The pouring of the water sample twice could result in some of the VOCs volatilizing to the air and thus the water cap VOC results could be biased low. The four grab samples for VOC analysis were requested to be composited by the lab, but were instead analyzed individually.

Water cap grab samples were collected by FMF personnel using a 1.5 inch sludge judge with a flapper valve in tandem with a measuring rod. FMF personnel would drop the measuring rod to identify the sludge water cap interface, then using the sludge judge collect the water sample from approximately six inches above the sludge surface. In coordination PGG and FMF personnel would determine if any water/sludge was to be discarded from the bottom of sampler prior to bottle filling. All samples were placed in iced coolers and delivered to the lab on the same day (July 17, 2014).

## 4.2 DATA VALIDATION

Analytical data collected for this investigation have been validated in accordance with the QAPP, including both laboratory and field quality assurance quality control procedures (PGG, 2014). Appendix A contains the data validation. Some analyses required sample dilution which resulted in elevated laboratory reporting limits; however, the QA/QC data are satisfactory and indicate that the data are acceptable for the project purposes.

The Dioxin results were flagged "JEMPC" by the analytical laboratory, indicating the concentrations are "Estimated Maximum Possible Concentrations", and are less than the analytical reporting limits (RL or Practical Quantitation Limit, PQL). The analysis was challenging due to the sludge matrix and high moisture content. These estimated and qualified analytical results are considered not sufficiently accurate to serve as a basis for regulatory decisions.

# 5.0 ANALYTICAL RESULTS

This section provides a summary of the analytical results. Section 6.0 provides an evaluation of the sludge analytical results within the context of regulatory requirements.

The analytical results for sludge samples collected at all three sites show detections of a few volatile organic compounds (VOCs) and semi-VOCs; metals; PCBs[2] (Aroclor 1260), and Total Cyanide. Elevated concentrations of N-ammonia and total Kjeldahl nitrogen (TKN) were also detected in the sludge. Pesticides were not detected in the sludge at all three sites.

The dominant organic chemicals (greater than 10 ppm[3]) detected in the sludge were:

- Bis(2-ethylhexyl)phthalate (at all three sites)
- 4-Methylphenol (Big Hanaford)
- Toluene (Newaukum Prairie and Big Hanaford)
- Phenol (Big Hanaford)

The dominant metals detected in the sludge at all three sites were:

- Zinc (~ 900 - 1100 ppm)
- Copper (~ 400 to 500 ppm)

---

[2] Polychlorinated Biphenyls
[3] Parts per million. One ppm (1 mg/kg) = 1000 ug/kg (1000 parts per billion or ppb)

As described in Section 6.1, the concentrations of chemicals in the sludge at all three sites do not trigger the land disposal restrictions set forth in Chapter WAC 173-303-140. Furthermore, as described in Section 6.2, except for the chemicals toluene, 4-methylphenol, phenol, molybdenum, and cobalt, the chemical concentrations detected in sludge at the Fire Mountain Farm sites are similar to or less than the national averages calculated by the U.S. EPA as part of their National Sewage Sludge Survey (NSSS) from Publically Owned Treatment Works (POTW).

Analytical results for the water cap samples collected from the bottom of the Burnt Ridge Lagoon showed detections of toluene (26 to 41 ug/L), some metals, and very low levels of nitrite and nitrite+nitrate (0.014 and 0.051 mg/L as N respectively). Except for toluene, no other VOCs or Semi-VOCs were detected in the water cap sample, suggesting minimal leaching of organic parameters from the sludge. As mentioned above, groundwater samples have been collected at the Burnt Ridge and Newaukum Prairie sludge storage sites to assess potential historical leaching of chemicals in the sludge with transport to the groundwater. The results of the groundwater sampling will be submitted as an addendum to this report.

The geometric means of total fecal coliform results at the three sites were 44 MPN[4] per gram (dw)[5] at Burnt Ridge; 145 MPN per gram (dw) at Big Hanaford; and 3,056 MPN per gram (dw) at Newaukum Prairie. All values are well below the required threshold of 2,000,000 MPN per gram (dw) for Class B biosolids (WAC 173-308-170(5))[6].

The analytical results for each storage site are described in more detail below. Section 6.0 provides describes the sludge analytical results within the context of regulatory requirements of land disposal restrictions under the State's Dangerous Waste Regulation (WAC 173-303-140), the State's Biosolids Management Rule (WAC 173-308), and comparison to the U.S. EPA National Sewage Sludge Survey (NSSS) dataset.

## 5.1 NEWAUKUM PRAIRIE ANALYTICAL RESULTS

Newaukum Prairie analytical results are shown in Table 3. Total Coliform Results are shown in Table 6. A summary is provided below.

### 5.1.1 Organic Results

The following organic chemicals were detected in the composite sludge samples collected at Newaukum Prairie (in order from highest concentrations to lowest concentrations):

- Toluene
- Bis(2-ethylhexyl)phthalate (BEHP)

[4] MPN = Most Probable Number
[5] dw = dry weight
[6] Total coliform results were reported by the lab as wet weight concentrations and were converted to dry weight concentrations using the average total solids results from the three composited sludge samples at each location (see Tables 3, 4, and 5). There was very little variability in percent total solids between the three composited samples, suggesting the use of an average is acceptable.

- Phenols (4-methylphenol & Phenol)
- 1,4-dichlorobenzene
- PAHs[7] (Fluoranthene; Indeno(1,2,3-cd)pyrene; Pyrene; Phenanthrene; Benzo(b)fluoranthene; Benzo(k)fluoranthene)
- PCBs (Aroclor 1260)
- Ethylbenzene

Toluene concentrations varied from 130 to 150 ppm, BEHP from 19 to 20 ppm, and 4-methylphenol from 2.4 to 2.6 ppm. The concentrations of all other detected organic chemicals were less than 1 ppm (Table 3).

### 5.1.2 Metals Results

The following metals were detected in sludge samples collected at Newaukum Prairie (in order from highest concentration to lowest concentration):

- Zinc (950 to 1060 ppm)
- Copper (440 to 503 ppm)
- Cobalt (76 to 89 ppm)
- Nickel (30 ppm)
- Chromium (24 to 27 ppm)
- Molybdenum (12 to 14 ppm)
- Mercury (0.9 to 1.2 ppm)

### 5.1.3 Inorganic Results

The following inorganics were detected in the sludge samples collected at Newaukum Prairie:

- N-Ammonia (21,400 mg/kg as N)
- TKN (71,400 mg/kg as N)
- Nitrate+Nitrite (4.01 mg/kg as N)
- Nitrite (6.09 mg/kg as N)
- Total Cyanide (1.73 mg/kg)

### 5.1.4 Total Coliform Results

Fourteen discrete sludge samples for Total Coliform analysis were collected from Newaukum Prairie (Table 6). Concentrations ranged from 504 MPN per grams (dw) to 14,060 MPN per grams (dw) with a geometric mean of 3,056 MPN per grams (dw).

## 5.2 BIG HANAFORD ANALYTICAL RESULTS

Big Hanaford analytical results are shown in Table 4. Total Coliform Results are shown in Table 6. A summary is provided below.

[7] Polycyclic Aromatic Hydrocarbons

### 5.2.1 Organic Results

The following organic chemicals were detected in the composite sludge samples collected at Big Hanaford site (in order from highest concentrations to lowest concentrations):

- Phenols (4-methylphenol and phenol)
- Toluene
- Bis(2-ethylhexyl)phthalate (BEHP)
- N-nitrosodiphenylamine
- 1,4-dichlorobenzene
- PAHs (Fluoranthene)
- PCBs (Aroclor 1260)

4-Methylphenol concentrations varied from 480 to 720 ppm, phenol from 14 to 23 ppm, toluene from 8.3 to 120 ppm, and BEHP from 24 to 25 ppm, N-nitrodiphenylamine from 1.1 to 1.4 ppm, and 1,4-dichlorobenzene from 1 to 1.3 ppm. The concentrations of PAHs and PCBs were all below 1 ppm (Table 4).

Although fluoranthene was the only PAH detected at the Big Hanaford site, the laboratory reporting limits were elevated for the samples analyzed at this site compared to the other two sites due to laboratory dilution requirements (see Appendix A). Therefore, the PAHs that were detected at relatively low levels at the Newaukum Prairie and Burnt Ridge site could also be present at the Big Hanaford site below the laboratory reporting limit.

### 5.2.2 Metals Results

The following metals were detected in sludge samples collected at Big Hanaford site (in order from highest concentration to lowest concentration):

- Zinc (1030 to 1100 ppm)
- Copper (473 to 521 ppm)
- Cobalt (15 to 165 ppm)
- Nickel (27 to 42 ppm)
- Lead (20 to 30 ppm)
- Chromium (25 to 29 ppm)
- Molybdenum (12 to 15 ppm)
- Silver (4 to 6 ppm)
- Mercury (1 to 3 ppm)
- Cadmium (2 ppm)

### 5.2.3 Inorganic Results

The following inorganics were detected in the sludge samples collected at Big Hanaford site:

- N-Ammonia (24,800 mg/kg as N)
- TKN (76,800 mg/kg as N)

- Nitrate+Nitrite (7.01 mg/kg as N)
- Nitrite (7.86  mg/kg as N)
- Total Cyanide (1.6 to 2.39 mg/kg)

### 5.2.4 Total Coliform Results

Seven discrete sludge samples for Total Coliform analysis were collected from Big Hanaford site (Table 6). Concentrations ranged from 5 MPN per grams (dw) to 6,800 MPN per grams (dw) with a geometric mean of 145 MPN per grams (dw).

## 5.3 BURNT RIDGE ANALYTICAL RESULTS

Burnt Ridge analytical results are shown in Table 5 (sludge results) and Table 7 (water cap results). Total Coliform Results for the sludge are shown in Table 6. A summary is provided below.

### 5.3.1 Organic Results (Sludge Samples)

The following organic chemicals were detected in the composite sludge samples collected at the Burnt Ridge site (in order from highest concentrations to lowest concentrations):

- Bis(2-ethylhexyl)phthalate (BEHP)
- 4-Methylphenol
- 1,4-Dichlorobenzene
- PAHs (Fluoranthene, Indeno(1,2,3-cd)pyrene, Pyrene, Benzo(b)fluoranthene, and Benzo(k)fluoranthene)
- PCBs (Aroclor 1260)
- Toluene

BEHP concentrations varied from 9.1 to 12 ppm and 4-methylphenol from 0.46 to 1.1 ppm. All other organics had concentrations below 1 ppm. Toluene concentrations in the Burnt Ridge sludge was noticeably lower than the concentrations of toluene at the other two sites.

### 5.3.2 Metals Results (Sludge Samples)

The following metals were detected in sludge samples collected at the Burnt Ridge site (in order from highest concentration to lowest concentration):

- Zinc (876 to 969 ppm)
- Copper (379 to 417 ppm)
- Cobalt (37 to 48 ppm)
- Chromium (31 to 45 ppm)
- Nickel (28 to 45 ppm)
- Lead (30 to 40 ppm)
- Molybdenum (14 to 16 ppm)
- Silver (5 to 6 ppm)
- Cadmium (3 ppm)

- Mercury (1 to 2 ppm)

### 5.3.3 Inorganic Results (Sludge Samples)

The following inorganics were detected in the sludge samples collected at the Burnt Ridge site:

- N-Ammonia (7,600 mg/kg as N)
- TKN (33,700 mg/kg as N)
- Nitrate+Nitrite (0.60 mg/kg as N)
- Nitrite (0.72 mg/kg as N)
- Total Cyanide (1.05 to 1.42 mg/kg)

The concentrations of N-Ammonia, TKN, Nitrate+Nitrite, and Nitrite were noticeably lower at the Burnt Ridge Site relative to the other two sites.

### 5.3.4 Burnt Ridge Water Cap Results

The only organic parameter detected in the water cap liquid sample was toluene with concentrations ranging from 26 ppb to 41 ppb (Table 7) – well below the Federal drinking water MCL (1000 ug/L)[8]. The following metals were detected in the water cap composite sample (from highest to lowest):

- Zinc (0.18 ppm)
- Copper (0.057 ppm)
- Nickel (0.02 ppm)
- Cobalt (0.017 ppm)
- Chromium (0.012 ppm)
- Molybdenum (0.006 ppm)
- Mercury (0.0003 ppm)

The concentration of chromium, copper, and mercury are all below the Federal MCL for drinking water (0.1, 1.3, and 0.002 ppm respectively) and the Washington State groundwater criteria in Chapter WAC 173-200 (0.05, 1.0, and 0.002 ppm respectively). There is no state or federal standard for cobalt, molybdenum, or nickel.

Low concentrations of nitrate+nitire (0.014 mg/L as N) and nitrite (0.051 mg/L as N) were also detected in the water cap sample - well below the federal drinking water MCL (10 and 1 mg/L as N respectively).

Except for the detection of toluene, no other VOCs or Semi-VOCs were detected in the liquid at the bottom of the Burnt Ridge lagoon, suggesting minimal leaching of organic parameters from the sludge. However, as explained above in Section 4.1.3, the water cap sample could not be poured directly into the 40 mL laboratory vials and instead were first emptied into 32 oz glass jars and then transferred to the 40 mL laboratory vials from the 32 oz jars. The pouring of the water sample twice could result in some VOCs volatilizing to the air and thus bias the results low.

[8] Maximum Contaminant Level (MCL) for toluene = 1000 micrograms per liter (ug/L)

As mentioned above, groundwater samples have been collected at the Burnt Ridge and Newaukum Prairie storage sites to assess potential historical leaching of chemicals in the sludge with transport to the groundwater. The results of the groundwater sampling will be submitted as an addendum to this report.

### 5.3.5 Total Coliform Results

Seven discrete sludge samples for Total Coliform analysis were collected from Burnt Ridge site (Table 6). Concentrations ranged from 16 MPN per grams (dw) to 156 MPN per grams (dw) with a geometric mean of 44 MPN per grams (dw).

# 6.0 EVALUATION OF SLUDGE ANALYTICAL RESULTS

The following sections provide an evaluation of the sludge analytical results under the Washington State land disposal restriction for dangerous waste (WAC 173-303-140); comparison of the analytical results to the U.S. EPA National Sewage Sludge Survey; and evaluation under the Washington State Biosolids Management Rule (WAC 173-308).

## 6.1 EVALUATION OF RESULTS - STATE LAND DISPOSAL RESTRICTIONS FOR DANGEROUS WASTE

The sludge analytical results from each storage site were evaluated against land disposal restrictions under the State's Dangerous Waste Regulation (WAC 173-303-140). Under the State's code, the following wastes are restricted from land disposal (WAC 173-303-140 (4)):

1. Disposal of extremely hazardous waste (EHW): Designated under WAC 173-303-100.
2. Disposal of Liquid Waste: Demonstrated using Method 9095 (Paint Filter Liquid Test)
3. Disposal of solid acid waste: pH ≤ 2 and pH ≥ 12.5 (WAC 173-303-90(6)(a)(iii).
4. Disposal of organic/carbonaceous Waste: wastes containing combined organics > 10% (WAC 173-303-140(3)(c)).

### 6.1.1 Liquid Waste Evaluation

Because biosolids are applied as solids at the land surface, it is considered a valid assumption that the waste would not likely designate as a liquid waste. We understand that this restriction applies to land disposal of liquid wastes at a landfill.

### 6.1.2 Solid Acid Waste Evaluation

The pH results for the sludge samples collected at all three sites (Tables 3, 4, and 5) were relatively similar (7.91 at Big Hanaford, 7.43 at Burnt Ridge, 7.38 at Newaukum Prairie) and do not designate as a solid acid.

### 6.1.3 Extremely Hazardous Waste Evaluation

Under WAC 173-303-100, a waste is evaluated as extremely hazardous under the Toxicity Criteria (WAC 173-303-100(5)) and the Persistence Criteria (WAC 173-303-100(6)). For this evaluation we considered the full list of organic chemicals, metals, and cyanide analyzed at each of the three storage sites.

For detected chemicals, we used the maximum concentration reported for each site; a valid alternative approach would be to use an average or mean value. For non-detected chemicals we used the minimum laboratory reporting limit as an estimated concentration. The use of the laboratory reporting limit is considered an upper bound estimate of the actual concentration, which is some unknown value between zero and the reporting limit.

#### 6.1.3.1 Toxicity Criteria (book designation method)

The toxicity criteria were evaluated using the book designation method. Under the book designation method, the toxicity category (X, A, B, C, or D) for each chemical constituent is determined from available toxicity data sources (WAC 173-303-100(5)(b)(i)). For this evaluation we used toxicity data from the current Hazardous Substances Data Bank (HSDB)[9] and ECOTOXicology[10].

An equivalent percent concentration (EC) is then determined by weighting the total percent concentration for each toxic category in the waste:

$$EC(\%) = \frac{\sum X\%}{1} + \frac{\sum A\%}{10} + \frac{\sum B\%}{100} + \frac{\sum C\%}{1000} + \frac{\sum D\%}{10{,}000}$$

The percent concentrations and associated toxic category for each chemical at each site are shown in Tables 8, 9, and 10.

A waste is designated as follows under the Toxicity Criteria (WAC 173-303-100(5)(b)(iii)):

- If EC(%) < 0.001%, the waste is not a toxic dangerous waste
- If EC(%) > 0.001% and < 1%, the waste is designated as dangerous waste (WT02)
- If EC(%) > 1%, the waste is designated as extremely hazardous waste (EHW) and would be restricted for land disposal.

The results show the EC(%) at the three storage sites range from 0.57 to 0.73% and therefore do not designate as EHW under the toxicity criteria (Table 11).

#### 6.1.3.2 Persistence Criteria

The Persistence Criteria (WAC 173-303-100(6) considers chemical compounds which are either halogenated organic compounds (HOC) or polycyclic aromatic hydrocarbons (PAHs). Under the persistence criteria, the total HOC and PAH concentrations in the

[9] http://toxnet.nlm.nih.gov/newtoxnet/hsdb.htm
[10] http://cfpub.epa.gov/ecotox/

waste are determined by summing the percent concentration for all HOC and all PAH compounds in the waste.

The percent concentrations and associated organic category (HOC or PAH) for each chemical at each site are shown in Tables 8, 9, and 10.

A waste is designated as follows under the Persistence Criteria (WAC 173-303=100(6)(d)):

- If total HOC = 0.01% to 1%, the waste is designated as dangerous waste (WP02)
- If total HOC > 1%, the waste is designated as extremely hazardous waste (EHW)
- If total PAH > 1%, the waste is designated as EHW

The results for the three storage sites show total percent HOC ranges from 0.13 to 0.46% (even with inclusion of the 2,3,7,8-TCDD Estimated Possible Maximum Concentrations) and total percent PAH ranges from 0.05% to 0.09% and therefore do not designate as EHW under the persistence criteria (Table 11).

### 6.1.4 Total Organic/Carbonaceous Waste Evaluation

Under the Land Disposal Restrictions (WAC 173-303-140), no person may dispose of organic carbonaceous waste defined as wastes containing combined organics > 10% (WAC 173-303-140(3)(c)).

The percent concentrations and organic designation for each chemical at each site are shown in Tables 8, 9, and 10.

The results for the three storage sites show the total percent organics at each site are 0.49%, 2.14%, and 10.26%. While two sites clearly do not designate as organic carbonaceous waste, Big Hanaford is marginally above 10% (Table 11). Our evaluation uses an upper bound estimate on non-detected chemicals and therefore the true value is most likely less than 10%. Also, our evaluation includes the 2,3,7,8-TCDD Estimated Possible Maximum Concentrations, which should be excluded.

Further, it appears that the sludge meets the requirements for Organic/Carbonaceous Waste Exemption (WAC 173-303-140), as it is 83.82 % water (Table 6) and with its water content, its caloric content is likely much less than 3000 BTU/LB:

(c) Organic/carbonaceous waste exemption. Any person may request an exemption from the requirements in subsection (4) of this section by demonstrating to the department that:

(i) Alternative management methods for organic/carbonaceous waste are less protective of public health and the environment than stabilization or landfilling; or

(ii) (A)The organic/carbonaceous waste has a heat content less than 3,000 BTU/LB or contains greater than sixty-five percent water or other noncombustible moisture; and

(B) Incineration is the only management method available within a radius of one thousand miles from Washington state's border (i.e., recycling or treatment are not available).

### 6.1.5 Land Disposal Restriction Evaluation Summary

Our evaluation indicates that the sludge at all three storage sites do not designate as wastes that would be restricted from land disposal under the State's Dangerous Waste Regulation (Table 11). Furthermore, because our evaluation uses an upper bound estimated concentration for non-detected chemicals, our evaluation provides a "worst-case" evaluation. As a result, even under a "worst-case" evaluation, the sludge would not be restricted from land disposal under the State's Dangerous Waste Regulation (WAC 173-303-140).

## 6.2 EVALUATION OF RESULTS - THE NATIONAL SEWAGE SLUDGE SURVEY

To evaluate whether the chemicals detected in the FMF sludge are characteristic of standard biosolids, we compared the analytical results to the average concentrations measured in sewage sludge from wastewater treatment plants.

In 1988, the U.S. EPA conducted the National Sewage Sludge Survey (NSSS) to identify and estimate the concentrations of expected pollutants in sewage sludge. The NSSS dataset includes concentration data for over 400 pollutants from samples collected at 178 Publicly Owned Treatment Works (POTWs) throughout the nation practicing at least secondary treatment of wastewater (U.S. EPA 1992 and 1996). Samples were collected just prior to the use or disposal of the sewage sludge. The results were used in establishing the Federal Biosolids rule in CFR 40 Part 50[11]. The U.S. EPA conducted statistical analyses of the NSSS dataset in 1992 (Round 1) and in 1996 (Round 2) and tabulated average concentrations, standard deviations, and percentiles for different pollutants (U.S. EPA 1992 and 1996).

Table 12 provides a comparison of the concentration of chemicals detected in the sludge at FMF relative to the mean concentrations calculated from the NSSS dataset (Round 1 and Round 2). The table provides a comparison of chemicals detected in at least one sample from the FMF site. Chemical concentrations from the FMF sites are shown in Table 12 as either the maximum detected value or as less than ("<") the minimum reporting limit (if the chemical was not detected at that site).

Mean values from the NSSS dataset are shown for both the Round 1 (U.S. EPA 1992) and Round 2 (U.S. EPA, 1996) analysis. Each round analyzed a different set of chemicals and a slightly different approach to calculating mean concentrations.

The mean value from the Round 1 NSSS dataset analysis is based on a multi-censored, maximum-likelihood estimation (MLE) statistical procedure for estimating non-detected concentrations for chemicals with a detection frequency greater than 10% (U.S. EPA,

[11] http://water.epa.gov/scitech/wastetech/biosolids/tnsss-overview.cfm#pastsurveys

1992). For chemicals with a detection frequency less than 10% the mean value is based on a non-parametric statistical method (U.S. EPA, 1992).

Two mean values were calculated during the Round 2 NSSS dataset analysis (U.S. EPA, 1996); one based on setting non-detections to a value of zero (a lower bound estimate) and another based on setting non-detections to the value of the reporting limit (an upper bound estimate).

The results show the chemical concentrations in the FMF sludge is either similar to or less than the mean chemical concentrations calculated from the NSSS dataset except for the following chemicals (in order from highest to lowest exceedance of the NSSS dataset) (Table 13):

- Cobalt at all three sites
- 4-Methylphenol at Big Hanaford
- Toluene at Newaukum Prairie and Big Hanaford
- Phenol at Big Hanaford
- Molybdenum at all three sites

Molybdenum concentrations in the FMF sludge (14 to 16 mg/kg) are only slightly higher than the mean concentration in the NSSS dataset (9.63 mg/kg) and well below the ceiling limit for Molybdenum (75 mg/kg) in the State Biosolids Rule (WAC 173-308-160).

Pollutant limits are not set for toluene, cobalt, 4-methylphenol, and phenol in the State Biosolids Rule.

## 6.3 EVALUATION OF RESULTS - STATE BIOSOLIDS MANAGEMENT RULE

Numerical limits for select metals are set under the State Biosolids Management Rule (WAC 173-308-160). The rule sets the maximum allowable concentration (ceiling limit) in biosolids that can be applied to land. The rule also sets pollutant concentration limits which, when achieved, relieves a biosolids facility operator from certain requirements related to recordkeeping, reporting, and labeling.

Comparison of the FMF sludge results to the rule limits show that all concentrations are below both the ceiling limits and the pollutant limits established under the rule (Table 12).

The geometric means of total fecal coliform results at the three sludge storage sites were 44 MPN per gram (dw) at Burnt Ridge; 145 MPN per gram (dw) at Big Hanaford; and 3,056 MPN per gram (dw) at Newaukum Prairie (Table 6). All values are well below the required threshold of 2,000,000 MPN per gram (dw) for Class B biosolids (WAC 173-308-170(5)).

# 7.0 REFERENCES

Pacific Groundwater Group, 2014. Fire Mountain Farms, Inc. Quality Assurance Project Plan Investigation of Emerald Kalama Chemical Sludge Comingled with Biosolids from Other Permitted Sources at Three Storage Sites.

U.S. Environmental Protection Agency, 1992. Statistical Support Documentation for the 40 CFR, Part 503. Final Standards for the Use or Disposal of Sewage Sludge Volume I. Final Report November 11, 1992

U.S. Environmental Protection Agency, 1996. Technical Support Document for the Round Two Sewage Sludge Pollutants. EPA-822-R-96-003.

Table 1. Chemical Analyses Performed on Each Sample Collected from Three Sludge Waste Sites at Fire Mountain Farms, Inc.
(see Table 6 for samples submitted for total coliform analysis)

| | | Sludge Samples | | | | | | | | | Water Cap Sample | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Newaukum Prairie | | | Big Hanaford | | | Burnt Ridge | | | Burnt Ridge | | | | |
| CHEMICAL ANALYSIS | Method | NP-Comp-1 | NP-Comp-2 | NP-Comp-3 | BH-Comp-1 | BH-Comp-2 | BH-Comp-3 | BR-Comp-1 | BR-Comp-2 | BR-Comp-3 | BR-I-9 | BR-II-8 | BR-III-8 | BR-IV-8.5 | BR-Comp |
| Volatile Organic Compounds | 8260C | X | X | X | X | X | X | X | X | X | X | X | X | X | |
| Semi-Volatile Organic Compounds | SW8270D | X | X | X | X | X | X | X | X | X | | | | | X |
| Metals | 6010C/7471A | X | X | X | X | X | X | X | X | X | | | | | X |
| Pesticides | SW8081B | X | X | | X | | | X | | | | | | | |
| Polychlorinated Biphenyls (PCB Aroclors) | SW8082A | X | X | | X | | | X | | | | | | | |
| Polychlorinated dibenzo-p-dioxin (2,3,7,8-TCDD) | EPA 1613B | X | | | X | | | X | | | | | | | |
| N-Nitrate | Calculated | X | | | X | | | X | | | | | | | X |
| N-Ammonia | EPA 350.1M | X | | | X | | | X | | | | | | | |
| Total Kjeldahl Nitrogen | EPA 351.2 | X | | | X | | | X | | | | | | | |
| Nitrate + Nitrite (NO3+NO2) | EPA 353.2 | X | | | X | | | X | | | | | | | X |
| N-Nitrite | EPA 353.2 | X | | | X | | | X | | | | | | | X |
| Total Solids | SM2540G | X | X | X | X | X | X | X | X | X | | | | | |
| Total Cyanide | EPA 335.4 | X | X | X | X | X | X | X | X | X | | | | | X |
| pH | SW9045 | X | | | X | | | X | | | | | | | |

Note: All samples were composited "Comp" from discrete grab samples (see Table #) except for the analysis of Volatile Organic Compounds from the water cap at the Burnt Ridge Site.

Table 2. Subsamples (grab samples) Collected for each Composite Sample (Fire Mountain Farms, Inc.)

| Newaukum Prairie Sludge Samples | | | Big Hanaford Sludge Samples | | | Burnt Ridge Sludge Samples | | | Burnt Ridge Water Cap Sample |
|---|---|---|---|---|---|---|---|---|---|
| NP-Comp-1 | NP-Comp-2 | NP-Comp-3 | BH-Comp-1 | BH-Comp-2 | BH-Comp-3 | BR-Comp-1 | BR-Comp-2 | BR-Comp-3 | BR-Comp |
| NP-A3-1-7 | NP-C1-2-6 | NP-A1-3-3 | BH-A7-1-2 | BH-A2-2-11 | BH-A3-3-10 | BR-A1-1-1 | BR-A1-2-3 | BR-A1-3-2 | BR-I-9 |
| NP-A2-1-7 | NP-C2-2-5 | NP-A2-3-3 | BH-A1-1-0 | BH-A5-2-4 | BH-A6-3-4.5 | BR-A2-1-3 | BR-A2-2-2 | BR-A2-3-1 | BR-II-8 |
| NP-A1-1-2 | NP-C3-2-7 | NP-A3-3-10 | BH-A4-1-7.5 | BH-A8-2-9 | BH-B1-3-1 | BR-A3-1-1 | BR-A3-2-2 | BR-A3-3-2 | BR-III-8 |
| NP-B1-1-10 | NP-B1-2-4 | NP-B1-3-1 | BH-C2-1-8 | BH-C1-2-1.5 | BH-B8-3-6 | BR-B1-1-3 | BR-B3-2-3 | BR-B3-3-1 | BR-IV-8.5 |
| NP-B2-1-7 | NP-B2-2-6 | NP-B2-3-6 | BH-C5-1-10 | BH-C4-2-10 | BH-C3-3-10 | BR-B2-1-3 | BR-B2-2-1 | BR-B2-3-2 | |
| NP-B3-1-3 | NP-B3-2-2 | NP-B3-3-3 | BH-C8-1-4 | BH-C7-2-2 | BH-C6-3-9 | BR-B3-1-3 | BR-B1-2-3 | BR-B1-3-2 | |
| NP-C3-1-6 | NP-A3-2-10 | NP-C1-3-3 | | | | BR-C1-1-3 | BR-C1-2-2 | BR-C1-3-3 | |
| NP-C2-1-5 | NP-A2-2-5 | NP-C2-3-3 | | | | BR-C2-1-2 | BR-C2-2-2 | BR-C2-3-2 | |
| NP-C1-1-7 | NP-A1-2-7 | NP-C3-3-8 | | | | BR-C3-1-3 | BR-C3-2-1 | BR-C3-3-3 | |

Sample ID Nomenclature for sludge samples (i.e. NP-A3-1-7)
NP = Site Name (Newaukum Prarire)
A3 = Grid Horizontal Location as Identified in QAPP
1 = Composite Number (in this case Comp-1)
7 = Sample Depth (7 feet)

Sample ID Nomenclature for water cap sample (i.e. BR-I-9)
BR = Site Name (Burnt Ridge)
I = Sampled Quadrant
9 = Sample Depth (9 feet)

Table 3. Sludge Analytical Results - Newaukum Prairie Lagoon (Fire Mountain Farms)
Samples collected: 7/7/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | NP-Comp-1 | NP-Comp-2 | NP-Comp-3 |
|---|---|---|---|---|---|---|
| Volatile Organic Compounds (VOCs) | | | | | | |
| 1,1,1-Trichloroethane | 71-55-6 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| 1,1,2-Trichloroethane | 79-00-5 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| 1,1-Dichloroethane | 75-34-3 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| 1,1-Dichloroethene | 75-35-4 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| 1,2,4-Trichlorobenzene | 120-82-1 | 8260C | ug/kg | 19U | 19U | 16U |
| 1,2-Dichlorobenzene | 95-50-1 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| 1,2-Dichloroethane | 107-06-2 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| 1,2-Dichloropropane | 78-87-5 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| 1,3-Dichlorobenzene | 541-73-1 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| 1,4-Dichlorobenzene | 106-46-7 | 8260C | ug/kg | **91** | **120** | **97** |
| 2-Chloroethylvinylether | 110-75-8 | 8260C | ug/kg | 19U | 19U | 16U |
| Acrolein | 107-02-8 | 8260C | ug/kg | 190U | 190U | 160U |
| Acrylonitrile | 107-13-1 | 8260C | ug/kg | 19U | 19U | 16U |
| Benzene | 71-43-2 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Bromodichloromethane | 75-27-4 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Bromoform | 75-25-2 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Bromomethane | 74-83-9 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Carbon Tetrachloride | 56-23-5 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Chlorobenzene | 108-90-7 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Chloroethane | 75-00-3 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Chloroform | 67-66-3 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Chloromethane | 74-87-3 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| cis-1,3-Dichloropropene | 10061-01-5 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Dibromochloromethane | 124-48-1 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Ethylbenzene | 100-41-4 | 8260C | ug/kg | 3.9U | **4.60** | **3.50** |
| Hexachlorobutadiene | 87-68-3 | 8260C | ug/kg | 19U | 19U | 16U |
| Methylene Chloride | 75-09-2 | 8260C | ug/kg | 7.8U | 7.5U | 6.5U |
| Naphthalene | 91-20-3 | 8260C | ug/kg | 19U | 19U | 16U |
| Tetrachloroethene | 127-18-4 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Toluene | 108-88-3 | 8260C | ug/kg | **140,000** | **150,000** | **130,000** |
| trans-1,2-Dichloroethene | 156-60-5 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| trans-1,3-Dichloropropene | 10061-02-6 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Trichloroethene | 79-01-6 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |
| Vinyl Chloride | 75-01-4 | 8260C | ug/kg | 3.9U | 3.7U | 3.2U |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).
U: Not detected at RL.
Y: Not detected at RL (raised RL).



PGG

Table 3. Sludge Analytical Results - Newaukum Prairie Lagoon (Fire Mountain Farms)
Samples collected: 7/7/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | NP-Comp-1 | NP-Comp-2 | NP-Comp-3 |
|---|---|---|---|---|---|---|
| Metals | | | | | | |
| Antimony | 7440-36-0 | 6010C | mg/kg | 70U | 80U | 80U |
| Arsenic | 7440-38-2 | 6010C | mg/kg | 70U | 80U | 80U |
| Beryllium | 7440-41-7 | 6010C | mg/kg | 1U | 2U | 2U |
| Cadmium | 7440-43-9 | 6010C | mg/kg | 3U | 3U | 3U |
| Chromium | 7440-47-3 | 6010C | mg/kg | **24** | **26** | **27** |
| Cobalt | 7440-48-4 | 6010C | mg/kg | **76** | **87** | **89** |
| Copper | 7440-50-8 | 6010C | mg/kg | **440** | **493** | **503** |
| Lead | 7439-92-1 | 6010C | mg/kg | 30U | 30U | 30U |
| Molybdenum | 7439-98-7 | 6010C | mg/kg | **12** | **13** | **14** |
| Nickel | 7440-02-0 | 6010C | mg/kg | **30** | **30** | **30** |
| Selenium | 7782-49-2 | 6010C | mg/kg | 70U | 80U | 80U |
| Silver | 7440-22-4 | 6010C | mg/kg | 4U | 5U | 5U |
| Thallium | 7440-28-0 | 6010C | mg/kg | 70U | 80U | 80U |
| Zinc | 7440-66-6 | 6010C | mg/kg | **950** | **1,060** | **1,060** |
| Mercury | 7439-97-6 | 7471A | mg/kg | **1.2** | **0.9** | **1.2** |
| Semi-Volatile Organic Compounds (SVOCs) | | | | | | |
| 1,2,4-Trichlorobenzene | 120-82-1 | SW8270D | ug/kg | 420U | 380U | 300U |
| 1,2-Dichlorobenzene | 95-50-1 | SW8270D | ug/kg | 420U | 380U | 300U |
| 1,2-Diphenylhydrazine | 122-66-7 | SW8270D | ug/kg | 420U | 380U | 300U |
| 1,3-Dichlorobenzene | 541-73-1 | SW8270D | ug/kg | 420U | 380U | 300U |
| 1,4-Dichlorobenzene | 106-46-7 | SW8270D | ug/kg | **700** | **730** | **750** |
| 2,2'-Oxybis(1-Chloropropane) | 108-60-1 | SW8270D | ug/kg | 420U | 380U | 300U |
| 2,4,6-Trichlorophenol | 88-06-2 | SW8270D | ug/kg | 2100U | 1900U | 1500U |
| 2,4-Dichlorophenol | 120-83-2 | SW8270D | ug/kg | 2100U | 1900U | 1500U |
| 2,4-Dimethylphenol | 105-67-9 | SW8270D | ug/kg | 420U | 380U | 300U |
| 2,4-Dinitrophenol | 51-28-5 | SW8270D | ug/kg | 4200U | 3800U | 3000U |
| 2,4-Dinitrotoluene | 121-14-2 | SW8270D | ug/kg | 2100U | 1900U | 1500U |
| 2,6-Dinitrotoluene | 606-20-2 | SW8270D | ug/kg | 2100U | 1900U | 1500U |
| 2-Chloronaphthalene | 91-58-7 | SW8270D | ug/kg | 420U | 380U | 300U |
| 2-Chlorophenol | 95-57-8 | SW8270D | ug/kg | 420U | 380U | 300U |
| 2-Nitrophenol | 88-75-5 | SW8270D | ug/kg | 420U | 380U | 300U |
| 3,3'-Dichlorobenzidine | 91-94-1 | SW8270D | ug/kg | 2100U | 1900U | 1500U |
| 4,6-Dinitro-2-Methylphenol | 534-52-1 | SW8270D | ug/kg | 4200U | 3800U | 3000U |
| 4-Bromophenyl-phenylether | 101-55-3 | SW8270D | ug/kg | 420U | 380U | 300U |
| 4-Chlorophenyl-phenylether | 7005-72-3 | SW8270D | ug/kg | 420U | 380U | 300U |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).
U: Not detected at RL.
Y: Not detected at RL (raised RL).



PgG

Table 3. Sludge Analytical Results - Newaukum Prairie Lagoon (Fire Mountain Farms)
Samples collected: 7/7/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | NP-Comp-1 | NP-Comp-2 | NP-Comp-3 |
|---|---|---|---|---|---|---|
| SVOC (cont.) | | | | | | |
| 4-Methylphenol | 106-44-5 | SW8270D | ug/kg | **2,400** | **2,400** | **2,600** |
| 4-Nitrophenol | 100-02-7 | SW8270D | ug/kg | 2100U | 1900U | 1500U |
| Acenaphthene | 83-32-9 | SW8270D | ug/kg | 420U | 380U | 300U |
| Acenaphthylene | 208-96-8 | SW8270D | ug/kg | 420U | 380U | 300U |
| Anthracene | 120-12-7 | SW8270D | ug/kg | 420U | 380U | 300U |
| Azobenzene | 103-33-3 | SW8270D | ug/kg | 420U | 380U | 300U |
| Benzo(a)anthracene | 56-55-3 | SW8270D | ug/kg | 420U | 380U | 300U |
| Benzo(a)pyrene | 50-32-8 | SW8270D | ug/kg | 420U | 380U | 300U |
| Benzo(b)fluoranthene | 205-99-2 | SW8270D | ug/kg | 420U | 380U | **360M** |
| Benzo(g,h,i)perylene | 191-24-2 | SW8270D | ug/kg | 420U | 380U | 300U |
| Benzo(k)fluoranthene | 207-08-9 | SW8270D | ug/kg | 420U | 380U | **340M** |
| bis(2-Chloroethoxy) Methane | 111-91-1 | SW8270D | ug/kg | 420U | 380U | 300U |
| Bis-(2-Chloroethyl) Ether | 111-44-4 | SW8270D | ug/kg | 420U | 380U | 300U |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | SW8270D | ug/kg | **19,000** | **20,000** | **19,000** |
| Butylbenzylphthalate | 85-68-7 | SW8270D | ug/kg | 420U | 380U | 300U |
| Chrysene | 218-01-9 | SW8270D | ug/kg | 420U | 380U | 300U |
| Dibenz(a,h)anthracene | 53-70-3 | SW8270D | ug/kg | 420U | 380U | 300U |
| Diethylphthalate | 84-66-2 | SW8270D | ug/kg | 420U | 380U | 300U |
| Dimethylphthalate | 131-11-3 | SW8270D | ug/kg | 420U | 380U | 300U |
| Di-n-Butylphthalate | 84-74-2 | SW8270D | ug/kg | 420U | 380U | 300U |
| Di-n-Octyl phthalate | 117-84-0 | SW8270D | ug/kg | 420U | 380U | 300U |
| Fluoranthene | 206-44-0 | SW8270D | ug/kg | **560** | **530** | **550** |
| Fluorene | 86-73-7 | SW8270D | ug/kg | 420U | 380U | 300U |
| Hexachlorobenzene | 118-74-1 | SW8270D | ug/kg | 420U | 380U | 300U |
| Hexachlorobutadiene | 87-68-3 | SW8270D | ug/kg | 420U | 380U | 300U |
| Hexachlorocyclopentadiene | 77-47-4 | SW8270D | ug/kg | 2100U | 1900U | 1500U |
| Hexachloroethane | 67-72-1 | SW8270D | ug/kg | 420U | 380U | 300U |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | SW8270D | ug/kg | **450M** | **470M** | **450M** |
| Isophorone | 78-59-1 | SW8270D | ug/kg | 420U | 380U | 300U |
| Naphthalene | 91-20-3 | SW8270D | ug/kg | 420U | 380U | 300U |
| Nitrobenzene | 98-95-3 | SW8270D | ug/kg | 420U | 380U | 300U |
| N-Nitrosodimethylamine | 62-75-9 | SW8270D | ug/kg | 2100U | 1900U | 1500U |
| N-Nitroso-Di-N-Propylamine | 621-64-7 | SW8270D | ug/kg | 420U | 380U | 300U |
| N-Nitrosodiphenylamine | 86-30-6 | SW8270D | ug/kg | 420U | 380U | 300U |
| Pentachlorophenol | 87-86-5 | SW8270D | ug/kg | 2100U | 1900U | 1500U |
| Phenanthrene | 85-01-8 | SW8270D | ug/kg | 420U | **440** | **360** |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).
U: Not detected at RL.
Y: Not detected at RL (raised RL).



PgG

Table 3. Sludge Analytical Results - Newaukum Prairie Lagoon (Fire Mountain Farms)
Samples collected: 7/7/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | NP-Comp-1 | NP-Comp-2 | NP-Comp-3 |
|---|---|---|---|---|---|---|
| SVOC (cont.) | | | | | | |
| Phenol | 108-95-2 | SW8270D | ug/kg | **520** | **630** | **410** |
| Pyrene | 129-00-0 | SW8270D | ug/kg | **450** | **420** | **450** |
| Total Benzofluoranthenes | TOTBFA | SW8270D | ug/kg | 420U | 380U | **380M** |
| PCB (Aroclors) | | | | | | |
| Aroclor 1016 | 12674-11-2 | SW8082A | ug/kg | 9.8U | 9.9U | NA |
| Aroclor 1221 | 11104-28-2 | SW8082A | ug/kg | 9.8U | 9.9U | NA |
| Aroclor 1232 | 11141-16-5 | SW8082A | ug/kg | 9.8U | 9.9U | NA |
| Aroclor 1242 | 53469-21-9 | SW8082A | ug/kg | 9.8U | 9.9U | NA |
| Aroclor 1248 | 12672-29-6 | SW8082A | ug/kg | 49Y | 99Y | NA |
| Aroclor 1254 | 11097-69-1 | SW8082A | ug/kg | 150Y | 150Y | NA |
| Aroclor 1260 | 11096-82-5 | SW8082A | ug/kg | **33** | **40** | NA |
| Pesticides | | | | | | |
| 4,4'-DDD | 72-54-8 | SW8081B | ug/kg | 17U | 17U | NA |
| 4,4'-DDE | 72-55-9 | SW8081B | ug/kg | 17U | 27Y | NA |
| 4,4'-DDT | 50-29-3 | SW8081B | ug/kg | 170Y | 100Y | NA |
| Aldrin | 309-00-2 | SW8081B | ug/kg | 8.3U | 8.3U | NA |
| alpha-BHC | 319-84-6 | SW8081B | ug/kg | 8.3U | 13Y | NA |
| beta-BHC | 319-85-7 | SW8081B | ug/kg | 22Y | 8.3U | NA |
| cis-Chlordane | 5103-71-9 | SW8081B | ug/kg | 40Y | 33Y | NA |
| delta-BHC | 319-86-8 | SW8081B | ug/kg | 180Y | 200Y | NA |
| Endosulfan I | 959-98-8 | SW8081B | ug/kg | 8.3U | 21Y | NA |
| Endosulfan II | 33213-65-9 | SW8081B | ug/kg | 17U | 17U | NA |
| Endosulfan Sulfate | 1031-07-8 | SW8081B | ug/kg | 140Y | 120Y | NA |
| Endrin | 72-20-8 | SW8081B | ug/kg | 17U | 17U | NA |
| Endrin Aldehyde | 7421-93-4 | SW8081B | ug/kg | 17U | 17U | NA |
| gamma-BHC (Lindane) | 58-89-9 | SW8081B | ug/kg | 8.3U | 8.3U | NA |
| Heptachlor | 76-44-8 | SW8081B | ug/kg | 8.3U | 8.3U | NA |
| Heptachlor Epoxide | 1024-57-3 | SW8081B | ug/kg | 340Y | 280Y | NA |
| Toxaphene | 8001-35-2 | SW8081B | ug/kg | 830U | 830U | NA |
| trans-Chlordane | 5103-74-2 | SW8081B | ug/kg | 1300Y | 1400Y | NA |
| Polychlorinated dibenzo-p-dioxin | | | | | | |
| 2,3,7,8-TCDD | 1746-01-6 | EPA 1613B | pg/g | 11.5U | 11.2U | NA |

Bold: Detected
NA: Not Analyzed
2,3,7,8-TCDD Est. Max Possible Concentration 2.76, 1.93 NP-Comp1, 2.
J: Est. (less than RL).
M: Est. (detected and confirmed but with low spectral match).
U: Not detected.
Y: Not detected at raised RL.

Table 3. Sludge Analytical Results - Newaukum Prairie Lagoon (Fire Mountain Farms)
Samples collected: 7/7/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | NP-Comp-1 | NP-Comp-2 | NP-Comp-3 |
|---|---|---|---|---|---|---|
| Inorganic Parameters | | | | | | |
| N-Nitrate | NITRATE | Calculated | mg-N/kg | 1.48U | NA | NA |
| N-Ammonia | AMMONIA | EPA 350.1M | mg-N/kg | **21,400** | NA | NA |
| Total Kjeldahl Nitrogen | KJELDAHL-N | EPA 351.2 | mg-N/kg | **71,400** | NA | NA |
| Nitrate + Nitrite (NO3+NO2) | NITRATE-NITRITE | EPA 353.2 | mg-N/kg | **4.01** | NA | NA |
| N-Nitrite | NITRITE | EPA 353.2 | mg-N/kg | **6.09** | NA | NA |
| Total Solids | TS104 | SM2540G | Percent | **6.43** | **6.51** | **6.69** |
| Total Cyanide | TOT CYANIDE | EPA 335.4 | mg/kg | **1.73** | **1.69** | **1.87** |
| pH | PH | SW9045 | std units | **7.38** | NA | NA |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).
U: Not detected at RL.
Y: Not detected at RL (raised RL).



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Table 4. Sludge Analytical Results - Big Hanaford Bunker (Fire Mountain Farms)
Samples collected: 7/8/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BH-Comp-1 | BH-Comp-2 | BH-Comp-3 |
|---|---|---|---|---|---|---|
| Volatile Organic Compounds (VOCs) | | | | | | |
| 1,1,1-Trichloroethane | 71-55-6 | 8260C | ug/kg | 780U | 800U | 860U |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 8260C | ug/kg | 780U | 800U | 860U |
| 1,1,2-Trichloroethane | 79-00-5 | 8260C | ug/kg | 780U | 800U | 860U |
| 1,1-Dichloroethane | 75-34-3 | 8260C | ug/kg | 780U | 800U | 860U |
| 1,1-Dichloroethene | 75-35-4 | 8260C | ug/kg | 780U | 800U | 860U |
| 1,2,4-Trichlorobenzene | 120-82-1 | 8260C | ug/kg | 3900U | 4000U | 4300U |
| 1,2-Dichlorobenzene | 95-50-1 | 8260C | ug/kg | 780U | 800U | 860U |
| 1,2-Dichloroethane | 107-06-2 | 8260C | ug/kg | 780U | 800U | 860U |
| 1,2-Dichloropropane | 78-87-5 | 8260C | ug/kg | 780U | 800U | 860U |
| 1,3-Dichlorobenzene | 541-73-1 | 8260C | ug/kg | 780U | 800U | 860U |
| 1,4-Dichlorobenzene | 106-46-7 | 8260C | ug/kg | **1,000** | **1,300** | **1,000** |
| 2-Chloroethylvinylether | 110-75-8 | 8260C | ug/kg | 3900U | 4000U | 4300U |
| Acrolein | 107-02-8 | 8260C | ug/kg | 39000U | 40000U | 43000U |
| Acrylonitrile | 107-13-1 | 8260C | ug/kg | 3900U | 4000U | 4300U |
| Benzene | 71-43-2 | 8260C | ug/kg | 780U | 800U | 860U |
| Bromodichloromethane | 75-27-4 | 8260C | ug/kg | 780U | 800U | 860U |
| Bromoform | 75-25-2 | 8260C | ug/kg | 780U | 800U | 860U |
| Bromomethane | 74-83-9 | 8260C | ug/kg | 780U | 800U | 860U |
| Carbon Tetrachloride | 56-23-5 | 8260C | ug/kg | 780U | 800U | 860U |
| Chlorobenzene | 108-90-7 | 8260C | ug/kg | 780U | 800U | 860U |
| Chloroethane | 75-00-3 | 8260C | ug/kg | 780U | 800U | 860U |
| Chloroform | 67-66-3 | 8260C | ug/kg | 780U | 800U | 860U |
| Chloromethane | 74-87-3 | 8260C | ug/kg | 780U | 800U | 860U |
| cis-1,3-Dichloropropene | 10061-01-5 | 8260C | ug/kg | 780U | 800U | 860U |
| Dibromochloromethane | 124-48-1 | 8260C | ug/kg | 780U | 800U | 860U |
| Ethylbenzene | 100-41-4 | 8260C | ug/kg | 780U | 800U | 860U |
| Hexachlorobutadiene | 87-68-3 | 8260C | ug/kg | 3900U | 4000U | 4300U |
| Methylene Chloride | 75-09-2 | 8260C | ug/kg | 1600U | 1600U | 1700U |
| Naphthalene | 91-20-3 | 8260C | ug/kg | 3900U | 4000U | 4300U |
| Tetrachloroethene | 127-18-4 | 8260C | ug/kg | 780U | 800U | 860U |
| Toluene | 108-88-3 | 8260C | ug/kg | **8,300** | **120,000** | **82,000** |
| trans-1,2-Dichloroethene | 156-60-5 | 8260C | ug/kg | 780U | 800U | 860U |
| trans-1,3-Dichloropropene | 10061-02-6 | 8260C | ug/kg | 780U | 800U | 860U |
| Trichloroethene | 79-01-6 | 8260C | ug/kg | 780U | 800U | 860U |
| Vinyl Chloride | 75-01-4 | 8260C | ug/kg | 780U | 800U | 860U |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).
U: Not detected at RL.
Y: Not detected at RL (raised RL).



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Table 4. Sludge Analytical Results - Big Hanaford Bunker (Fire Mountain Farms)
Samples collected: 7/8/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BH-Comp-1 | BH-Comp-2 | BH-Comp-3 |
|---|---|---|---|---|---|---|
| Metals | | | | | | |
| Antimony | 7440-36-0 | 6010C | mg/kg | 30U | 30U | 30U |
| Arsenic | 7440-38-2 | 6010C | mg/kg | 30U | 30U | 30U |
| Beryllium | 7440-41-7 | 6010C | mg/kg | 0.6U | 0.6U | 0.7U |
| Cadmium | 7440-43-9 | 6010C | mg/kg | **2** | **2** | **2** |
| Chromium | 7440-47-3 | 6010C | mg/kg | **25** | **29** | **28** |
| Cobalt | 7440-48-4 | 6010C | mg/kg | **15** | **64** | **165** |
| Copper | 7440-50-8 | 6010C | mg/kg | **473** | **485** | **521** |
| Lead | 7439-92-1 | 6010C | mg/kg | **30** | **20** | **20** |
| Molybdenum | 7439-98-7 | 6010C | mg/kg | **12** | **15** | **13** |
| Nickel | 7440-02-0 | 6010C | mg/kg | **27** | **38** | **42** |
| Selenium | 7782-49-2 | 6010C | mg/kg | 30U | 30U | 30U |
| Silver | 7440-22-4 | 6010C | mg/kg | **6** | **4** | **4** |
| Thallium | 7440-28-0 | 6010C | mg/kg | 30U | 30U | 30U |
| Zinc | 7440-66-6 | 6010C | mg/kg | **1,030** | **1,100** | **1,070** |
| Mercury | 7439-97-6 | 7471A | mg/kg | **1** | **1.2** | **3** |
| Semi-Volatile Organic Compounds (SVOCs) | | | | | | |
| 1,2,4-Trichlorobenzene | 120-82-1 | SW8270D | ug/kg | 580U | 600U | 720U |
| 1,2-Dichlorobenzene | 95-50-1 | SW8270D | ug/kg | 580U | 600U | 720U |
| 1,2-Diphenylhydrazine | 122-66-7 | SW8270D | ug/kg | 570U | 600U | 710U |
| 1,3-Dichlorobenzene | 541-73-1 | SW8270D | ug/kg | 580U | 600U | 720U |
| 1,4-Dichlorobenzene | 106-46-7 | SW8270D | ug/kg | **860** | **750** | 720U |
| 2,2'-Oxybis(1-Chloropropane) | 108-60-1 | SW8270D | ug/kg | 580U | 600U | 720U |
| 2,4,6-Trichlorophenol | 88-06-2 | SW8270D | ug/kg | 2800U | 3000U | 3500U |
| 2,4-Dichlorophenol | 120-83-2 | SW8270D | ug/kg | 2800U | 3000U | 3500U |
| 2,4-Dimethylphenol | 105-67-9 | SW8270D | ug/kg | 580U | 600U | 720U |
| 2,4-Dinitrophenol | 51-28-5 | SW8270D | ug/kg | 5800U | 6000U | 7200U |
| 2,4-Dinitrotoluene | 121-14-2 | SW8270D | ug/kg | 2800U | 3000U | 3500U |
| 2,6-Dinitrotoluene | 606-20-2 | SW8270D | ug/kg | 2800U | 3000U | 3500U |
| 2-Chloronaphthalene | 91-58-7 | SW8270D | ug/kg | 580U | 600U | 720U |
| 2-Chlorophenol | 95-57-8 | SW8270D | ug/kg | 580U | 600U | 720U |
| 2-Nitrophenol | 88-75-5 | SW8270D | ug/kg | 580U | 600U | 720U |
| 3,3'-Dichlorobenzidine | 91-94-1 | SW8270D | ug/kg | 2800U | 3000U | 3500U |
| 4,6-Dinitro-2-Methylphenol | 534-52-1 | SW8270D | ug/kg | 5800U | 6000U | 7200U |
| 4-Bromophenyl-phenylether | 101-55-3 | SW8270D | ug/kg | 580U | 600U | 720U |
| 4-Chlorophenyl-phenylether | 7005-72-3 | SW8270D | ug/kg | 580U | 600U | 720U |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).
U: Not detected at RL.
Y: Not detected at RL (raised RL).



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Table 4. Sludge Analytical Results - Big Hanaford Bunker (Fire Mountain Farms)
Samples collected: 7/8/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BH-Comp-1 | BH-Comp-2 | BH-Comp-3 |
|---|---|---|---|---|---|---|
| SVOC (cont.) | | | | | | |
| 4-Methylphenol | 106-44-5 | SW8270D | ug/kg | **480,000** | **720,000** | **540,000** |
| 4-Nitrophenol | 100-02-7 | SW8270D | ug/kg | 2800U | 3000U | 3500U |
| Acenaphthene | 83-32-9 | SW8270D | ug/kg | 580U | 600U | 720U |
| Acenaphthylene | 208-96-8 | SW8270D | ug/kg | 580U | 600U | 720U |
| Anthracene | 120-12-7 | SW8270D | ug/kg | 580U | 600U | 720U |
| Azobenzene | 103-33-3 | SW8270D | ug/kg | 580U | 600U | 720U |
| Benzo(a)anthracene | 56-55-3 | SW8270D | ug/kg | 580U | 600U | 720U |
| Benzo(a)pyrene | 50-32-8 | SW8270D | ug/kg | 580U | 600U | 720U |
| Benzo(b)fluoranthene | 205-99-2 | SW8270D | ug/kg | 570U | 600U | 710U |
| Benzo(g,h,i)perylene | 191-24-2 | SW8270D | ug/kg | 580U | 600U | 720U |
| Benzo(k)fluoranthene | 207-08-9 | SW8270D | ug/kg | 570U | 600U | 710U |
| bis(2-Chloroethoxy) Methane | 111-91-1 | SW8270D | ug/kg | 580U | 600U | 720U |
| Bis-(2-Chloroethyl) Ether | 111-44-4 | SW8270D | ug/kg | 580U | 600U | 720U |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | SW8270D | ug/kg | **25,000** | **25,000** | **24,000** |
| Butylbenzylphthalate | 85-68-7 | SW8270D | ug/kg | 580U | 600U | 720U |
| Chrysene | 218-01-9 | SW8270D | ug/kg | 580U | 600U | 720U |
| Dibenz(a,h)anthracene | 53-70-3 | SW8270D | ug/kg | 580U | 600U | 720U |
| Diethylphthalate | 84-66-2 | SW8270D | ug/kg | 580U | 600U | 720U |
| Dimethylphthalate | 131-11-3 | SW8270D | ug/kg | 580U | 600U | 720U |
| Di-n-Butylphthalate | 84-74-2 | SW8270D | ug/kg | 580U | 600U | 720U |
| Di-n-Octyl phthalate | 117-84-0 | SW8270D | ug/kg | 580U | 600U | 720U |
| Fluoranthene | 206-44-0 | SW8270D | ug/kg | **640** | 600U | 720U |
| Fluorene | 86-73-7 | SW8270D | ug/kg | 580U | 600U | 720U |
| Hexachlorobenzene | 118-74-1 | SW8270D | ug/kg | 580U | 600U | 720U |
| Hexachlorobutadiene | 87-68-3 | SW8270D | ug/kg | 580U | 600U | 720U |
| Hexachlorocyclopentadiene | 77-47-4 | SW8270D | ug/kg | 2800U | 3000U | 3500U |
| Hexachloroethane | 67-72-1 | SW8270D | ug/kg | 580U | 600U | 720U |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | SW8270D | ug/kg | 580U | 600U | 720U |
| Isophorone | 78-59-1 | SW8270D | ug/kg | 580U | 600U | 720U |
| Naphthalene | 91-20-3 | SW8270D | ug/kg | 580U | 600U | 720U |
| Nitrobenzene | 98-95-3 | SW8270D | ug/kg | 580U | 600U | 720U |
| N-Nitrosodimethylamine | 62-75-9 | SW8270D | ug/kg | 2800U | 3000U | 3500U |
| N-Nitroso-Di-N-Propylamine | 621-64-7 | SW8270D | ug/kg | 580U | 600U | 720U |
| N-Nitrosodiphenylamine | 86-30-6 | SW8270D | ug/kg | **1200M** | **1100M** | **1400M** |
| Pentachlorophenol | 87-86-5 | SW8270D | ug/kg | 2800U | 3000U | 3500U |
| Phenanthrene | 85-01-8 | SW8270D | ug/kg | 580U | 600U | 720U |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).
U: Not detected at RL.
Y: Not detected at RL (raised RL).



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Table 4. Sludge Analytical Results - Big Hanaford Bunker (Fire Mountain Farms)
Samples collected: 7/8/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BH-Comp-1 | BH-Comp-2 | BH-Comp-3 |
|---|---|---|---|---|---|---|
| SVOC (cont.) | | | | | | |
| Phenol | 108-95-2 | SW8270D | ug/kg | **14,000** | **23,000** | **16,000** |
| Pyrene | 129-00-0 | SW8270D | ug/kg | 580U | 600U | 720U |
| Total Benzofluoranthenes | TOTBFA | SW8270D | ug/kg | 580U | 600U | 720U |
| PCB (Aroclors) | | | | | | |
| Aroclor 1016 | 12674-11-2 | SW8082A | ug/kg | 9.9U | NA | NA |
| Aroclor 1221 | 11104-28-2 | SW8082A | ug/kg | 9.9U | NA | NA |
| Aroclor 1232 | 11141-16-5 | SW8082A | ug/kg | 9.9U | NA | NA |
| Aroclor 1242 | 53469-21-9 | SW8082A | ug/kg | 9.9U | NA | NA |
| Aroclor 1248 | 12672-29-6 | SW8082A | ug/kg | 99Y | NA | NA |
| Aroclor 1254 | 11097-69-1 | SW8082A | ug/kg | 150Y | NA | NA |
| Aroclor 1260 | 11096-82-5 | SW8082A | ug/kg | **35** | NA | NA |
| Pesticides | | | | | | |
| 4,4'-DDD | 72-54-8 | SW8081B | ug/kg | 17U | NA | NA |
| 4,4'-DDE | 72-55-9 | SW8081B | ug/kg | 17U | NA | NA |
| 4,4'-DDT | 50-29-3 | SW8081B | ug/kg | 120Y | NA | NA |
| Aldrin | 309-00-2 | SW8081B | ug/kg | 8.3U | NA | NA |
| alpha-BHC | 319-84-6 | SW8081B | ug/kg | 8.3U | NA | NA |
| beta-BHC | 319-85-7 | SW8081B | ug/kg | 8.3U | NA | NA |
| cis-Chlordane | 5103-71-9 | SW8081B | ug/kg | 34Y | NA | NA |
| delta-BHC | 319-86-8 | SW8081B | ug/kg | 180Y | NA | NA |
| Dieldrin | 60-57-1 | SW8081B | ug/kg | 39Y | NA | NA |
| Endosulfan I | 959-98-8 | SW8081B | ug/kg | 22Y | NA | NA |
| Endosulfan II | 33213-65-9 | SW8081B | ug/kg | 17U | NA | NA |
| Endosulfan Sulfate | 1031-07-8 | SW8081B | ug/kg | 17U | NA | NA |
| Endrin | 72-20-8 | SW8081B | ug/kg | 49Y | NA | NA |
| Endrin Aldehyde | 7421-93-4 | SW8081B | ug/kg | 77Y | NA | NA |
| gamma-BHC (Lindane) | 58-89-9 | SW8081B | ug/kg | 25Y | NA | NA |
| Heptachlor | 76-44-8 | SW8081B | ug/kg | 8.3U | NA | NA |
| Heptachlor Epoxide | 1024-57-3 | SW8081B | ug/kg | 690Y | NA | NA |
| Toxaphene | 8001-35-2 | SW8081B | ug/kg | 830U | NA | NA |
| trans-Chlordane | 5103-74-2 | SW8081B | ug/kg | 1200Y | NA | NA |
| Polychlorinated dibenzo-p-dioxin | | | | | | |
| 2,3,7,8-TCDD | 1746-01-6 | EPA 1613B | pg/g | 5.71U | NA | NA |

Bold: Detected
NA: Not Analyzed
2,3,7,8-TCDD Est. Max Possible Concentration 0.72 BH-Comp1
J: Est. (less than RL).
M: Est. (detected and confirmed but with low spectral match).
U: Not detected at RL.
Y: Not detected at RL (raised RL).

Table 4. Sludge Analytical Results - Big Hanaford Bunker (Fire Mountain Farms)
Samples collected: 7/8/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BH-Comp-1 | BH-Comp-2 | BH-Comp-3 |
|---|---|---|---|---|---|---|
| Inorganic Parameters | | | | | | |
| N-Nitrate | NITRATE | Calculated | mg-N/kg | 0.57U | NA | NA |
| N-Ammonia | AMMONIA | EPA 350.1M | mg-N/kg | **24,800** | NA | NA |
| Total Kjeldahl Nitrogen | KJELDAHL-N | EPA 351.2 | mg-N/kg | **76,800** | NA | NA |
| Nitrate + Nitrite (NO3+NO2) | ΓRATE-NITRITE | EPA 353.2 | mg-N/kg | **7.01** | NA | NA |
| N-Nitrite | NITRITE | EPA 353.2 | mg-N/kg | **7.86** | NA | NA |
| Total Solids | TS104 | SM2540G | Percent | **16.33** | **17.04** | **15.16** |
| Total Cyanide | TOT CYANIDE | EPA 335.4 | mg/kg | **1.60** | **2.39** | **1.77** |
| pH | PH | SW9045 | std units | **7.91** | NA | NA |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).
U: Not detected at RL.
Y: Not detected at RL (raised RL).



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Table 5. Sludge Analytical Results - Burnt Ridge Lagoon (Fire Mountain Farms)
Samples collected: 7/9/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BR-Comp-1 | BR-Comp-2 | BR-Comp-3 |
|---|---|---|---|---|---|---|
| Volatile Organic Compounds (VOCs) | | | | | | |
| 1,1,1-Trichloroethane | 71-55-6 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| 1,1,2-Trichloroethane | 79-00-5 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| 1,1-Dichloroethane | 75-34-3 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| 1,1-Dichloroethene | 75-35-4 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| 1,2,4-Trichlorobenzene | 120-82-1 | 8260C | ug/kg | 12U | 10U | 9U |
| 1,2-Dichlorobenzene | 95-50-1 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| 1,2-Dichloroethane | 107-06-2 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| 1,2-Dichloropropane | 78-87-5 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| 1,3-Dichlorobenzene | 541-73-1 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| 1,4-Dichlorobenzene | 106-46-7 | 8260C | ug/kg | **48** | **26** | **32** |
| 2-Chloroethylvinylether | 110-75-8 | 8260C | ug/kg | 12U | 10U | 9U |
| Acrolein | 107-02-8 | 8260C | ug/kg | 120U | 100U | 90U |
| Acrylonitrile | 107-13-1 | 8260C | ug/kg | 12U | 10U | 9U |
| Benzene | 71-43-2 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Bromodichloromethane | 75-27-4 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Bromoform | 75-25-2 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Bromomethane | 74-83-9 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Carbon Tetrachloride | 56-23-5 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Chlorobenzene | 108-90-7 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Chloroethane | 75-00-3 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Chloroform | 67-66-3 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Chloromethane | 74-87-3 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| cis-1,3-Dichloropropene | 10061-01-5 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Dibromochloromethane | 124-48-1 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Ethylbenzene | 100-41-4 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Hexachlorobutadiene | 87-68-3 | 8260C | ug/kg | 12U | 10U | 9U |
| Methylene Chloride | 75-09-2 | 8260C | ug/kg | 4.6U | 4U | 3.6U |
| Naphthalene | 91-20-3 | 8260C | ug/kg | 12U | 10U | 9U |
| Tetrachloroethene | 127-18-4 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Toluene | 108-88-3 | 8260C | ug/kg | **20** | **35** | **19** |
| trans-1,2-Dichloroethene | 156-60-5 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| trans-1,3-Dichloropropene | 10061-02-6 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Trichloroethene | 79-01-6 | 8260C | ug/kg | 2.3U | 2U | 1.8U |
| Vinyl Chloride | 75-01-4 | 8260C | ug/kg | 2.3U | 2U | 1.8U |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).

Table 5. Sludge Analytical Results - Burnt Ridge Lagoon (Fire Mountain Farms)
Samples collected: 7/9/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BR-Comp-1 | BR-Comp-2 | BR-Comp-3 |
|---|---|---|---|---|---|---|
| Metals | | | | | | |
| Antimony | 7440-36-0 | 6010C | mg/kg | 40U | 30U | 30U |
| Arsenic | 7440-38-2 | 6010C | mg/kg | 40U | 30U | 30U |
| Beryllium | 7440-41-7 | 6010C | mg/kg | 0.7U | 0.7U | 0.6U |
| Cadmium | 7440-43-9 | 6010C | mg/kg | **3** | **3** | **3** |
| Chromium | 7440-47-3 | 6010C | mg/kg | **31** | **45** | **35** |
| Cobalt | 7440-48-4 | 6010C | mg/kg | **43** | **48** | **37** |
| Copper | 7440-50-8 | 6010C | mg/kg | **379** | **417** | **358** |
| Lead | 7439-92-1 | 6010C | mg/kg | **40** | **30** | **30** |
| Molybdenum | 7439-98-7 | 6010C | mg/kg | **14** | **16** | **16** |
| Nickel | 7440-02-0 | 6010C | mg/kg | **28** | **45** | **31** |
| Selenium | 7782-49-2 | 6010C | mg/kg | 40U | 30U | 30U |
| Silver | 7440-22-4 | 6010C | mg/kg | **5** | **5** | **6** |
| Thallium | 7440-28-0 | 6010C | mg/kg | 40U | 30U | 30U |
| Zinc | 7440-66-6 | 6010C | mg/kg | **886** | **969** | **876** |
| Mercury | 7439-97-6 | 7471A | mg/kg | **1** | **1.9** | **1.8** |
| Semi-Volatile Organic Compounds (SVOCs) | | | | | | |
| 1,2,4-Trichlorobenzene | 120-82-1 | SW8270D | ug/kg | 260U | 310U | 260U |
| 1,2-Dichlorobenzene | 95-50-1 | SW8270D | ug/kg | 260U | 310U | 260U |
| 1,2-Diphenylhydrazine | 122-66-7 | SW8270D | ug/kg | 260U | 310U | 260U |
| 1,3-Dichlorobenzene | 541-73-1 | SW8270D | ug/kg | 260U | 310U | 260U |
| 1,4-Dichlorobenzene | 106-46-7 | SW8270D | ug/kg | **480** | **540** | 260U |
| 2,2'-Oxybis(1-Chloropropane) | 108-60-1 | SW8270D | ug/kg | 260U | 310U | 260U |
| 2,4,6-Trichlorophenol | 88-06-2 | SW8270D | ug/kg | 1300U | 1500U | 1300U |
| 2,4-Dichlorophenol | 120-83-2 | SW8270D | ug/kg | 1300U | 1500U | 1300U |
| 2,4-Dimethylphenol | 105-67-9 | SW8270D | ug/kg | 260U | 310U | 260U |
| 2,4-Dinitrophenol | 51-28-5 | SW8270D | ug/kg | 2600U | 3100U | 2600U |
| 2,4-Dinitrotoluene | 121-14-2 | SW8270D | ug/kg | 1300U | 1500U | 1300U |
| 2,6-Dinitrotoluene | 606-20-2 | SW8270D | ug/kg | 1300U | 1500U | 1300U |
| 2-Chloronaphthalene | 91-58-7 | SW8270D | ug/kg | 260U | 310U | 260U |
| 2-Chlorophenol | 95-57-8 | SW8270D | ug/kg | 260U | 310U | 260U |
| 2-Nitrophenol | 88-75-5 | SW8270D | ug/kg | 260U | 310U | 260U |
| 3,3'-Dichlorobenzidine | 91-94-1 | SW8270D | ug/kg | 1300U | 1500U | 1300U |
| 4,6-Dinitro-2-Methylphenol | 534-52-1 | SW8270D | ug/kg | 2600U | 3100U | 2600U |
| 4-Bromophenyl-phenylether | 101-55-3 | SW8270D | ug/kg | 260U | 310U | 260U |
| 4-Chlorophenyl-phenylether | 7005-72-3 | SW8270D | ug/kg | 260U | 310U | 260U |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).



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Table 5. Sludge Analytical Results - Burnt Ridge Lagoon (Fire Mountain Farms)
Samples collected: 7/9/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BR-Comp-1 | BR-Comp-2 | BR-Comp-3 |
|---|---|---|---|---|---|---|
| SVOC (cont.) | | | | | | |
| 4-Methylphenol | 106-44-5 | SW8270D | ug/kg | **1,100** | **450** | **460** |
| 4-Nitrophenol | 100-02-7 | SW8270D | ug/kg | 1300U | 1500U | 1300U |
| Acenaphthene | 83-32-9 | SW8270D | ug/kg | 260U | 310U | 260U |
| Acenaphthylene | 208-96-8 | SW8270D | ug/kg | 260U | 310U | 260U |
| Anthracene | 120-12-7 | SW8270D | ug/kg | 260U | 310U | 260U |
| Azobenzene | 103-33-3 | SW8270D | ug/kg | 260U | 310U | 260U |
| Benzo(a)anthracene | 56-55-3 | SW8270D | ug/kg | 260U | 310U | 260U |
| Benzo(a)pyrene | 50-32-8 | SW8270D | ug/kg | 260U | 310U | 260U |
| Benzo(b)fluoranthene | 205-99-2 | SW8270D | ug/kg | **330M** | 310U | **380M** |
| Benzo(g,h,i)perylene | 191-24-2 | SW8270D | ug/kg | 260U | 310U | 260U |
| Benzo(k)fluoranthene | 207-08-9 | SW8270D | ug/kg | **330M** | 310U | **360M** |
| bis(2-Chloroethoxy) Methane | 111-91-1 | SW8270D | ug/kg | 260U | 310U | 260U |
| Bis-(2-Chloroethyl) Ether | 111-44-4 | SW8270D | ug/kg | 260U | 310U | 260U |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | SW8270D | ug/kg | **10,000** | **12,000** | **9,100** |
| Butylbenzylphthalate | 85-68-7 | SW8270D | ug/kg | 260U | 310U | 260U |
| Chrysene | 218-01-9 | SW8270D | ug/kg | 260U | 310U | 260U |
| Dibenz(a,h)anthracene | 53-70-3 | SW8270D | ug/kg | 260U | 310U | 260U |
| Diethylphthalate | 84-66-2 | SW8270D | ug/kg | 260U | 310U | 260U |
| Dimethylphthalate | 131-11-3 | SW8270D | ug/kg | 260U | 310U | 260U |
| Di-n-Butylphthalate | 84-74-2 | SW8270D | ug/kg | 260U | 310U | 260U |
| Di-n-Octyl phthalate | 117-84-0 | SW8270D | ug/kg | 260U | 310U | 260U |
| Fluoranthene | 206-44-0 | SW8270D | ug/kg | **360** | **390** | **450** |
| Fluorene | 86-73-7 | SW8270D | ug/kg | 260U | 310U | 260U |
| Hexachlorobenzene | 118-74-1 | SW8270D | ug/kg | 260U | 310U | 260U |
| Hexachlorobutadiene | 87-68-3 | SW8270D | ug/kg | 260U | 310U | 260U |
| Hexachlorocyclopentadiene | 77-47-4 | SW8270D | ug/kg | 1300U | 1500U | 1300U |
| Hexachloroethane | 67-72-1 | SW8270D | ug/kg | 260U | 310U | 260U |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | SW8270D | ug/kg | 260U | 310U | **400** |
| Isophorone | 78-59-1 | SW8270D | ug/kg | 260U | 310U | 260U |
| Naphthalene | 91-20-3 | SW8270D | ug/kg | 260U | 310U | 260U |
| Nitrobenzene | 98-95-3 | SW8270D | ug/kg | 260U | 310U | 260U |
| N-Nitrosodimethylamine | 62-75-9 | SW8270D | ug/kg | 1300U | 1500U | 1300U |
| N-Nitroso-Di-N-Propylamine | 621-64-7 | SW8270D | ug/kg | 260U | 310U | 260U |
| N-Nitrosodiphenylamine | 86-30-6 | SW8270D | ug/kg | 260U | 310U | 260U |
| Pentachlorophenol | 87-86-5 | SW8270D | ug/kg | 1300U | 1500U | 1300U |
| Phenanthrene | 85-01-8 | SW8270D | ug/kg | 260U | 310U | 260U |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).



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Table 5. Sludge Analytical Results - Burnt Ridge Lagoon (Fire Mountain Farms)
Samples collected: 7/9/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BR-Comp-1 | BR-Comp-2 | BR-Comp-3 |
|---|---|---|---|---|---|---|
| SVOC (cont.) | | | | | | |
| Phenol | 108-95-2 | SW8270D | ug/kg | 260U | 310U | 260U |
| Pyrene | 129-00-0 | SW8270D | ug/kg | **390** | **310** | **270** |
| Total Benzofluoranthenes | TOTBFA | SW8270D | ug/kg | **350M** | 310U | **400M** |
| PCB (Aroclors) | | | | | | |
| Aroclor 1016 | 12674-11-2 | SW8082A | ug/kg | 9.8U | NA | NA |
| Aroclor 1221 | 11104-28-2 | SW8082A | ug/kg | 9.8U | NA | NA |
| Aroclor 1232 | 11141-16-5 | SW8082A | ug/kg | 9.8U | NA | NA |
| Aroclor 1242 | 53469-21-9 | SW8082A | ug/kg | 9.8U | NA | NA |
| Aroclor 1248 | 12672-29-6 | SW8082A | ug/kg | 98Y | NA | NA |
| Aroclor 1254 | 11097-69-1 | SW8082A | ug/kg | 150Y | NA | NA |
| Aroclor 1260 | 11096-82-5 | SW8082A | ug/kg | **61** | NA | NA |
| Pesticides | | | | | | |
| 4,4'-DDD | 72-54-8 | SW8081B | ug/kg | 16U | NA | NA |
| 4,4'-DDE | 72-55-9 | SW8081B | ug/kg | 16U | NA | NA |
| 4,4'-DDT | 50-29-3 | SW8081B | ug/kg | 16U | NA | NA |
| Aldrin | 309-00-2 | SW8081B | ug/kg | 8.2U | NA | NA |
| alpha-BHC | 319-84-6 | SW8081B | ug/kg | 8.2U | NA | NA |
| beta-BHC | 319-85-7 | SW8081B | ug/kg | 8.2U | NA | NA |
| cis-Chlordane | 5103-71-9 | SW8081B | ug/kg | 19Y | NA | NA |
| delta-BHC | 319-86-8 | SW8081B | ug/kg | 110Y | NA | NA |
| Dieldrin | 60-57-1 | SW8081B | ug/kg | 57Y | NA | NA |
| Endosulfan I | 959-98-8 | SW8081B | ug/kg | 14Y | NA | NA |
| Endosulfan II | 33213-65-9 | SW8081B | ug/kg | 16U | NA | NA |
| Endosulfan Sulfate | 1031-07-8 | SW8081B | ug/kg | 72Y | NA | NA |
| Endrin | 72-20-8 | SW8081B | ug/kg | 25Y | NA | NA |
| Endrin Aldehyde | 7421-93-4 | SW8081B | ug/kg | 16U | NA | NA |
| gamma-BHC (Lindane) | 58-89-9 | SW8081B | ug/kg | 8.2U | NA | NA |
| Heptachlor | 76-44-8 | SW8081B | ug/kg | 8.2U | NA | NA |
| Heptachlor Epoxide | 1024-57-3 | SW8081B | ug/kg | 8.2U | NA | NA |
| Toxaphene | 8001-35-2 | SW8081B | ug/kg | 820U | NA | NA |
| trans-Chlordane | 5103-74-2 | SW8081B | ug/kg | 1100Y | NA | NA |
| Polychlorinated dibenzo-p-dioxin | | | | | | |
| 2,3,7,8-TCDD | 1746-01-6 | EPA 1613B | pg/g | **2.35JEMPC** | NA | NA |

Bold: Detected
NA: Not Analyzed
2,3,7,8-TCDD Est. Max Possible Concentration 2.35 BR-Comp1.
J: Est. (less than RL).
M: Est. (detected and confirmed but with low spectral match).



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Table 5. Sludge Analytical Results - Burnt Ridge Lagoon (Fire Mountain Farms)
Samples collected: 7/9/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | BR-Comp-1 | BR-Comp-2 | BR-Comp-3 |
|---|---|---|---|---|---|---|
| Inorganic Parameters | | | | | | |
| N-Nitrate | NITRATE | Calculated | mg-N/kg | 0.6U | NA | NA |
| N-Ammonia | AMMONIA | EPA 350.1M | mg-N/kg | **7,600** | NA | NA |
| Total Kjeldahl Nitrogen | KJELDAHL-N | EPA 351.2 | mg-N/kg | **33,700** | NA | NA |
| Nitrate + Nitrite (NO3+NO2) | NITRATE-NITRITE | EPA 353.2 | mg-N/kg | **0.60** | NA | NA |
| N-Nitrite | NITRITE | EPA 353.2 | mg-N/kg | **0.72** | NA | NA |
| Total Solids | TS104 | SM2540G | Percent | **15.06** | **13.40** | **15.91** |
| Total Cyanide | TOT CYANIDE | EPA 335.4 | mg/kg | **1.05** | **1.42** | **1.08** |
| pH | PH | SW9045 | std units | **7.43** | NA | NA |

Bold: Detected Value
NA: Not Analyzed
EMPC: Est. Max Possible Concentration.
J: Est. value (less than RL).
M: Est. value (detected and confirmed but with low spectral match).



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Table 6. Total Fecal Coliform Analytical Results (Fire Mountain Farms)

| Sample Location and ID | MPN per 100 grams (wet weight) | MPN per grams (wet weight) | Total Solids (Percent)* | MPN per grams (dry weight) | Geometric Mean MPN per grams (dry weight) |
|---|---|---|---|---|---|
| Newaukum Prairie | | | | | |
| NP-A3-1-7 | 49,000 | 490 | 6.54 | 7,489 | 3,056 |
| NP-A2-1-7 | 17,000 | 170 | 6.54 | 2,598 | |
| NP-A1-1-2 | 3,300 | 33 | 6.54 | 504 | |
| NP-B1-1-10 | 49,000 | 490 | 6.54 | 7,489 | |
| NP-B2-1-7 | 79,000 | 790 | 6.54 | 12,073 | |
| NP-B3-1-3 | 17,000 | 170 | 6.54 | 2,598 | |
| NP-C3-1-6 | 92,000 | 920 | 6.54 | 14,060 | |
| NP-C1-1-7 | 8,400 | 84 | 6.54 | 1,284 | |
| NP-C2-1-5 | 7,000 | 70 | 6.54 | 1,070 | |
| NP-C1-2-6 | 18,000 | 180 | 6.54 | 2,751 | |
| NP-C3-2-7 | 7,900 | 79 | 6.54 | 1,207 | |
| NP-B1-2-4 | 49,000 | 490 | 6.54 | 7,489 | |
| NP-B2-2-6 | 49,000 | 490 | 6.54 | 7,489 | |
| NP-B3-2-2 | 4,900 | 49 | 6.54 | 749 | |
| Big Hanaford | | | | | |
| BH-A4-1-3.5 | 7,900 | 79 | 16.18 | 488 | 145 |
| BH-A7-1-1 | 330 | 3 | 16.18 | 20 | |
| BH-C2-1-8 | 23,000 | 230 | 16.18 | 1,422 | |
| BH-A5-2-4 | 2,300 | 23 | 16.18 | 142 | |
| BH-A6-3-4.5 | 78 | 1 | 16.18 | 5 | |
| BH-B8-3-6 | 110,000 | 1,100 | 16.18 | 6,800 | |
| BH-C8-1-4 | 330 | 3 | 16.18 | 20 | |
| Burnt Ridge | | | | | |
| BR-A1-1-1 | 330 | 3 | 14.79 | 22 | 44 |
| BR-A2-1-3 | 330 | 3 | 14.79 | 22 | |
| BR-A3-1-1 | 490 | 5 | 14.79 | 33 | |
| BR-B1-1-3 | 2,300 | 23 | 14.79 | 156 | |
| BR-B2-1-3 | 1,300 | 13 | 14.79 | 88 | |
| BR-B3-1-3 | 230 | 2 | 14.79 | 16 | |
| BR-C1-1-3 | 1,300 | 13 | 14.79 | 88 | |

MPN: Most Probable Number
Samples analyzed using method 9221E
*Total Solids: avg. value from composited samples at each location

Table 7. Water Cap Analytical Results - Burnt Ridge Lagoon (Fire Mountain Farms)
Samples collected: 7/17/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | GRAB BR-I-9 | GRAB BR-II-8 | GRAB BR-III-8 | GRAB BR-IV-8.5 | COMP BR-Comp |
|---|---|---|---|---|---|---|---|---|
| Volatile Organic Compounds (VOCs) | | | | | | | | |
| 1,1,1-Trichloroethane | 71-55-6 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| 1,1,2-Trichloroethane | 79-00-5 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| 1,1-Dichloroethane | 75-34-3 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| 1,1-Dichloroethene | 75-35-4 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| 1,2,4-Trichlorobenzene | 120-82-1 | 8260C | ug/L | 2.5U | 2.5U | 2.5U | 2.5U | NA |
| 1,2-Dichlorobenzene | 95-50-1 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| 1,2-Dichloroethane | 107-06-2 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| 1,2-Dichloropropane | 78-87-5 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| 1,3-Dichlorobenzene | 541-73-1 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| 1,4-Dichlorobenzene | 106-46-7 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| 2-Chloroethylvinylether | 110-75-8 | 8260C | ug/L | 5U | 5U | 5U | 5U | NA |
| Acrolein | 107-02-8 | 8260C | ug/L | 25U | 25U | 25U | 25U | NA |
| Acrylonitrile | 107-13-1 | 8260C | ug/L | 5U | 5U | 5U | 5U | NA |
| Benzene | 71-43-2 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Bromodichloromethane | 75-27-4 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Bromoform | 75-25-2 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Bromomethane | 74-83-9 | 8260C | ug/L | 5U | 5U | 5U | 5U | NA |
| Carbon Tetrachloride | 56-23-5 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Chlorobenzene | 108-90-7 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Chloroethane | 75-00-3 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Chloroform | 67-66-3 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Chloromethane | 74-87-3 | 8260C | ug/L | 2.5U | 2.5U | 2.5U | 2.5U | NA |
| cis-1,3-Dichloropropene | 10061-01-5 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Dibromochloromethane | 124-48-1 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Ethylbenzene | 100-41-4 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Hexachlorobutadiene | 87-68-3 | 8260C | ug/L | 2.5U | 2.5U | 2.5U | 2.5U | NA |
| Methylene Chloride | 75-09-2 | 8260C | ug/L | 5U | 5U | 5U | 5U | NA |
| Naphthalene | 91-20-3 | 8260C | ug/L | 2.5U | 2.5U | 2.5U | 2.5U | NA |
| Tetrachloroethene | 127-18-4 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Toluene | 108-88-3 | 8260C | ug/L | **35** | **31** | **41** | **26** | NA |
| trans-1,2-Dichloroethene | 156-60-5 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| trans-1,3-Dichloropropene | 10061-02-6 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Trichloroethene | 79-01-6 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |
| Vinyl Chloride | 75-01-4 | 8260C | ug/L | 1U | 1U | 1U | 1U | NA |

Bold: Detected Value
NA: Not Analyzed
U: Not detected at RL.
GRAB: Discrete grab samples
COMP: Composited grab samples



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Table 7. Water Cap Analytical Results - Burnt Ridge Lagoon (Fire Mountain Farms)
Samples collected: 7/17/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | GRAB BR-I-9 | GRAB BR-II-8 | GRAB BR-III-8 | GRAB BR-IV-8.5 | COMP BR-Comp |
|---|---|---|---|---|---|---|---|---|
| Metals | | | | | | | | |
| Antimony, Total | 7440-36-0 | SW6010C | mg/L | NA | NA | NA | NA | 0.05U |
| Arsenic, Total | 7440-38-2 | SW6010C | mg/L | NA | NA | NA | NA | 0.05U |
| Beryllium, Total | 7440-41-7 | SW6010C | mg/L | NA | NA | NA | NA | 0.001U |
| Cadmium, Total | 7440-43-9 | SW6010C | mg/L | NA | NA | NA | NA | 0.002U |
| Chromium, Total | 7440-47-3 | SW6010C | mg/L | NA | NA | NA | NA | **0.012** |
| Cobalt, Total | 7440-48-4 | SW6010C | mg/L | NA | NA | NA | NA | **0.017** |
| Copper, Total | 7440-50-8 | SW6010C | mg/L | NA | NA | NA | NA | **0.057** |
| Lead, Total | 7439-92-1 | SW6010C | mg/L | NA | NA | NA | NA | 0.02U |
| Molybdenum, Total | 7439-98-7 | SW6010C | mg/L | NA | NA | NA | NA | **0.006** |
| Nickel, Total | 7440-02-0 | SW6010C | mg/L | NA | NA | NA | NA | **0.02** |
| Selenium, Total | 7782-49-2 | SW6010C | mg/L | NA | NA | NA | NA | 0.05U |
| Silver, Total | 7440-22-4 | SW6010C | mg/L | NA | NA | NA | NA | 0.003U |
| Thallium, Total | 7440-28-0 | SW6010C | mg/L | NA | NA | NA | NA | 0.05U |
| Zinc, Total | 7440-66-6 | SW6010C | mg/L | NA | NA | NA | NA | **0.18** |
| Mercury, Total | 7439-97-6 | SW7470A | mg/L | NA | NA | NA | NA | **0.0003** |
| Semi-Volatile Organic Compounds (SVOCs) | | | | | | | | |
| 1,2,4-Trichlorobenzene | 120-82-1 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| 1,2-Dichlorobenzene | 95-50-1 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| 1,2-Diphenylhydrazine | 122-66-7 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| 1,3-Dichlorobenzene | 541-73-1 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| 1,4-Dichlorobenzene | 106-46-7 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| 2,2'-Oxybis(1-Chloropropane) | 108-60-1 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| 2,4,6-Trichlorophenol | 88-06-2 | SW8270D | ug/L | NA | NA | NA | NA | 3U |
| 2,4-Dichlorophenol | 120-83-2 | SW8270D | ug/L | NA | NA | NA | NA | 3U |
| 2,4-Dimethylphenol | 105-67-9 | SW8270D | ug/L | NA | NA | NA | NA | 3U |
| 2,4-Dinitrophenol | 51-28-5 | SW8270D | ug/L | NA | NA | NA | NA | 20U |
| 2,4-Dinitrotoluene | 121-14-2 | SW8270D | ug/L | NA | NA | NA | NA | 3U |
| 2,6-Dinitrotoluene | 606-20-2 | SW8270D | ug/L | NA | NA | NA | NA | 3U |
| 2-Chloronaphthalene | 91-58-7 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| 2-Chlorophenol | 95-57-8 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| 2-Nitrophenol | 88-75-5 | SW8270D | ug/L | NA | NA | NA | NA | 3U |
| 3,3'-Dichlorobenzidine | 91-94-1 | SW8270D | ug/L | NA | NA | NA | NA | 5U |
| 4,6-Dinitro-2-Methylphenol | 534-52-1 | SW8270D | ug/L | NA | NA | NA | NA | 10U |
| 4-Bromophenyl-phenylether | 101-55-3 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| 4-Chlorophenyl-phenylether | 7005-72-3 | SW8270D | ug/L | NA | NA | NA | NA | 1U |

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Table 7. Water Cap Analytical Results - Burnt Ridge Lagoon (Fire Mountain Farms)
Samples collected: 7/17/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | GRAB BR-I-9 | GRAB BR-II-8 | GRAB BR-III-8 | GRAB BR-IV-8.5 | COMP BR-Comp |
|---|---|---|---|---|---|---|---|---|
| SVOC (cont.) | | | | | | | | |
| 4-Methylphenol | 106-44-5 | SW8270D | ug/L | NA | NA | NA | NA | 2U |
| 4-Nitrophenol | 100-02-7 | SW8270D | ug/L | NA | NA | NA | NA | 10U |
| Acenaphthene | 83-32-9 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Acenaphthylene | 208-96-8 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Anthracene | 120-12-7 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Azobenzene | 103-33-3 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Benzo(a)anthracene | 56-55-3 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Benzo(a)pyrene | 50-32-8 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Benzo(b)fluoranthene | 205-99-2 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Benzo(g,h,i)perylene | 191-24-2 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Benzo(k)fluoranthene | 207-08-9 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| bis(2-Chloroethoxy) Methane | 111-91-1 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Bis-(2-Chloroethyl) Ether | 111-44-4 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | SW8270D | ug/L | NA | NA | NA | NA | 3U |
| Butylbenzylphthalate | 85-68-7 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Chrysene | 218-01-9 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Dibenz(a,h)anthracene | 53-70-3 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Diethylphthalate | 84-66-2 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Dimethylphthalate | 131-11-3 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Di-n-Butylphthalate | 84-74-2 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Di-n-Octyl phthalate | 117-84-0 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Fluoranthene | 206-44-0 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Fluorene | 86-73-7 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Hexachlorobenzene | 118-74-1 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Hexachlorobutadiene | 87-68-3 | SW8270D | ug/L | NA | NA | NA | NA | 3U |
| Hexachlorocyclopentadiene | 77-47-4 | SW8270D | ug/L | NA | NA | NA | NA | 5U |
| Hexachloroethane | 67-72-1 | SW8270D | ug/L | NA | NA | NA | NA | 2U |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Isophorone | 78-59-1 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Naphthalene | 91-20-3 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Nitrobenzene | 98-95-3 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| N-Nitrosodimethylamine | 62-75-9 | SW8270D | ug/L | NA | NA | NA | NA | 3U |
| N-Nitroso-Di-N-Propylamine | 621-64-7 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| N-Nitrosodiphenylamine | 86-30-6 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Pentachlorophenol | 87-86-5 | SW8270D | ug/L | NA | NA | NA | NA | 10U |
| Phenanthrene | 85-01-8 | SW8270D | ug/L | NA | NA | NA | NA | 1U |

Bold: Detected Value
NA: Not Analyzed
U: Not detected at RL.
GRAB: Discrete grab samples
COMP: Composited grab samples



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Table 7. Water Cap Analytical Results - Burnt Ridge Lagoon (Fire Mountain Farms)
Samples collected: 7/17/14

| PARAMETERS | CAS ID | ANALYSIS METHOD | UNITS | GRAB BR-I-9 | GRAB BR-II-8 | GRAB BR-III-8 | GRAB BR-IV-8.5 | COMP BR-Comp |
|---|---|---|---|---|---|---|---|---|
| SVOC (cont.) | | | | | | | | |
| Phenol | 108-95-2 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Pyrene | 129-00-0 | SW8270D | ug/L | NA | NA | NA | NA | 1U |
| Total Benzofluoranthenes | TOTBFA | SW8270D | ug/L | NA | NA | NA | NA | 2U |
| Inorganic Parameters | | | | | | | | |
| N-Nitrate | NITRATE | Calculated | mg-N/L | NA | NA | NA | NA | 0.01U |
| Nitrate + Nitrite | NITRATE-NITRITE | EPA 353.2 | mg-N/L | NA | NA | NA | NA | **0.014** |
| N-Nitrite | NITRITE | EPA 353.2 | mg-N/L | NA | NA | NA | NA | **0.051** |
| Total Cyanide | TOT CYANIDE | EPA 335.4 | mg/L | NA | NA | NA | NA | 0.005U |

Bold: Detected Value
NA: Not Analyzed
U: Not detected at RL.
GRAB: Discrete grab samples
COMP: Composited grab samples



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Table 8. Newaukum Prairie Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| Volatile Organic Compounds (VOCs) | | | | | |
| 1,1,1-Trichloroethane | ug/kg | 3.2 | 3.20E-07 | D | HOC |
| 1,1,2,2-Tetrachloroethane | ug/kg | 3.2 | 3.20E-07 | C | HOC |
| 1,1,2-Trichloroethane | ug/kg | 3.2 | 3.20E-07 | D | HOC |
| 1,1-Dichloroethane | ug/kg | 3.2 | 3.20E-07 | D | HOC |
| 1,1-Dichloroethene | ug/kg | 3.2 | 3.20E-07 | C | HOC |
| 1,2,4-Trichlorobenzene | ug/kg | 16 | 1.60E-06 | C | HOC |
| 1,2-Dichlorobenzene | ug/kg | 3.2 | 3.20E-07 | C | HOC |
| 1,2-Dichloroethane | ug/kg | 3.2 | 3.20E-07 | D | HOC |
| 1,2-Dichloropropane | ug/kg | 3.2 | 3.20E-07 | C | HOC |
| 1,3-Dichlorobenzene | ug/kg | 3.2 | 3.20E-07 | C | HOC |
| 1,4-Dichlorobenzene | ug/kg | See Semi-VOCs | | | |
| 2-Chloroethylvinylether | ug/kg | 16 | 1.60E-06 | C | HOC |
| Acrolein | ug/kg | 160 | 1.60E-05 | A | C-H |
| Acrylonitrile | ug/kg | 16 | 1.60E-06 | C | C-H |
| Benzene | ug/kg | 3.2 | 3.20E-07 | D | C-H |
| Bromodichloromethane | ug/kg | 3.2 | 3.20E-07 | D | HOC |
| Bromoform | ug/kg | 3.2 | 3.20E-07 | C | C-H |
| Bromomethane | ug/kg | 3.2 | 3.20E-07 | B | HOC |
| Carbon Tetrachloride | ug/kg | 3.2 | 3.20E-07 | C | HOC |
| Chlorobenzene | ug/kg | 3.2 | 3.20E-07 | C | HOC |
| Chloroethane | ug/kg | 3.2 | 3.20E-07 | No Data | HOC |
| Chloroform | ug/kg | 3.2 | 3.20E-07 | C | HOC |
| Chloromethane | ug/kg | 3.2 | 3.20E-07 | C | HOC |
| cis-1,3-Dichloropropene | ug/kg | 3.2 | 3.20E-07 | No Data | HOC |
| Dibromochloromethane | ug/kg | 3.2 | 3.20E-07 | D | HOC |
| Ethylbenzene | ug/kg | 4.6 | 4.60E-07 | C | C-H |
| Hexachlorobutadiene | ug/kg | 16 | 1.60E-06 | A | HOC |
| Methylene Chloride | ug/kg | 6.5 | 6.50E-07 | D | HOC |
| Naphthalene | ug/kg | 16 | 1.60E-06 | C | C-H |
| Tetrachloroethene | ug/kg | 3.2 | 3.20E-07 | C | HOC |
| Toluene | ug/kg | 150,000 | 1.50E-02 | A | C-H |
| trans-1,2-Dichloroethene | ug/kg | 3.2 | 3.20E-07 | D | HOC |
| trans-1,3-Dichloropropene | ug/kg | 3.2 | 3.20E-07 | No Data | HOC |
| Trichloroethene | ug/kg | 3.2 | 3.20E-07 | D | HOC |
| Vinyl Chloride | ug/kg | 3.2 | 3.20E-07 | D | HOC |

Note1:
Toxicity Categories based on toxicity data
from HSDB or ECOTOX online databases [WAC 173-303-100(5)(b)(i)]

Organic Catogories:
HOC = Halogenated Organics
C-H = Carbon-Hydrogen Oranics
PAH = Polyaromatic Hydrocarbons



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Table 8. Newaukum Prairie Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| Metals | | | | | |
| Antimony | mg/kg | 70 | 7.00E-03 | D | Non-Organic |
| Arsenic | mg/kg | 70 | 7.00E-03 | C | Non-Organic |
| Beryllium | mg/kg | 1 | 1.00E-04 | No Data | Non-Organic |
| Cadmium | mg/kg | 3 | 3.00E-04 | C | Non-Organic |
| Chromium | mg/kg | 27 | 2.70E-03 | D | Non-Organic |
| Cobalt | mg/kg | 89 | 8.90E-03 | C | Non-Organic |
| Copper | mg/kg | 503 | 5.03E-02 | No Data | Non-Organic |
| Lead | mg/kg | 30 | 3.00E-03 | No Data | Non-Organic |
| Molybdenum | mg/kg | 14 | 1.40E-03 | B | Non-Organic |
| Nickel | mg/kg | 30 | 3.00E-03 | X | Non-Organic |
| Selenium | mg/kg | 70 | 7.00E-03 | C | Non-Organic |
| Silver | mg/kg | 4 | 4.00E-04 | X | Non-Organic |
| Thallium | mg/kg | 70 | 7.00E-03 | C | Non-Organic |
| Zinc | mg/kg | 1,060 | 1.06E-01 | D | Non-Organic |
| Mercury | mg/kg | 1.2 | 1.20E-04 | B | Non-Organic |
| Semi-Volatile Organic Compounds (SVOCs) | | | | | |
| 1,2,4-Trichlorobenzene | ug/kg | See VOCs | | | |
| 1,2-Dichlorobenzene | ug/kg | See VOCs | | | |
| 1,2-Diphenylhydrazine | ug/kg | 300 | 3.00E-05 | B | C-H |
| 1,3-Dichlorobenzene | ug/kg | See VOCs | | | |
| 1,4-Dichlorobenzene | ug/kg | 750 | 7.50E-05 | B | HOC |
| 2,2'-Oxybis(1-Chloropropane) | ug/kg | 300 | 3.00E-05 | C | HOC |
| 2,4,6-Trichlorophenol | ug/kg | 1,500 | 1.50E-04 | C | HOC |
| 2,4-Dichlorophenol | ug/kg | 1,500 | 1.50E-04 | C | HOC |
| 2,4-Dimethylphenol | ug/kg | 300 | 3.00E-05 | D | C-H |
| 2,4-Dinitrophenol | ug/kg | 3,000 | 3.00E-04 | B | C-H |
| 2,4-Dinitrotoluene | ug/kg | 1,500 | 1.50E-04 | C | C-H |
| 2,6-Dinitrotoluene | ug/kg | 1,500 | 1.50E-04 | D | C-H |
| 2-Chloronaphthalene | ug/kg | 300 | 3.00E-05 | D | HOC |
| 2-Chlorophenol | ug/kg | 300 | 3.00E-05 | C | HOC |
| 2-Nitrophenol | ug/kg | 300 | 3.00E-05 | C | C-H |
| 3,3'-Dichlorobenzidine | ug/kg | 1,500 | 1.50E-04 | D | HOC |
| 4,6-Dinitro-2-Methylphenol | ug/kg | 3,000 | 3.00E-04 | A | C-H |
| 4-Bromophenyl-phenylether | ug/kg | 300 | 3.00E-05 | C | C-H |
| 4-Chlorophenyl-phenylether | ug/kg | 300 | 3.00E-05 | B | HOC |

Note1:
Toxicity Categories based on toxicity data
from HSDB or ECOTOX online databases [WAC 173-303-100(5)(b)(i)]

Organic Catogories:
HOC = Halogenated Organics
C-H = Carbon-Hydrogen Oranics
PAH = Polyaromatic Hydrocarbons

Table 8. Newaukum Prairie Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| SVOC (cont.) | | | | | |
| 4-Methylphenol | ug/kg | 2,600 | 2.60E-04 | C | C-H |
| 4-Nitrophenol | ug/kg | 1,500 | 1.50E-04 | C | C-H |
| Acenaphthene | ug/kg | 300 | 3.00E-05 | B | PAH |
| Acenaphthylene | ug/kg | 300 | 3.00E-05 | No Data | PAH |
| Anthracene | ug/kg | 300 | 3.00E-05 | B | PAH |
| Azobenzene | ug/kg | 300 | 3.00E-05 | B | C-H |
| Benzo(a)anthracene | ug/kg | 300 | 3.00E-05 | X | PAH |
| Benzo(a)pyrene | ug/kg | 300 | 3.00E-05 | X | PAH |
| Benzo(b)fluoranthene | ug/kg | 360 | 3.60E-05 | No Data | PAH |
| Benzo(g,h,i)perylene | ug/kg | 300 | 3.00E-05 | No Data | PAH |
| Benzo(k)fluoranthene | ug/kg | 340 | 3.40E-05 | No Data | PAH |
| bis(2-Chloroethoxy) Methane | ug/kg | 300 | 3.00E-05 | C | HOC |
| Bis-(2-Chloroethyl) Ether | ug/kg | 300 | 3.00E-05 | C | HOC |
| bis(2-Ethylhexyl)phthalate | ug/kg | 20,000 | 2.00E-03 | B | C-H |
| Butylbenzylphthalate | ug/kg | 300 | 3.00E-05 | C | C-H |
| Chrysene | ug/kg | 300 | 3.00E-05 | No Data | PAH |
| Dibenz(a,h)anthracene | ug/kg | 300 | 3.00E-05 | No Data | PAH |
| Diethylphthalate | ug/kg | 300 | 3.00E-05 | D | C-H |
| Dimethylphthalate | ug/kg | 300 | 3.00E-05 | D | C-H |
| Di-n-Butylphthalate | ug/kg | 300 | 3.00E-05 | C | C-H |
| Di-n-Octyl phthalate | ug/kg | 300 | 3.00E-05 | D | C-H |
| Fluoranthene | ug/kg | 560 | 5.60E-05 | C | PAH |
| Fluorene | ug/kg | 300 | 3.00E-05 | B | PAH |
| Hexachlorobenzene | ug/kg | 300 | 3.00E-05 | D | HOC |
| Hexachlorobutadiene | ug/kg | See VOCs | | | HOC |
| Hexachlorocyclopentadiene | ug/kg | 1,500 | 1.50E-04 | X | HOC |
| Hexachloroethane | ug/kg | 300 | 3.00E-05 | B | HOC |
| Indeno(1,2,3-cd)pyrene | ug/kg | 470 | 4.70E-05 | No Data | PAH |
| Isophorone | ug/kg | 300 | 3.00E-05 | C | C-H |
| Naphthalene | ug/kg | See VOCs | | | |
| Nitrobenzene | ug/kg | 300 | 3.00E-05 | D | C-H |
| N-Nitrosodimethylamine | ug/kg | 1,500 | 1.50E-04 | B | C-H |
| N-Nitroso-Di-N-Propylamine | ug/kg | 300 | 3.00E-05 | D | C-H |
| N-Nitrosodiphenylamine | ug/kg | 300 | 3.00E-05 | C | C-H |
| Pentachlorophenol | ug/kg | 1,500 | 1.50E-04 | A | C-H |
| Phenanthrene | ug/kg | 440 | 4.40E-05 | A | PAH |

Note1:
Toxicity Categories based on toxicity data
from HSDB or ECOTOX online databases [WAC 173-303-100(5)(b)(i)]

Organic Catogories:
HOC = Halogenated Organics
C-H = Carbon-Hydrogen Oranics
PAH = Polyaromatic Hydrocarbons



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Table 8. Newaukum Prairie Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| SVOC (cont.) | | | | | |
| Phenol | ug/kg | 630 | 6.30E-05 | C | C-H |
| Pyrene | ug/kg | 450 | 4.50E-05 | C | PAH |
| Total Benzofluoranthenes | ug/kg | 380 | 3.80E-05 | Not Applicable | Not Applicable |
| PCB (Aroclors) | | | | | |
| Aroclor 1016 | ug/kg | 9.8 | 9.80E-07 | B | HOC |
| Aroclor 1221 | ug/kg | 9.8 | 9.80E-07 | C | HOC |
| Aroclor 1232 | ug/kg | 9.8 | 9.80E-07 | C | HOC |
| Aroclor 1242 | ug/kg | 9.8 | 9.80E-07 | A | HOC |
| Aroclor 1248 | ug/kg | 49 | 4.90E-06 | X | HOC |
| Aroclor 1254 | ug/kg | 150 | 1.50E-05 | X | HOC |
| Aroclor 1260 | ug/kg | 40 | 4.00E-06 | A | HOC |
| Pesticides | | | | | |
| 4,4'-DDD | ug/kg | 17 | 1.70E-06 | A | HOC |
| 4,4'-DDE | ug/kg | 17 | 1.70E-06 | A | HOC |
| 4,4'-DDT | ug/kg | 100 | 1.00E-05 | X | HOC |
| Aldrin | ug/kg | 8.3 | 8.30E-07 | X | HOC |
| alpha-BHC | ug/kg | 8.3 | 8.30E-07 | B | HOC |
| beta-BHC | ug/kg | 8.3 | 8.30E-07 | C | HOC |
| cis-Chlordane | ug/kg | 33 | 3.30E-06 | X | HOC |
| delta-BHC | ug/kg | 180 | 1.80E-05 | B | HOC |
| Endosulfan I | ug/kg | 8.3 | 8.30E-07 | X | HOC |
| Endosulfan II | ug/kg | 17 | 1.70E-06 | X | HOC |
| Endosulfan Sulfate | ug/kg | 120 | 1.20E-05 | X | HOC |
| Endrin | ug/kg | 17 | 1.70E-06 | X | HOC |
| Endrin Aldehyde | ug/kg | 17 | 1.70E-06 | No Data | HOC |
| gamma-BHC (Lindane) | ug/kg | 8.3 | 8.30E-07 | X | HOC |
| Heptachlor | ug/kg | 8.3 | 8.30E-07 | X | HOC |
| Heptachlor Epoxide | ug/kg | 280 | 2.80E-05 | A | HOC |
| Toxaphene | ug/kg | 830 | 8.30E-05 | X | HOC |
| trans-Chlordane | ug/kg | 1,300 | 1.30E-04 | A | HOC |
| Polychlorinated dibenzo-p-dioxin | | | | | |
| 2,3,7,8-TCDD | pg/g | 2.76 | 2.76E-04 | X | HOC |
| Inorganic Parameters | | | | | |
| Total Cyanide | mg/kg | 1.87 | 1.87E-04 | B | Non-Organic |

Note1:
Toxicity Categories based on toxicity data
from HSDB or ECOTOX online databases [WAC 173-303-100(5)(b)(i)]

Organic Catogories:
HOC = Halogenated Organics
C-H = Carbon-Hydrogen Oranics
PAH = Polyaromatic Hydrocarbons



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Table 9. Big Hanaford Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| Volatile Organic Compounds (VOCs) | | | | | |
| 1,1,1-Trichloroethane | ug/kg | 780 | 7.80E-05 | D | HOC |
| 1,1,2,2-Tetrachloroethane | ug/kg | 780 | 7.80E-05 | C | HOC |
| 1,1,2-Trichloroethane | ug/kg | 780 | 7.80E-05 | D | HOC |
| 1,1-Dichloroethane | ug/kg | 780 | 7.80E-05 | D | HOC |
| 1,1-Dichloroethene | ug/kg | 780 | 7.80E-05 | C | HOC |
| 1,2,4-Trichlorobenzene | ug/kg | See Semi-VOCs | | | |
| 1,2-Dichlorobenzene | ug/kg | See Semi-VOCs | | | |
| 1,2-Dichloroethane | ug/kg | 780 | 7.80E-05 | D | HOC |
| 1,2-Dichloropropane | ug/kg | 780 | 7.80E-05 | C | HOC |
| 1,3-Dichlorobenzene | ug/kg | See Semi-VOCs | | | |
| 1,4-Dichlorobenzene | ug/kg | 1,300 | 1.30E-04 | B | HOC |
| 2-Chloroethylvinylether | ug/kg | 3,900 | 3.90E-04 | C | HOC |
| Acrolein | ug/kg | 39,000 | 3.90E-03 | A | C-H |
| Acrylonitrile | ug/kg | 3,900 | 3.90E-04 | C | C-H |
| Benzene | ug/kg | 780 | 7.80E-05 | D | C-H |
| Bromodichloromethane | ug/kg | 780 | 7.80E-05 | D | HOC |
| Bromoform | ug/kg | 780 | 7.80E-05 | C | C-H |
| Bromomethane | ug/kg | 780 | 7.80E-05 | B | HOC |
| Carbon Tetrachloride | ug/kg | 780 | 7.80E-05 | C | HOC |
| Chlorobenzene | ug/kg | 780 | 7.80E-05 | C | HOC |
| Chloroethane | ug/kg | 780 | 7.80E-05 | No Data | HOC |
| Chloroform | ug/kg | 780 | 7.80E-05 | C | HOC |
| Chloromethane | ug/kg | 780 | 7.80E-05 | C | HOC |
| cis-1,3-Dichloropropene | ug/kg | 780 | 7.80E-05 | No Data | HOC |
| Dibromochloromethane | ug/kg | 780 | 7.80E-05 | D | HOC |
| Ethylbenzene | ug/kg | 780 | 7.80E-05 | C | C-H |
| Hexachlorobutadiene | ug/kg | See Semi-VOCs | | | |
| Methylene Chloride | ug/kg | 1600 | 1.60E-04 | D | HOC |
| Naphthalene | ug/kg | See Semi-VOCs | | | |
| Tetrachloroethene | ug/kg | 780 | 7.80E-05 | C | HOC |
| Toluene | ug/kg | 120,000 | 1.20E-02 | A | C-H |
| trans-1,2-Dichloroethene | ug/kg | 780 | 7.80E-05 | D | HOC |
| trans-1,3-Dichloropropene | ug/kg | 780 | 7.80E-05 | No Data | HOC |
| Trichloroethene | ug/kg | 780 | 7.80E-05 | D | HOC |
| Vinyl Chloride | ug/kg | 780 | 7.80E-05 | D | HOC |

Note1:
Toxicity Categories based on toxicity data
from HSDB or ECOTOX online databases [WAC 173-303-100(5)(b)(i)]

Organic Catogories:
HOC = Halogenated Organics
C-H = Carbon-Hydrogen Oranics
PAH = Polyaromatic Hydrocarbons



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Table 9. Big Hanaford Sludge - Parameters for Land Disposal Restriction Evaluation (see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| Metals | | | | | |
| Antimony | mg/kg | 30 | 3.00E-03 | D | Non-Organic |
| Arsenic | mg/kg | 30 | 3.00E-03 | C | Non-Organic |
| Beryllium | mg/kg | 0.6 | 6.00E-05 | No Data | Non-Organic |
| Cadmium | mg/kg | 2 | 2.00E-04 | C | Non-Organic |
| Chromium | mg/kg | 29 | 2.90E-03 | D | Non-Organic |
| Cobalt | mg/kg | 165 | 1.65E-02 | C | Non-Organic |
| Copper | mg/kg | 521 | 5.21E-02 | No Data | Non-Organic |
| Lead | mg/kg | 30 | 3.00E-03 | No Data | Non-Organic |
| Molybdenum | mg/kg | 15 | 1.50E-03 | B | Non-Organic |
| Nickel | mg/kg | 42 | 4.20E-03 | X | Non-Organic |
| Selenium | mg/kg | 30 | 3.00E-03 | C | Non-Organic |
| Silver | mg/kg | 6 | 6.00E-04 | X | Non-Organic |
| Thallium | mg/kg | 30 | 3.00E-03 | C | Non-Organic |
| Zinc | mg/kg | 1,100 | 1.10E-01 | D | Non-Organic |
| Mercury | mg/kg | 3 | 3.00E-04 | B | Non-Organic |
| Semi-Volatile Organic Compounds (SVOCs) | | | | | |
| 1,2,4-Trichlorobenzene | ug/kg | 580 | 5.80E-05 | C | HOC |
| 1,2-Dichlorobenzene | ug/kg | 580 | 5.80E-05 | C | HOC |
| 1,2-Diphenylhydrazine | ug/kg | 570 | 5.70E-05 | B | C-H |
| 1,3-Dichlorobenzene | ug/kg | 580 | 5.80E-05 | C | HOC |
| 1,4-Dichlorobenzene | ug/kg | See VOCs | | | |
| 2,2'-Oxybis(1-Chloropropane) | ug/kg | 580 | 5.80E-05 | C | HOC |
| 2,4,6-Trichlorophenol | ug/kg | 2,800 | 2.80E-04 | C | HOC |
| 2,4-Dichlorophenol | ug/kg | 2,800 | 2.80E-04 | C | HOC |
| 2,4-Dimethylphenol | ug/kg | 580 | 5.80E-05 | D | C-H |
| 2,4-Dinitrophenol | ug/kg | 5,800 | 5.80E-04 | B | C-H |
| 2,4-Dinitrotoluene | ug/kg | 2,800 | 2.80E-04 | C | C-H |
| 2,6-Dinitrotoluene | ug/kg | 2,800 | 2.80E-04 | D | C-H |
| 2-Chloronaphthalene | ug/kg | 580 | 5.80E-05 | D | HOC |
| 2-Chlorophenol | ug/kg | 580 | 5.80E-05 | C | HOC |
| 2-Nitrophenol | ug/kg | 580 | 5.80E-05 | C | C-H |
| 3,3'-Dichlorobenzidine | ug/kg | 2,800 | 2.80E-04 | D | HOC |
| 4,6-Dinitro-2-Methylphenol | ug/kg | 5,800 | 5.80E-04 | A | C-H |
| 4-Bromophenyl-phenylether | ug/kg | 580 | 5.80E-05 | C | C-H |
| 4-Chlorophenyl-phenylether | ug/kg | 580 | 5.80E-05 | B | HOC |

Note1:
Toxicity Categories based on toxicity data
from HSDB or ECOTOX online databases [WAC 173-303-100(5)(b)(i)]

Organic Catogories:
HOC = Halogenated Organics
C-H = Carbon-Hydrogen Oranics
PAH = Polyaromatic Hydrocarbons

Table 9. Big Hanaford Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| SVOC (cont.) | | | | | |
| 4-Methylphenol | ug/kg | 720,000 | 7.20E-02 | C | C-H |
| 4-Nitrophenol | ug/kg | 2,800 | 2.80E-04 | C | C-H |
| Acenaphthene | ug/kg | 580 | 5.80E-05 | B | PAH |
| Acenaphthylene | ug/kg | 580 | 5.80E-05 | No Data | PAH |
| Anthracene | ug/kg | 580 | 5.80E-05 | B | PAH |
| Azobenzene | ug/kg | 580 | 5.80E-05 | B | C-H |
| Benzo(a)anthracene | ug/kg | 580 | 5.80E-05 | X | PAH |
| Benzo(a)pyrene | ug/kg | 580 | 5.80E-05 | X | PAH |
| Benzo(b)fluoranthene | ug/kg | 570 | 5.70E-05 | No Data | PAH |
| Benzo(g,h,i)perylene | ug/kg | 580 | 5.80E-05 | No Data | PAH |
| Benzo(k)fluoranthene | ug/kg | 570 | 5.70E-05 | No Data | PAH |
| bis(2-Chloroethoxy) Methane | ug/kg | 580 | 5.80E-05 | C | HOC |
| Bis-(2-Chloroethyl) Ether | ug/kg | 580 | 5.80E-05 | C | HOC |
| bis(2-Ethylhexyl)phthalate | ug/kg | 25,000 | 2.50E-03 | B | C-H |
| Butylbenzylphthalate | ug/kg | 580 | 5.80E-05 | C | C-H |
| Chrysene | ug/kg | 580 | 5.80E-05 | No Data | PAH |
| Dibenz(a,h)anthracene | ug/kg | 580 | 5.80E-05 | No Data | PAH |
| Diethylphthalate | ug/kg | 580 | 5.80E-05 | D | C-H |
| Dimethylphthalate | ug/kg | 580 | 5.80E-05 | D | C-H |
| Di-n-Butylphthalate | ug/kg | 580 | 5.80E-05 | C | C-H |
| Di-n-Octyl phthalate | ug/kg | 580 | 5.80E-05 | D | C-H |
| Fluoranthene | ug/kg | 640 | 6.40E-05 | C | PAH |
| Fluorene | ug/kg | 580 | 5.80E-05 | B | PAH |
| Hexachlorobenzene | ug/kg | 580 | 5.80E-05 | D | HOC |
| Hexachlorobutadiene | ug/kg | 580 | 5.80E-05 | A | HOC |
| Hexachlorocyclopentadiene | ug/kg | 2,800 | 2.80E-04 | X | HOC |
| Hexachloroethane | ug/kg | 580 | 5.80E-05 | B | HOC |
| Indeno(1,2,3-cd)pyrene | ug/kg | 580 | 5.80E-05 | No Data | PAH |
| Isophorone | ug/kg | 580 | 5.80E-05 | C | C-H |
| Naphthalene | ug/kg | 580 | 5.80E-05 | C | C-H |
| Nitrobenzene | ug/kg | 580 | 5.80E-05 | D | C-H |
| N-Nitrosodimethylamine | ug/kg | 2,800 | 2.80E-04 | B | C-H |
| N-Nitroso-Di-N-Propylamine | ug/kg | 580 | 5.80E-05 | D | C-H |
| N-Nitrosodiphenylamine | ug/kg | 1,400 | 1.40E-04 | C | C-H |
| Pentachlorophenol | ug/kg | 2,800 | 2.80E-04 | A | C-H |
| Phenanthrene | ug/kg | 580 | 5.80E-05 | A | PAH |

Note1:
Toxicity Categories based on toxicity data
from HSDB or ECOTOX online databases [WAC 173-303-100(5)(b)(i)]

Organic Catogories:
HOC = Halogenated Organics
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PAH = Polyaromatic Hydrocarbons



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Table 9. Big Hanaford Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| SVOC (cont.) | | | | | |
| Phenol | ug/kg | 23,000 | 2.30E-03 | C | C-H |
| Pyrene | ug/kg | 580 | 5.80E-05 | C | PAH |
| Total Benzofluoranthenes | ug/kg | 580 | 5.80E-05 | Not Applicable | Not Applicable |
| PCB (Aroclors) | | | | | |
| Aroclor 1016 | ug/kg | 9.9 | 9.90E-07 | B | HOC |
| Aroclor 1221 | ug/kg | 9.9 | 9.90E-07 | C | HOC |
| Aroclor 1232 | ug/kg | 9.9 | 9.90E-07 | C | HOC |
| Aroclor 1242 | ug/kg | 9.9 | 9.90E-07 | A | HOC |
| Aroclor 1248 | ug/kg | 99 | 9.90E-06 | X | HOC |
| Aroclor 1254 | ug/kg | 150 | 1.50E-05 | X | HOC |
| Aroclor 1260 | ug/kg | 35 | 3.50E-06 | A | HOC |
| Pesticides | | | | | |
| 4,4'-DDD | ug/kg | 17 | 1.70E-06 | A | HOC |
| 4,4'-DDE | ug/kg | 17 | 1.70E-06 | A | HOC |
| 4,4'-DDT | ug/kg | 120 | 1.20E-05 | X | HOC |
| Aldrin | ug/kg | 8.3 | 8.30E-07 | X | HOC |
| alpha-BHC | ug/kg | 8.3 | 8.30E-07 | B | HOC |
| beta-BHC | ug/kg | 8.3 | 8.30E-07 | C | HOC |
| cis-Chlordane | ug/kg | 34 | 3.40E-06 | X | HOC |
| delta-BHC | ug/kg | 180 | 1.80E-05 | B | HOC |
| Dieldrin | ug/kg | 39 | 3.90E-06 | X | HOC |
| Endosulfan I | ug/kg | 22 | 2.20E-06 | X | HOC |
| Endosulfan II | ug/kg | 17 | 1.70E-06 | X | HOC |
| Endosulfan Sulfate | ug/kg | 17 | 1.70E-06 | X | HOC |
| Endrin | ug/kg | 49 | 4.90E-06 | X | HOC |
| Endrin Aldehyde | ug/kg | 77 | 7.70E-06 | No Data | HOC |
| gamma-BHC (Lindane) | ug/kg | 25 | 2.50E-06 | X | HOC |
| Heptachlor | ug/kg | 8.3 | 8.30E-07 | X | HOC |
| Heptachlor Epoxide | ug/kg | 690 | 6.90E-05 | A | HOC |
| Toxaphene | ug/kg | 830 | 8.30E-05 | X | HOC |
| trans-Chlordane | ug/kg | 1,200 | 1.20E-04 | A | HOC |
| Polychlorinated dibenzo-p-dioxin | | | | | |
| 2,3,7,8-TCDD | pg/g | 0.72 | 7.20E-05 | X | HOC |
| Inorganic Parameters | | | | | |
| Total Cyanide | mg/kg | 2.39 | 2.39E-04 | B | Non-Organic |

Note1:
Toxicity Categories based on toxicity data
from HSDB or ECOTOX online databases [WAC 173-303-100(5)(b)(i)]

Organic Catogories:
HOC = Halogenated Organics
C-H = Carbon-Hydrogen Oranics
PAH = Polyaromatic Hydrocarbons



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Table 10. Burnt Ridge Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| Volatile Organic Compounds (VOCs) | | | | | |
| 1,1,1-Trichloroethane | ug/kg | 1.8 | 1.80E-07 | D | HOC |
| 1,1,2,2-Tetrachloroethane | ug/kg | 1.8 | 1.80E-07 | C | HOC |
| 1,1,2-Trichloroethane | ug/kg | 1.8 | 1.80E-07 | D | HOC |
| 1,1-Dichloroethane | ug/kg | 1.8 | 1.80E-07 | D | HOC |
| 1,1-Dichloroethene | ug/kg | 1.8 | 1.80E-07 | C | HOC |
| 1,2,4-Trichlorobenzene | ug/kg | 9 | 9.00E-07 | C | HOC |
| 1,2-Dichlorobenzene | ug/kg | 1.8 | 1.80E-07 | C | HOC |
| 1,2-Dichloroethane | ug/kg | 1.8 | 1.80E-07 | D | HOC |
| 1,2-Dichloropropane | ug/kg | 1.8 | 1.80E-07 | C | HOC |
| 1,3-Dichlorobenzene | ug/kg | 1.8 | 1.80E-07 | C | HOC |
| 1,4-Dichlorobenzene | ug/kg | See Semi-VOCs | | | |
| 2-Chloroethylvinylether | ug/kg | 9 | 9.00E-07 | C | HOC |
| Acrolein | ug/kg | 90 | 9.00E-06 | A | C-H |
| Acrylonitrile | ug/kg | 9 | 9.00E-07 | C | C-H |
| Benzene | ug/kg | 1.8 | 1.80E-07 | D | C-H |
| Bromodichloromethane | ug/kg | 1.8 | 1.80E-07 | D | HOC |
| Bromoform | ug/kg | 1.8 | 1.80E-07 | C | C-H |
| Bromomethane | ug/kg | 1.8 | 1.80E-07 | B | HOC |
| Carbon Tetrachloride | ug/kg | 1.8 | 1.80E-07 | C | HOC |
| Chlorobenzene | ug/kg | 1.8 | 1.80E-07 | C | HOC |
| Chloroethane | ug/kg | 1.8 | 1.80E-07 | No Data | HOC |
| Chloroform | ug/kg | 1.8 | 1.80E-07 | C | HOC |
| Chloromethane | ug/kg | 1.8 | 1.80E-07 | C | HOC |
| cis-1,3-Dichloropropene | ug/kg | 1.8 | 1.80E-07 | No Data | HOC |
| Dibromochloromethane | ug/kg | 1.8 | 1.80E-07 | D | HOC |
| Ethylbenzene | ug/kg | 1.8 | 1.80E-07 | C | C-H |
| Hexachlorobutadiene | ug/kg | 9 | 9.00E-07 | A | HOC |
| Methylene Chloride | ug/kg | 3.6 | 3.60E-07 | D | HOC |
| Naphthalene | ug/kg | 9 | 9.00E-07 | C | C-H |
| Tetrachloroethene | ug/kg | 1.8 | 1.80E-07 | C | HOC |
| Toluene | ug/kg | 35 | 3.50E-06 | A | C-H |
| trans-1,2-Dichloroethene | ug/kg | 1.8 | 1.80E-07 | D | HOC |
| trans-1,3-Dichloropropene | ug/kg | 1.8 | 1.80E-07 | No Data | HOC |
| Trichloroethene | ug/kg | 1.8 | 1.80E-07 | D | HOC |
| Vinyl Chloride | ug/kg | 1.8 | 1.80E-07 | D | HOC |

Note1: Parameters analyzed as VOCs and Semi-VOCs use only one value - selection based on max detect value or min RL (if ND)

Note2:
Tox. Cat. from HSDB or ECOTOX
HOC: Halogenated
C-H: Carbon-Hydrogen
PAH: Polyaromatic Hydrocarbons



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Table 10. Burnt Ridge Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| Metals | | | | | |
| Antimony | mg/kg | 30 | 3.00E-03 | D | Non-Organic |
| Arsenic | mg/kg | 30 | 3.00E-03 | C | Non-Organic |
| Beryllium | mg/kg | 0.6 | 6.00E-05 | No Data | Non-Organic |
| Cadmium | mg/kg | 3 | 3.00E-04 | C | Non-Organic |
| Chromium | mg/kg | 45 | 4.50E-03 | D | Non-Organic |
| Cobalt | mg/kg | 48 | 4.80E-03 | C | Non-Organic |
| Copper | mg/kg | 417 | 4.17E-02 | No Data | Non-Organic |
| Lead | mg/kg | 40 | 4.00E-03 | No Data | Non-Organic |
| Molybdenum | mg/kg | 16 | 1.60E-03 | B | Non-Organic |
| Nickel | mg/kg | 45 | 4.50E-03 | X | Non-Organic |
| Selenium | mg/kg | 30 | 3.00E-03 | C | Non-Organic |
| Silver | mg/kg | 6 | 6.00E-04 | X | Non-Organic |
| Thallium | mg/kg | 30 | 3.00E-03 | C | Non-Organic |
| Zinc | mg/kg | 969 | 9.69E-02 | D | Non-Organic |
| Mercury | mg/kg | 1.9 | 1.90E-04 | B | Non-Organic |
| Semi-Volatile Organic Compounds (SVOCs) | | | | | |
| 1,2,4-Trichlorobenzene | ug/kg | VOC | | | |
| 1,2-Dichlorobenzene | ug/kg | VOC | | | |
| 1,2-Diphenylhydrazine | ug/kg | 260 | 2.60E-05 | B | C-H |
| 1,3-Dichlorobenzene | ug/kg | See VOCs | | | |
| 1,4-Dichlorobenzene | ug/kg | 540 | 5.40E-05 | B | HOC |
| 2,2'-Oxybis(1-Chloropropane) | ug/kg | 260 | 2.60E-05 | C | HOC |
| 2,4,6-Trichlorophenol | ug/kg | 1,300 | 1.30E-04 | C | HOC |
| 2,4-Dichlorophenol | ug/kg | 1,300 | 1.30E-04 | C | HOC |
| 2,4-Dimethylphenol | ug/kg | 260 | 2.60E-05 | D | C-H |
| 2,4-Dinitrophenol | ug/kg | 2,600 | 2.60E-04 | B | C-H |
| 2,4-Dinitrotoluene | ug/kg | 1,300 | 1.30E-04 | C | C-H |
| 2,6-Dinitrotoluene | ug/kg | 1,300 | 1.30E-04 | D | C-H |
| 2-Chloronaphthalene | ug/kg | 260 | 2.60E-05 | D | HOC |
| 2-Chlorophenol | ug/kg | 260 | 2.60E-05 | C | HOC |
| 2-Nitrophenol | ug/kg | 260 | 2.60E-05 | C | C-H |
| 3,3'-Dichlorobenzidine | ug/kg | 1,300 | 1.30E-04 | D | HOC |
| 4,6-Dinitro-2-Methylphenol | ug/kg | 2,600 | 2.60E-04 | A | C-H |
| 4-Bromophenyl-phenylether | ug/kg | 260 | 2.60E-05 | C | C-H |
| 4-Chlorophenyl-phenylether | ug/kg | 260 | 2.60E-05 | B | HOC |

Note1: Parameters analyzed as VOCs and Semi-VOCs use only one value - selection based on max detect value or min RL (if ND)

Note2:
Tox. Cat. from HSDB or ECOTOX
HOC: Halogenated
C-H: Carbon-Hydrogen
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Table 10. Burnt Ridge Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| SVOC (cont.) | | | | | |
| 4-Methylphenol | ug/kg | 1,100 | 1.10E-04 | C | C-H |
| 4-Nitrophenol | ug/kg | 1,300 | 1.30E-04 | C | C-H |
| Acenaphthene | ug/kg | 260 | 2.60E-05 | B | PAH |
| Acenaphthylene | ug/kg | 260 | 2.60E-05 | No Data | PAH |
| Anthracene | ug/kg | 260 | 2.60E-05 | B | PAH |
| Azobenzene | ug/kg | 260 | 2.60E-05 | B | C-H |
| Benzo(a)anthracene | ug/kg | 260 | 2.60E-05 | X | PAH |
| Benzo(a)pyrene | ug/kg | 260 | 2.60E-05 | X | PAH |
| Benzo(b)fluoranthene | ug/kg | 380 | 3.80E-05 | No Data | PAH |
| Benzo(g,h,i)perylene | ug/kg | 260 | 2.60E-05 | No Data | PAH |
| Benzo(k)fluoranthene | ug/kg | 360 | 3.60E-05 | No Data | PAH |
| bis(2-Chloroethoxy) Methane | ug/kg | 260 | 2.60E-05 | C | HOC |
| Bis-(2-Chloroethyl) Ether | ug/kg | 260 | 2.60E-05 | C | HOC |
| bis(2-Ethylhexyl)phthalate | ug/kg | 12,000 | 1.20E-03 | B | C-H |
| Butylbenzylphthalate | ug/kg | 260 | 2.60E-05 | C | C-H |
| Chrysene | ug/kg | 260 | 2.60E-05 | No Data | PAH |
| Dibenz(a,h)anthracene | ug/kg | 260 | 2.60E-05 | No Data | PAH |
| Diethylphthalate | ug/kg | 260 | 2.60E-05 | D | C-H |
| Dimethylphthalate | ug/kg | 260 | 2.60E-05 | D | C-H |
| Di-n-Butylphthalate | ug/kg | 260 | 2.60E-05 | C | C-H |
| Di-n-Octyl phthalate | ug/kg | 260 | 2.60E-05 | D | C-H |
| Fluoranthene | ug/kg | 450 | 4.50E-05 | C | PAH |
| Fluorene | ug/kg | 260 | 2.60E-05 | B | PAH |
| Hexachlorobenzene | ug/kg | 260 | 2.60E-05 | D | HOC |
| Hexachlorobutadiene | ug/kg | 260 | 2.60E-05 | A | HOC |
| Hexachlorocyclopentadiene | ug/kg | 1,300 | 1.30E-04 | X | HOC |
| Hexachloroethane | ug/kg | 260 | 2.60E-05 | B | HOC |
| Indeno(1,2,3-cd)pyrene | ug/kg | 400 | 4.00E-05 | No Data | PAH |
| Isophorone | ug/kg | 260 | 2.60E-05 | C | C-H |
| Naphthalene | ug/kg | 260 | 2.60E-05 | C | C-H |
| Nitrobenzene | ug/kg | 260 | 2.60E-05 | D | C-H |
| N-Nitrosodimethylamine | ug/kg | 1,300 | 1.30E-04 | B | C-H |
| N-Nitroso-Di-N-Propylamine | ug/kg | 260 | 2.60E-05 | D | C-H |
| N-Nitrosodiphenylamine | ug/kg | 260 | 2.60E-05 | C | C-H |
| Pentachlorophenol | ug/kg | 1,300 | 1.30E-04 | A | C-H |
| Phenanthrene | ug/kg | 260 | 2.60E-05 | A | PAH |

Note1: Parameters analyzed as VOCs and Semi-VOCs use only one value - selection based on max detect value or min RL (if ND)

Note2:
Tox. Cat. from HSDB or ECOTOX
HOC: Halogenated
C-H: Carbon-Hydrogen
PAH: Polyaromatic Hydrocarbons



PgG

Table 10. Burnt Ridge Sludge - Parameters for Land Disposal Restriction Evaluation
(see Table 11)

| PARAMETERS | UNITS | Max Detect Value or Min Reporting Limit (if not detected) | Percent Concentration | Toxicity Category (See Note 1) | Organic Category (See Note 1) |
|---|---|---|---|---|---|
| SVOC (cont.) | | | | | |
| Phenol | ug/kg | 260 | 2.60E-05 | C | C-H |
| Pyrene | ug/kg | 390 | 3.90E-05 | C | PAH |
| Total Benzofluoranthenes | ug/kg | 400 | 4.00E-05 | Not Applicable | Not Applicable |
| PCB (Aroclors) | | | | | |
| Aroclor 1016 | ug/kg | 9.8 | 9.80E-07 | B | HOC |
| Aroclor 1221 | ug/kg | 9.8 | 9.80E-07 | C | HOC |
| Aroclor 1232 | ug/kg | 9.8 | 9.80E-07 | C | HOC |
| Aroclor 1242 | ug/kg | 9.8 | 9.80E-07 | A | HOC |
| Aroclor 1248 | ug/kg | 98 | 9.80E-06 | X | HOC |
| Aroclor 1254 | ug/kg | 150 | 1.50E-05 | X | HOC |
| Aroclor 1260 | ug/kg | 61 | 6.10E-06 | A | HOC |
| Pesticides | | | | | |
| 4,4'-DDD | ug/kg | 16 | 1.60E-06 | A | HOC |
| 4,4'-DDE | ug/kg | 16 | 1.60E-06 | A | HOC |
| 4,4'-DDT | ug/kg | 16 | 1.60E-06 | X | HOC |
| Aldrin | ug/kg | 8.2 | 8.20E-07 | X | HOC |
| alpha-BHC | ug/kg | 8.2 | 8.20E-07 | B | HOC |
| beta-BHC | ug/kg | 8.2 | 8.20E-07 | C | HOC |
| cis-Chlordane | ug/kg | 19 | 1.90E-06 | X | HOC |
| delta-BHC | ug/kg | 110 | 1.10E-05 | B | HOC |
| Dieldrin | ug/kg | 57 | 5.70E-06 | X | HOC |
| Endosulfan I | ug/kg | 14 | 1.40E-06 | X | HOC |
| Endosulfan II | ug/kg | 16 | 1.60E-06 | X | HOC |
| Endosulfan Sulfate | ug/kg | 72 | 7.20E-06 | X | HOC |
| Endrin | ug/kg | 25 | 2.50E-06 | X | HOC |
| Endrin Aldehyde | ug/kg | 16 | 1.60E-06 | No Data | HOC |
| gamma-BHC (Lindane) | ug/kg | 8.2 | 8.20E-07 | X | HOC |
| Heptachlor | ug/kg | 8.2 | 8.20E-07 | X | HOC |
| Heptachlor Epoxide | ug/kg | 8.2 | 8.20E-07 | A | HOC |
| Toxaphene | ug/kg | 820 | 8.20E-05 | X | HOC |
| trans-Chlordane | ug/kg | 1,100 | 1.10E-04 | A | HOC |
| Polychlorinated dibenzo-p-dioxin | | | | | |
| 2,3,7,8-TCDD | pg/g | 2.35 | 2.35E-04 | X | HOC |
| Inorganic Parameters | | | | | |
| Total Cyanide | mg/kg | 1.42 | 1.42E-04 | B | Non-Organic |

Note1: Parameters analyzed as VOCs and Semi-VOCs use only one value - selection based on max detect value or min RL (if ND)

Note2:
Tox. Cat. from HSDB or ECOTOX
HOC: Halogenated
C-H: Carbon-Hydrogen
PAH: Polyaromatic Hydrocarbons



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Table 11. Land Disposal Restriction Evaluation (Fire Mountain Farms)
(WAC 173-303-100 and WAC 173-303-140)

| Toxicity Critiera (Book Designation) | | | | Persistence Criteria | | | | Organic/Carbonaceous Criteria Restriction | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Toxic Cat. | Newaukum Prairie | Big Hanaford | Burnt Ridge | Persistence Cat. | Newaukum Prairie | Big Hanaford | Burnt Ridge | Sum Org./Carb % | Newaukum Prairie | Big Hanaford | Burnt Ridge |
| X (Sum%) | 0.402% | 0.541% | 0.565% | Sum HOC% | 0.15% | 0.46% | 0.13% | Sum% | 2.14% | 10.26% | 0.49% |
| A (Sum %) | 1.568% | 1.707% | 0.058% | Sum PAH % | 0.05% | 0.09% | 0.05% | | | | |
| B (Sum %) | 0.446% | 0.603% | 0.377% | | | | | | | | |
| C (Sum %) | 3.154% | 10.370% | 1.513% | | | | | | | | |
| D (Sum %) | 11.624% | 11.786% | 10.487% | | | | | | | | |
| EC (%) | 0.568% | 0.729% | 0.577% | | | | | | | | |
| Toxicity Designation | DW (WT02) | DW (WT02) | DW (WT02) | Persistence Designation | DW (WP02) | DW (WP02) | DW (WP02) | >10%? | No | Yes | No |
| Land Disposal Restriction (WAC-173-303-140) | No | No | No | Land Disposal Restriction (WAC-173-303-140) | No | No | No | Land Disposal Restriction (WAC-173-303-140) | No | No | No |

Table 12. Comparison of Detected Concentrations of Organics and Metals in FMF Sludge to U.S. EPA National Sewage Sludge Survey (NSSS) Dataset and WAC 173-308-160 (Biosolids Pollutant Limits)

| DETECTED PARAMETERS[See Note 1] | UNITS | Max Concentration (non-detections shown as < RL) | | | WAC 173-308-160 | | USEPA National Sewage Sludge Survey Data | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Round 1 (1992)[See Note 2] | | | Round 2 (1996)[See Note 3] | | | |
| | | Newaukum Prairie | Big Hanaford | Burnt Ridge | Ceiling Limit | Pollutant Limit | Percent Detection | Mean | Standard Deviation (SD) | Percent Detection | Mean (ND = Zero) | 50th Percentile (ND = Zero) | Mean (ND - Min Level) |
| VOCs | | | | | | | | | | | | | |
| Ethylbenzene | ug/kg | 4.6 | <780 | <1.8 | | | No Data | No Data | No Data | 4% | 24.80 | 0.00 | 995.0 |
| Toluene | ug/kg | 150,000 | 120,000 | 35 | | | No Data | No Data | No Data | 61% | 40,800 | 92,400 | 41,300 |
| Metals | | | | | | | | | | | | | |
| Cadmium | mg/kg | <3 | 2 | 3 | 85 | 39 | 69% | 7.18 | 0.78 | No Data | No Data | No Data | No Data |
| Chromium | mg/kg | 27 | 29 | 45 | | | 91% | 124 | 34 | No Data | No Data | No Data | No Data |
| Cobalt | mg/kg | 89 | 165 | 48 | | | No Data | No Data | | 9% | 1.15 | 0.00 | 24 |
| Copper | mg/kg | 503 | 521 | 417 | 4,300 | 1,500 | 100% | 724 | 110 | No Data | No Data | No Data | No Data |
| Lead | mg/kg | <30 | 30 | 40 | 840 | 300 | 80% | 131 | 20 | No Data | No Data | No Data | No Data |
| Molybdenum | mg/kg | 14 | 15 | 16 | 75 | | 53% | 9.63 | 2.03 | No Data | No Data | No Data | No Data |
| Nickel | mg/kg | 30 | 42 | 45 | 420 | 420 | 67% | 46 | 12.3 | No Data | No Data | No Data | No Data |
| Silver | mg/kg | <4 | 6 | 6 | | | No Data | No Data | | No Data | No Data | No Data | No Data |
| Zinc | mg/kg | 1,060 | 1,100 | 969 | 7,500 | 2,800 | 100% | 1,220 | 151 | No Data | No Data | No Data | No Data |
| Mercury | mg/kg | 1.2 | 3 | 1.9 | 57 | 17 | 64% | 5.3 | 2.03 | No Data | No Data | No Data | No Data |
| Semi-VOCs | | | | | | | | | | | | | |
| 1,4-Dichlorobenzene | ug/kg | 750 | 1,300 | 540 | | | No Data | No Data | No Data | 2% | 88.90 | 0.00 | 9,720 |
| 4-Methylphenol | ug/kg | 2,600 | 720,000 | 1,100 | | | No Data | No Data | No Data | 43% | 46,200 | 202,000 | 52,300 |
| Benzo(b)fluoranthene | ug/kg | 360 | <570 | 380 | | | No Data | No Data | No Data | 6% | 181 | 0.0 | 9,830 |
| Benzo(k)fluoranthene | ug/kg | 340 | <570 | 360 | | | No Data | No Data | No Data | 4% | 136 | 0.0 | 9,790 |
| bis(2-Ethylhexyl)phthalate | ug/kg | 20,000 | 25,000 | 12,000 | | | 63% | 73,600 | 46,400 | 62% | 50,500 | 148,000 | 55,800 |
| Fluoranthene | ug/kg | 560 | 640 | 450 | | | No Data | No Data | No Data | 5% | 331 | 0.0 | 9,950 |
| N-Nitrosodiphenylamine | ug/kg | <300 | 1,200 | <260 | | | No Data | No Data | No Data | 1% | 101 | 0.0 | 19,400 |
| Indeno(1,2,3-cd)pyrene | ug/kg | 470 | <580 | 400 | | | No Data | No Data | No Data | 0% | 0.0 | 0.0 | 19,400 |
| Phenanthrene | ug/kg | 440 | <580 | <260 | | | No Data | No Data | No Data | No Data | No Data | No Data | No Data |
| Phenol | ug/kg | 630 | 23,000 | <260 | | | No Data | No Data | No Data | 34% | 12,200 | 0.0 | 18,700 |
| Pyrene | ug/kg | 450 | <580 | 390 | | | No Data | No Data | No Data | 5% | 320 | 0.0 | 9,950 |
| Other | | | | | | | | | | | | | |
| Aroclor 1260 | ug/kg | 40 | 35 | 61 | | | 10% | 62.3 (307) | 35.1 (43.80) | 10% | 97.20 | 0.00 | 337 |
| 2,3,7,8-TCDD[See Note 4] | pg/g | 2.76 | 0.72 | 2.35 | | | No Data | No Data | No Data | 16% | 1.71 | 0.00 | 10.80 |
| Total Cyanide | mg/kg | 1.87 | 2.39 | 1.42 | | | No Data | No Data | No Data | 37% | 14.30 | 0.00 | 35.20 |

Note 1 Shaded parameters and concentrations are above the mean values measured in the USEPA National Sewage Sludge Survey
None of the metals regulated under Washington State Biosolids Management rule had concentrations exceeding the State's limits (Chapter WAC 173-308-160)

Note 2 Values are from Tables 7-9 and 7-10 (U.S. EAP, 1992 Statistical Support Documentation for the 40 CFR, Part 503 - Final Standards for the Use or Disposal of Sewage Sludge)
For all parameters with detection frequency (df) > 10%, mean value is based on the "Multi-Censored, Maximum-Likelihood Method" under an assumption of a log normal distribution
df </= 10%, mean value based on a non-parammetric method. Lower values for Aroclor 1260 assume non-detects = zero and higher value assumes non-detects = reporting limit

Note 3 Tables 3 and 4 in Appendix B (U.S. EPA, 1996 Technical Support Document for the Round Two Sewage Sludge Pollutants)

Note 4 2,3,7,8-TCDD were flagged by the analytical laboratory as Estimated Maximum Possible Concentration (JEMPC) due to sludge matrix and moisture content.
JEMPC data is not considered sufficiently accurate to serve as a basis for regulatory decisions.

Table 13. Parameter Exceedance Factors in Composite Sludge Samples from Fire Mountain Farms, Inc. (Exceedance of the NSSS mean)

| | | | Exccedance Factors in Composite Sluge Samples | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Newaukum Prairie | | | Big Hanaford | | | Burnt Ridge | | |
| Parameter | Units | NSSS Mean | Comp-1 | Comp-2 | Comp-3 | Comp-1 | Comp-2 | Comp-3 | Comp-1 | Comp-2 | Comp-3 |
| Toluene | ug/kg | 40,800 | 3.4 | 3.7 | 3.2 | 0.2 | 2.9 | 2.0 | 0.00 | 0.00 | 0.00 |
| Cobalt | mg/kg | 1.15 | 66.1 | 75.7 | 77.4 | 13.0 | 55.7 | 143.5 | 37.4 | 41.7 | 32.2 |
| Molybdenum | mg/kg | 9.63 | 1.2 | 1.3 | 1.5 | 1.2 | 1.6 | 1.3 | 1.5 | 1.7 | 1.7 |
| 4-Methylphenol | ug/kg | 46,200 | 0.05 | 0.05 | 0.06 | 10.4 | 15.6 | 11.7 | 0.02 | 0.01 | 0.01 |
| Phenol | ug/kg | 12,200 | 0.04 | 0.05 | 0.03 | 1.1 | 1.9 | 1.3 | ND | ND | ND |

Exceedance Factor = NSSS Mean/Analytical Results.

Shaded = Exceedance Factor > 1 (analytical results are higher than the NSSS Mean value)

Only the Parameters with EF >1 in one or more samples from one or more sites are shown

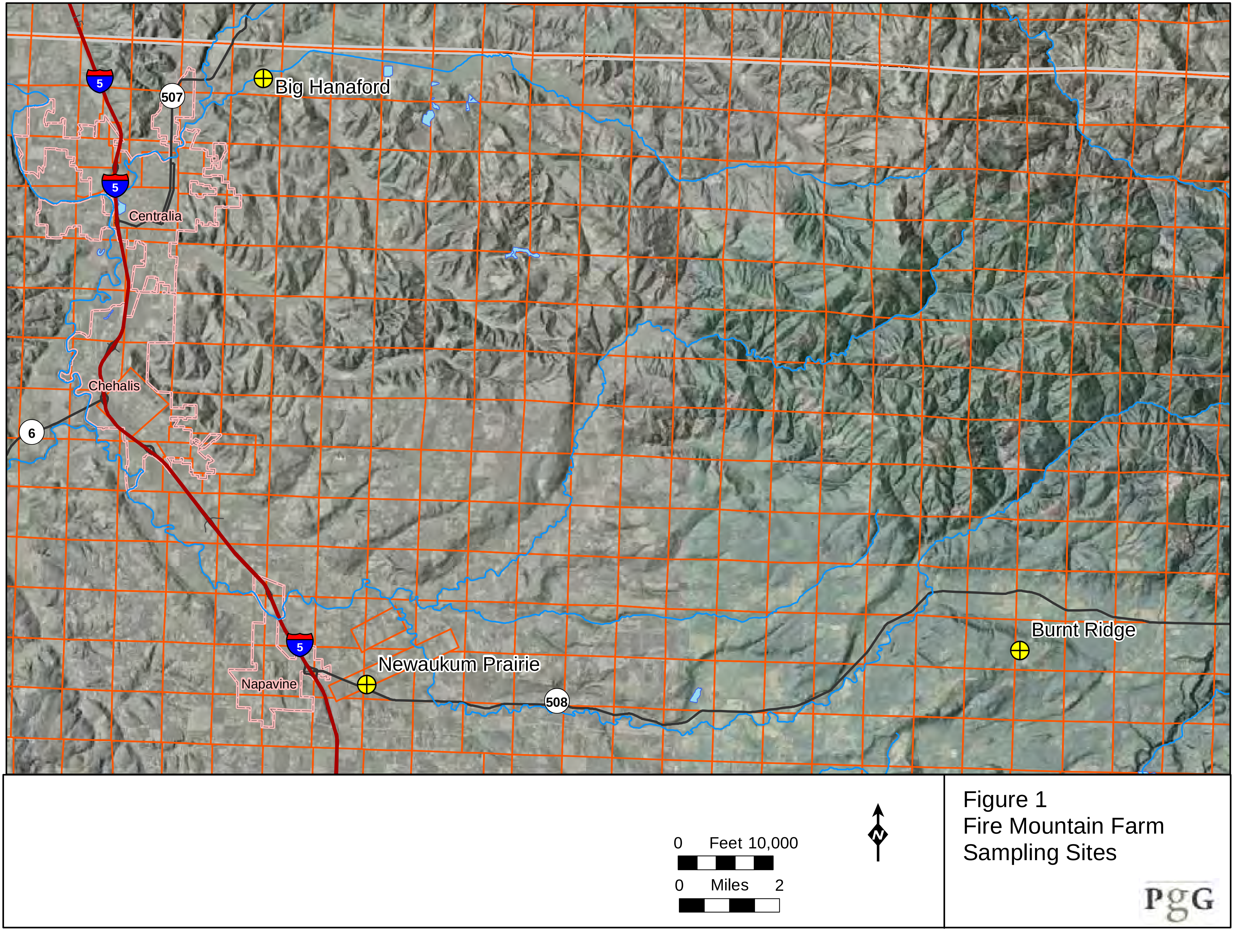


Figure 1
Fire Mountain Farm
Sampling Sites

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K:\Linton\FireMtn_JW9901\GIS\FireMtFarmSites.mxd 6/18/2014

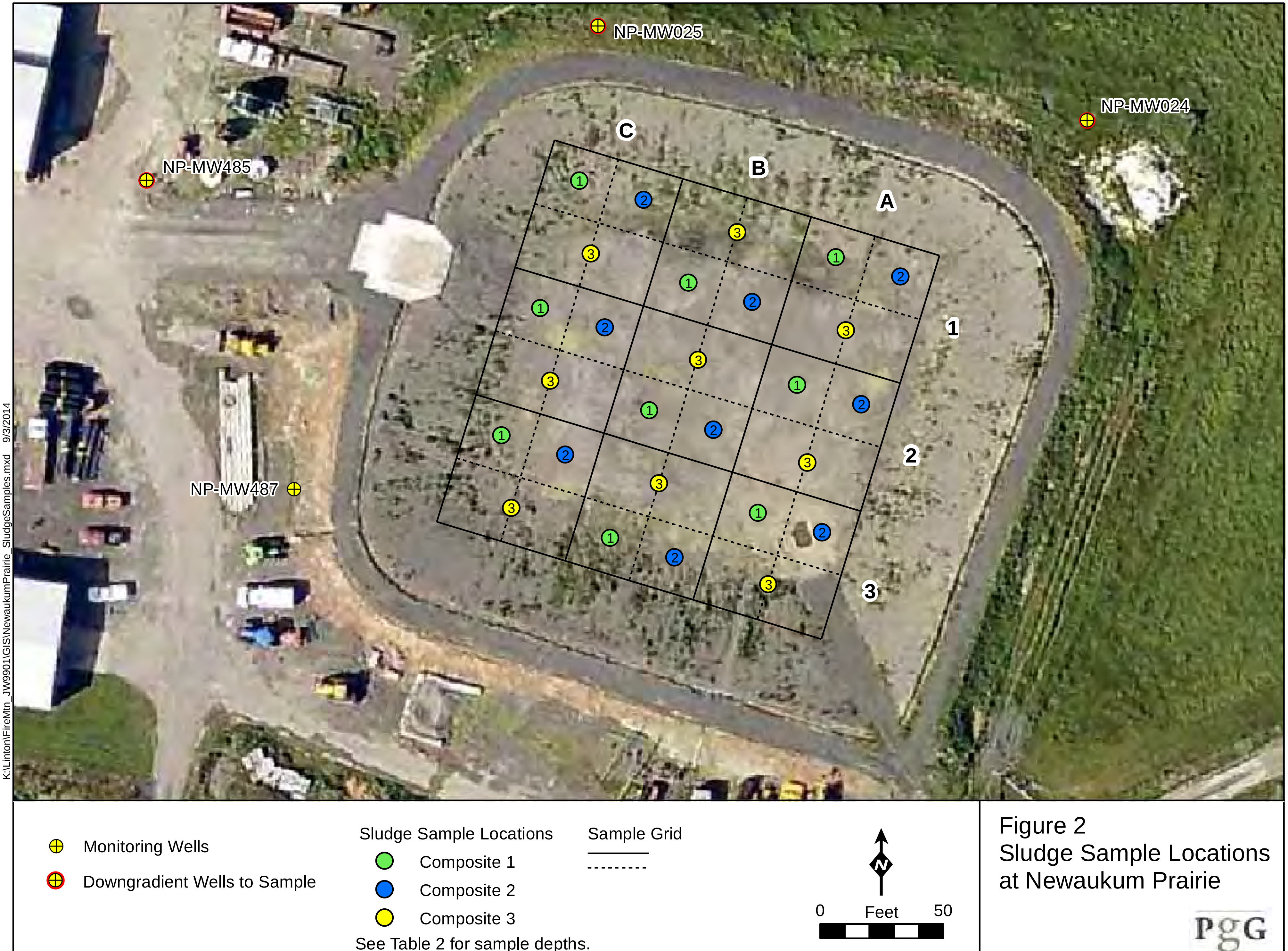


Figure 2
Sludge Sample Locations
at Newaukum Prairie

K:\Linton\FireMtn_JW9901\GIS\NewaukumPrairie_SludgeSamples.mxd 9/3/2014


Sludge Sample Locations
- Composite 1
- Composite 2
- Composite 3
- Sample Grid

See Table 2 for sample depths.

N

0 Feet 50

# Figure 3
Sludge Sample Locations
at Big Hanaford

PgG

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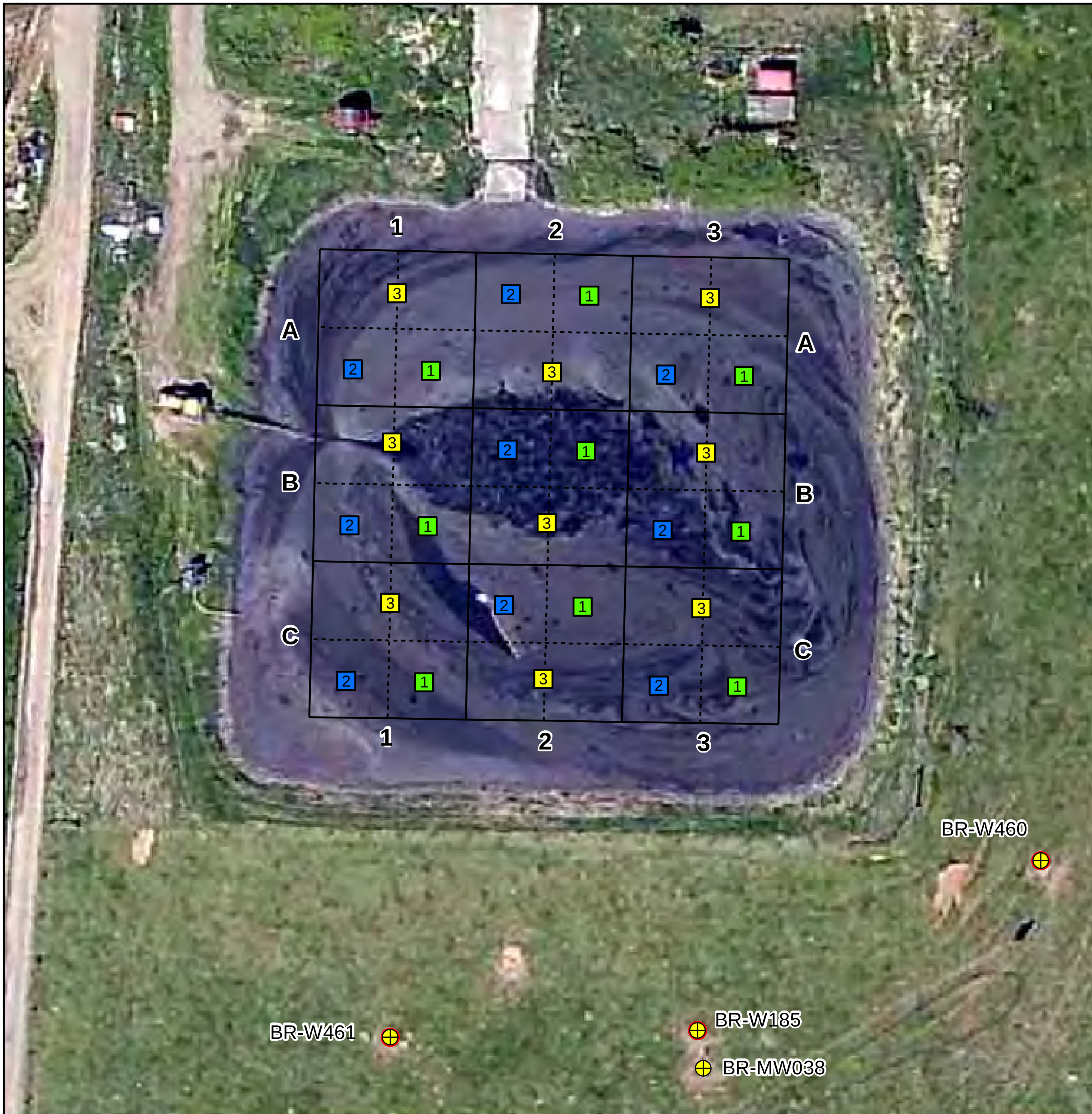
# Figure 4
# Sludge Sample Locations at Burnt Ridge




Sludge Sample Locations
- Composite 1
- Composite 2
- Composite 3

Sample Grid

Monitoring Wells

Downgradient Wells to Sample

See Table 2 for sample depths.

N

0 Feet 50

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# Figure 5
# Water Cap Sample Locations at Burnt Ridge

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Water Sample Locations

Sample Grid

Monitoring Wells

Downgradient Wells to Sample

N

0 Feet 50

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# APPENDIX A
# QUALITY ASSURANCE AND QUALITY CONTROL

Analytical data collected for this investigation have been validated in accordance with the QAPP, including both laboratory and field quality assurance quality control procedures (PGG, 2014). Tables A1 through A4 provide a summary of the quality assurance and quality control evaluation for each site

Sludge samples from the Newaukum Prairie, Big Hanaford, and Burnt Ridge storage sites were collected and delivered to Analytical Resources, Inc. (ARI) on July 7, through July 9, 2014. Water cap samples from the Burnt Ridge site were collected and delivered to Analytical Resources, Inc. (ARI) on July 17, 2014. Fecal coliform sludge samples were collected on July 7, through July 9, 2014 and run by Water Management Laboratories, Inc.

All analyses were completed within their respective holding times. Surrogate spikes, blank spikes, and standard references were added to samples for analyses, and recoveries were all within acceptable ranges. Method blanks were run for all analytes and no analytes were detected. Trip Blanks were submitted and analyzed for volatile constituents and none were detected. The Relative Percent Differences (RPD) for all matrix spike duplicates were generally within the required limits with exceptions noted below.

The QA/QC data are satisfactory and indicate that the data are acceptable for the projects purposes. The following irregularities are noted:

- Dioxin/Furan concentrations in the Fire Mountain Farms sludge samples were less than the lab reporting limit (RL), also referred to as the practical quantitation limit (PQL). To meet project purposes, PGG requested that the lab quantify concentrations less than the RL and above the method detection limit (MDL) instead of reporting the results as non-detect at the RL. Following standard procedure, Analytical Resources Incorporated (ARI) flagged all dioxin/furan concentrations between the RL and the MDL as estimated maximum possible concentration (JEMPC).

- Total Solids analysis were not run for lab batch YR29 (Big Hanaford sludge samples for VOC analysis). As authorized by PGG, ARI reported the VOC data using the total solids from samples associated with lab batch YQ99 (Big Hanaford sludge samples for SVOC, Dioxin/Furans, metals, pH, PCBs, Pesticides, and TKN).

- Laboratory Control Samples (LCS) were run for all batches and spike recovery for dibenz (a,h) anthracene was out of control low for all batches. All other spike recoveries were within laboratory control limits. dibenz (a,h) anthracene was not detected in any of the samples.

- Continuing calibrations for 2x dilution pesticides batches YQ84, YQ99, and YR00 were out of control low, reported data were in control.

- Continuing calibrations for semi-volatile batches YQ84, YQ99, and YR00 were out of control low; these compounds were not detected in any samples.

- The reporting limits for various batches and analyses were elevated resulting from sample dilutions. Semi-volatile reporting limits for batches YQ99 and YR00 were elevated due to sample dilutions resulting from matrix interference. Pesticide reporting limits for batches YQ84, YQ99 and YR00 were elevated due to sample dilutions resulting from matrix interference.

- Matrix spike was out of control high for mercury in lab batch YQ99 no other irregularities with this analysis.

- Matrix spike was out of control low for total cyanide in lab batch YQ84 no other irregularities with this analysis.

- Matrix spike relative percent difference was outside the laboratory control limits for lab batch YQ99, cobalt in sample BH-COMP1. All other analytes were in control and there were no other irregularities with this analysis.

- Continuing calibration was out of control low for batches YQ80, YQ96, and YR29, VOC analyses, bromomethane. All other constituents were in control, there were no other irregularities.

- Surrogate recoveries for d8-toluene in samples NP-COMP-2 and NP-COMP-3 were out of control low, samples were reanalyzed, and surrogate recoveries were in control.

- The matrix spike duplicate for 1,2,4-Trichlorobenzen in lab batch YQ80 was out of control low. All other recoveries were in control, and there were no other irregularities with the analyses.

- Continuing calibration was out of control low for lab batch YS17, 3,3-Dichlorobenzidine. All other analytes were in control, there were no other irregularities.

- Matrix spike matrix spike duplicate relative percent difference was low for lab batch YS17 nitrate/nitrite, water cap sample BR-COMP.

Table A1. Quality Assurance Quality Control Summary for Sludge Samples at Newaukum Prairie

| LAB BATCH ID | yq80 | yq84 | yq84 | yq84 | yq84 | yq84 | yq84 | yq84 | yq84 | yq84 | | yq84 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **METHODOLOGY** | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge |
| Method | VOCS SW8260 | SVOCS SW8270 | Metals | Nitrate/Nitrite | PCBs Aroclor | Pesticides | TKN | Total Solids | pH | 2,3,7,8 TCDD | Total Coliform | Total cyanide |
| Date Sampled | July 7, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 7, 2014 | July 9, 2014 |
| Date Extracted | July 14, 2014 | July 14, 2014 | July 10, 2014 | July 10, 2014 | July 16, 2014 | July 14, 2014 | July 10, 2014 | July 10, 2014 | July 9, 2014 | September 1, 2014 | July 7, 2014 | July 21, 2014 |
| Date Analyzed | July 14, 2014 | July 17, 2014 | July 14, 2014 | July 10, 2014 | July 20, 2014 | 7/17/2014-7/19/2014 | July 10, 2014 | July 10, 2014 | July 9, 2014 | September 4, 2014 | July 7, 2014 | July 21, 2014 |
| Holding Time | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good |
| Acceptability | Good | Good, continuing calibration is out of control low. | Good | Good | Good | Good, raised reporting limits due to sample dilution. | Good | Good | Good | Concentrations between PQL/RL and MDL flagged as estimated | Good | Good |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **SURROGATE SPIKES/Standard Reference Results (Conventionals)/Blank Spikes (metals)** | | | | | | | | | | | | |
| Sample Spike Recovery | Within Range | Within Range | Within Range | Within Range | Within Range | Within Range | NA | NA | NA | NA | NA | Within Range |
| Acceptability | Good | Good | Good | Good | Good | Good | NA | NA | NA | NA | NA | Good |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **MS/MSD** | | | | | | | | | | | | |
| MS Recovery | Within Range | NA | NA | Within Range | NA | NA | NA | NA | NA | NA | NA | Within Range |
| DMS Recovery | Within Range (out of control low 1,2,4 trichlorobenzene) | NA | NA | Within Range | NA | NA | NA | NA | NA | NA | NA | Within Range, matrix spike recovery for total cyanide was out of cotrol low, all other spike recoveries were within lab control limits. |
| Surrogate Recovery | Within Range | NA | NA | Within Range | NA | NA | NA | NA | NA | NA | NA | Within Range |
| RPD | Within Range | NA | NA | Within Range | NA | NA | NA | NA | NA | NA | NA | Within Range |
| Acceptability | Good | NA | NA | Good | NA | NA | NA | NA | NA | NA | NA | Good |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **METHOD BLANK** | | | | | | | | | | | | |
| Detections | None | None | None | None | None | None | None | None | NA | None | NA | None |
| Acceptability | Good | Good | Good | Good | Good | Good | Good | Good | NA | Good | NA | Good |
| | | | | | | | | | | | | |
| **TRIP BLANK** | | | | | | | | | | | | |
| Detections | None | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | Good | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| **FIELD BLANK** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Detections | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| **FIELD DUPLICATES** | | | | | | | | | | | | |
| Sample: | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| RPD | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| **LAB DUPLICATES** | | | | | | | | | | | | |
| RPD | NA | NA | NA | Within Range | NA | NA | NA | NA | Within Range | NA | NA | Within Range |
| Acceptability | NA | NA | NA | Good | NA | NA | NA | NA | Good | NA | NA | Good |
| | | | | | | | | | | | | |
| **LAB CONTROL** | | | | | | | | | | | | |
| Spike Recovery | Within Range | Within Range, LCS/LCSD spike recovery is out of control low for dibenz (a,h) anthracene, all other recoveries were in control. | Within Range | NA | NA | Within Range | Within Range | NA | Within Range | Within Range | NA | NA |
| Surrogate Recovery | Within Range | Within Range | Within Range | NA | NA | Within Range | Within Range | NA | Within Range | Within Range | NA | NA |
| Acceptability | Good | Good | Good | NA | NA | Good | Good | NA | Good | Good | NA | NA |
| | | | | | | | | | | | | |
| **COC** | | | | | | | | | | | | |
| Acceptability | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good |

1. All other QA/QC = good, samples not flagged
2. RPD >30%, Samples "J" Flagged
RPD = 2 x (C1 - C2) x 100/(C1 + C2)

Table A2. Quality Assurance Quality Control Summary for Sludge Samples at Big Hanaford

| **LAB BATCH ID** | yr29 | yq99 | yq99 | yq99 | yq99 | yq99 | yq99 | yq99 | yq99 | yq99 | | yq99 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **METHODOLOGY** | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge |
| Method | VOCS SW8260 | SVOCS SW8270 | Metals | Nitrate/Nitrite | PCBs Aroclor | Pesticides | TKN | Total Solids | pH | 2,3,7,8 TCDD | Total Coliform | Total cyanide |
| Date Sampled | July 8, 2014 | July 8, 2014 | July 7, 2014 | July 8, 2014 | July 8, 2014 | July 8, 2014 | July 8, 2014 | July 8, 2014 | July 8, 2014 | July 8, 2014 | July 8, 2014 | July 8, 2014 |
| Date Extracted | July 15, 2014 | July 14, 2014 | July 11, 2014 | July 10, 2014 | July 16, 2014 | July 14, 2014 | July 10, 2014 | July 14, 2014 | July 14, 2014 | September 1, 2014 | July 8, 2014 | July 21, 2014 |
| Date Analyzed | July 15, 2014 | July 17, 2014 | July 15, 2014 | July 10, 2014 | July 20, 2014 | July 19, 2014 | July 10, 2014 | July 14, 2014 | July 14, 2014 | September 4, 2014 | July 8, 2014 | July 21, 2014 |
| Holding Time | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good |
| Acceptability | Good | Good, continuing calibration is out of control low. | Good | Good | Good | Good, raised reporting limits due to sample dilution. | Good | Good | Good | Concentrations between PQL/RL and MDL flagged as estimated | Good | Good |
| | | | | | | | | | | | | |
| **SURROGATE SPIKES/Standard Reference Results (Conventionals)/Blank Spikes (metals)** | | | | | | | | | | | | |
| Sample Spike Recovery | Within Range | Within Range | Within Range | Within Range | Within Range | Within Range | Within Range | NA | NA | NA | NA | Within Range |
| Acceptability | Good | Good | Good | Good | Good | Good | Good | NA | NA | NA | NA | Good |
| | | | | | | | | | | | | |
| **MS/MSD** | | | | | | | | | | | | |
| MS Recovery | NA | NA | Within Range , Matrix spike recovery was outside laboratory recovery limits for mercury, all other spike recoveries were within control limits. | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| DMS Recovery | NA | NA | Within Range | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Surrogate Recovery | NA | NA | Within Range | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| RPD | NA | NA | Within Range except the following; MS RPD cadmium 66.7%. Cobalt 30.8%, lead 40%, silver 40% | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | NA | NA | Good | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| **METHOD BLANK** | | | | | | | | | | | | |
| Detections | None | None | None | None | None | None | None | None | NA | None | NA | None |
| Acceptability | Good | Good | Good | Good | Good | Good | Good | Good | NA | Good | NA | Good |
| | | | | | | | | | | | | |
| **TRIP BLANK** | | | | | | | | | | | | |
| Detections | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| **FIELD BLANK** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Detections | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| **FIELD DUPLICATES** | | | | | | | | | | | | |
| Sample: | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| RPD | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| **LAB DUPLICATES** | | | | | | | | | | | | |
| RPD | NA | NA | NA | NA | NA | NA | NA | Within Range | Within Range | NA | NA | Within Range |
| Acceptability | NA | NA | NA | NA | NA | NA | NA | Good | Good | NA | NA | Good |
| | | | | | | | | | | | | |
| **LAB CONTROL** | | | | | | | | | | | | |
| Spike Recovery | Within Range | Within Range, LCS/LCSD spike recovery is out of control low for dibenz (a,h) anthracene, all other recoveries were in control. | NA | NA | Within Range | Within Range | Within Range | NA | Within Range | Within Range | NA | NA |
| Surrogate Recovery | Within Range | Within Range | NA | NA | Within Range | Within Range | Within Range | NA | Within Range | Within Range | NA | NA |
| Acceptability | Good | Good | NA | NA | Good | Good | Good | NA | Good | Good | NA | NA |
| | | | | | | | | | | | | |
| **COC** | | | | | | | | | | | | |
| Acceptability | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good |

1. All other QA/QC = good, samples not flagged
2. RPD >30%, Samples "J" Flagged
RPD = 2 x (C1 - C2) x 100/(C1 + C2)

Table A3. Quality Assurance Quality Control Summary for Sludge Samples at Burnt Ridge

| **LAB BATCH ID** | yq96 | yr00 | yr00 | yr00 | yr00 | yr00 | yr00 | yr00 | yr00 | yr00 | | yr00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **METHODOLOGY** | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge | Sludge |
| Method | VOCS SW8260 | SVOCS SW8270 | Metals | Nitrate/Nitrite | PCBs Aroclor | Pesticides | TKN | Total Solids | pH | 2,3,7,8 TCDD | Total Coliform | Total cyanide |
| Date Sampled | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 | July 9, 2014 |
| Date Extracted | July 15, 2014 | July 14, 2014 | July 11, 2014 | July 10, 2014 | July 16, 2014 | July 14, 2014 | July 10, 2014 | July 14, 2014 | July 14, 2014 | September 1, 2014 | July 9, 2014 | July 21, 2014 |
| Date Analyzed | July 15, 2014 | July 17, 2014 | July 15, 2014 | July 10, 2014 | July 20, 2014 | 7/18/2014-7/19/2014 | July 10, 2014 | July 14, 2014 | July 14, 2014 | September 4, 2014 | July 9, 2014 | July 21, 2014 |
| Holding Time | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good |
| Acceptability | Good | Good, continuing calibration is out of control low. | Good | Good | Good | Good, raised reporting limits due to sample dilution. | Good | Good | Good | Concentrations between PQL/RL and MDL flagged as estimated | Good | Good |
| | | | | | | | | | | | | |
| **SURROGATE SPIKES/Standard Reference Results (Conventionals)/Blank Spikes (metals)** | | | | | | | | | | | | |
| Sample Spike Recovery | Within Range | Within Range | Within Range | Within Range | Within Range | Within Range | Within Range | NA | NA | NA | NA | Within Range |
| Acceptability | Good | Good | Good | Good | Good | Good | Good | NA | NA | NA | NA | Good |
| | | | | | | | | | | | | |
| **MS/MSD** | | | | | | | | | | | | |
| MS Recovery | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| DMS Recovery | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Surrogate Recovery | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| RPD | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| **METHOD BLANK** | | | | | | | | | | | | |
| Detections | None | None | None | None | None | None | None | None | NA | None | NA | None |
| Acceptability | Good | Good | Good | Good | Good | Good | Good | Good | NA | Good | NA | Good |
| | | | | | | | | | | | | |
| **TRIP BLANK** | | | | | | | | | | | | |
| Detections | None | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | Good | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| **FIELD BLANK** | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Detections | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| **FIELD DUPLICATES** | | | | | | | | | | | | |
| Sample: | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| RPD | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| **LAB DUPLICATES** | | | | | | | | | | | | |
| RPD | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acceptability | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| **LAB CONTROL** | | | | | | | | | | | | |
| Spike Recovery | Within Range | Within Range, LCS/LCSD spike recovery is out of control low for dibenz (a,h) anthracene, all other recoveries were in control. | NA | NA | Within Range | Within Range | Within Range | NA | Within Range | Within Range | NA | NA |
| Surrogate Recovery | Within Range | Within Range | NA | NA | Within Range | Within Range | Within Range | NA | Within Range | Within Range | NA | NA |
| Acceptability | Good | Good | NA | NA | Good | Good | Good | NA | Good | Good | NA | NA |
| | | | | | | | | | | | | |
| **COC** | | | | | | | | | | | | |
| Acceptability | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good | Good |

1. All other QA/QC = good, samples not flagged
2. RPD >30%, Samples "J" Flagged
RPD = 2 x (C1 - C2) x 100/(C1 + C2)

Table A4. Quality Assurance Quality Control Summary for Water Cap Samples at Big Hanaford

| **BATCH** | ys16 | ys17 | ys17 | ys17 | ys17 |
|---|---|---|---|---|---|
| **METHODOLOGY** | Watercap | Watercap | Watercap | Watercap | Watercap |
| Method | VOCS SW8260 | SVOCS SW8270 | Metals | Nitrate/Nitrite | Total cyanide |
| Date Sampled | July 17, 2014 | July 17, 2014 | July 17, 2014 | July 17, 2014 | July 17, 2014 |
| Date Extracted | July 25, 2014 | July 21, 2014 | July 21, 2014 | 7/18/2014-7/23/2014 | July 28, 2014 |
| Date Analyzed | July 25, 2014 | July 23, 2014 | 7/22/2014-7/24/2014 | 7/18/2014-7/23/2014 | July 28, 2014 |
| Holding Time | Good | Good | Good | Good | Good |
| Acceptability | Good | Good | Good | Good | Good |
| | | | | | |
| | | | | | |
| **SURROGATE SPIKES/Standard Reference Results (Conventionals)/Blank Spikes (metals)** | | | | | |
| Sample Spike Recovery | Within Range | Within Range | Within Range | Within Range | Within Range |
| Acceptability | Good | Good | Good | Good | Good |
| | | | | | |
| | | | | | |
| **MS/MSD** | | | | | |
| MS Recovery | NA | NA | NA | Within Range, Matrix spike matrix spike duplicate relative percent difference was low for lab batch YS17 nitrate/nitrite, water cap sample BR-COMP. | Within Range |
| DMS Recovery | NA | NA | NA | Within Range | Within Range |
| Surrogate Recovery | NA | NA | NA | Within Range | Within Range |
| RPD | NA | NA | NA | Within Range | Within Range |
| Acceptability | NA | NA | NA | Good | Good |
| | | | | | |
| | | | | | |
| **METHOD BLANK** | | | | | |
| Detections | None | None | None | None | None |
| Acceptability | Good | Good | Good | Good | Good |
| | | | | | |
| **LAB DUPLICATES** | | | | | |
| RPD | NA | NA | NA | Within Range | Within Range |
| Acceptability | NA | NA | NA | Good | Good |
| | | | | | |
| **LAB CONTROL** | | | | | |
| Spike Recovery | Within Range | Within Range | Within Range | NA | NA |
| Surrogate Recovery | Within Range | Within Range | Within Range | NA | NA |
| Acceptability | Good | Good | Good | NA | NA |
| | | | | | |
| **COC** | | | | | |
| Acceptability | Good | Good | Good | Good | Good |
| | | | | | |
| | | | | | |

1. All other QA/QC = good, samples not flagged
2. RPD >30%, Samples "J" Flagged
RPD = 2 x (C1 - C2) x 100/(C1 + C2)

# APPENDI B
# FIELD PHOTOS

**Field Photos from Burnt Ridge Site:**

**Field Photos from Newaukum Prairie Site:**

**Field Photos from Big Hanaford Site:**

# APPENDI C
# LABORATORY REPORTS

APPENDIX B

# Pacific Groundwater Group: Fire Mountain Farms, Inc. Quality Assurance Project Plan

PACIFIC groundwater GROUP

# FIRE MOUNTAIN FARMS, INC.
# QUALITY ASSURANCE PROJECT PLAN
# INVESTIGATION OF
# EMERALD KALAMA CHEMICAL SLUDGE COMINGLED WITH BIOSOLIDS FROM OTHER PERMITTED SOURCES AT THREE STORAGE SITES

**JULY 2014**

# FIRE MOUNTAIN FARMS, INC.
# QUALITY ASSURANCE PROJECT PLAN
# INVESTIGATION OF
# EMERALD KALAMA CHEMICAL SLUDGE COMINGLED WITH BIOSOLIDS FROM OTHER PERMITTED SOURCES AT THREE STORAGE SITES

*Prepared for:*

**Fire Mountain Farms, Inc.**
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*Prepared by:*

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*July 2, 2014*
*JW9901.01*
*FireMountain_QAPP_EcologyFinal_v3.docx*

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## SIGNATURE

This report, and Pacific Groundwater Group's work contributing to this report, were reviewed by the undersigned and approved for release.


**Janet K. Knox**
Principal Geochemist
Washington State Geologist No. 413

# 1.0 INTRODUCTION

Pacific Groundwater Group (PGG) has prepared this Quality Assurance Project Plan (QAPP) for Fire Mountain Farms, Inc. (FMF) for sampling and investigative work to be conducted at three biosolids storage sites operated by FMF. The investigative work is being conducted to meet the requirements of an Administrative Order (Docket #10721) issued by the Washington Department of Ecology (Ecology) on June 2, 2014.

This QAPP has been prepared in accordance with Ecology guidelines for preparing QAPPs for environmental studies (Publication No. 04-03-030 July 2004). Investigative work specified in this QAPP will commence as soon as the final QAPP is approved by Ecology. Once approved, the field work should be able to commence with about one week of preparation time.

## BACKGROUND

Fire Mountain Farms, Inc. (FMF) operates several facilities in Lewis County where biosolids are applied to fields as fertilizer under the Washington State General Permit for Biosolids Management. On June 2, 2014 FMF was issued an Administrative Order (AO), Docket #10721 by Ecology.

The AO was issued in response to Ecology's uncertainty in the current designation of waste generated at Emerald Kalama Chemical. FMF has been receiving clarifier solids from Emerald Kalama Chemical's wastewater treatment plant and mixing it with biosolids managed under FMF's General Permit for Biosolids (Chapter 173-308 WAC). As stated in the AO, although material from Emerald Kalama Chemical was registered through the year 2003 with the Washington State Department of Agriculture for use as a waste-derived commercial fertilizer product, the material being sent to FMF is not currently registered nor has it been tested for designation and there is concern it may designate as a listed dangerous waste under Chapter 173-303 WAC. As stated in the AO, Ecology is currently conducting an investigation into the designation and characteristics of the material received from Emerald Kalama Chemical.

Under the AO, Ecology is requiring FMF to cease receiving materials from Emerald Kalama Chemical and to cease land application of all stored materials currently mixed with wastes received from Emerald Kalama Chemical. Ecology is also requiring FMF to undergo a rigorous investigation to sample and characterize the material at the three FMF sites where material mixed with wastes from Emerald Kalama Chemical is currently being stored (Figure 1):

- Newaukum Prairie Surface Impoundment
- Burnt Ridge Surface Lagoon
- Big Hanaford Bunker

As stated in the AO, sample collection must follow an Ecology approved QAPP that shall specify a rigorous method of sampling (gridding, randomized sampling, compositing, etc.) to address the heterogeneity of the materials stored at the three sites.

The AO requested that Ecology be notified of the vector attraction reduction (VAR) option to be used at each site listed above. For the Burnt Ridge and Newuakum Prairie sites, FMF uses the Volatile Solids Reduction (Alternative 1) in accordance with Chapter 173-308-180(1)(a) of the Biosolids Management Rule. For the Big Hanaford Bunker Site, FMF uses the Incorporation Option (Section 10.5.2) in the Washington State General Permit for Biosolids Management.

# 2.0 PURPOSE AND OBJECTIVES

The purpose of this plan is to present field and analytical procedures that will be used to characterize the material at the three FMF sites where material mixed with wastes from Emerald Kalama Chemical is currently being stored (Figure 1):

- Newaukum Prairie Impoundment
- Burnt Ridge Lagoon
- Big Hanaford Bunker

Three downgradient groundwater monitoring wells at the Burnt Ridge and Newaukum Prairie will also be sampled to characterize groundwater quality in the vicinity of those sites. This plan also presents the field and analytical procedures to collect those groundwater samples.

This plan presents field observations and sampling procedures, analytical methods, and data evaluation methods to be implemented for this investigation. The plan also identified data quality objectives and quality control measures and validation procedures.

This QAPP has been prepared in accordance with Ecology guidelines for preparing QAPPs for environmental studies (Publication No. 04-03-030 July 2004).

# 3.0 PROJECT ORGANIZATION AND HEALTH AND SAFETY

The following section describes project organization and responsibilities for conducting the work in this QAPP.

## 3.1 PROJECT ORGANIZATION

The project team is formed by Fire Mountain Farms Inc. (FMF), Pacific Groundwater Group (PGG), and Washington State Department of Ecology (Ecology):

| | |
|---|---|
| FMF: | Robert Thode (Owner) |
| PGG: | Janet Knox (Principal)<br>Linton Wildrick (Project Manager)<br>Dawn Chapel (Assistant Project Manager)<br>Travis Klaas (Field Geologist) |

Ecology: Jamie Olivarez (Site Manager)
Peter Lyon (Waste 2 Resources Program)
Tom Culhane (Hydrogeologist)

FMF is owned by Robert Thode. Mr. Thode and his employees will assist PGG with site access and field sampling. FMF will follow their own health and safety plan for conducting their work. PGG personnel will be responsible for project management, data collection, data management, and reporting. Ecology is the lead regulatory agency for the project. Ecology staff will provide regulatory oversight and approvals.

## 3.2 PGG HEALTH AND SAFETY

PGG will be responsible for the health and safety of PGG personnel conducting the field investigation and will follow their own health and safety plan. All PGG field personnel will have 40 hour HAZWOPER training. PGG personnel will wear the following personal protective equipment during sludge sampling:

- Disposable Tyvek suits or chest waders to keep sludge materials off personal clothing
- Knee high rubber boots
- Safety Glasses
- Respirator (to be worn if odors become strong)
- Disposable Nitrile Gloves (during sampling and decontamination)

# 4.0 SLUDGE AND WATER CAP SAMPLING PROCEDURES

Sludge samples will be collected at the following storage sites at Fire Mountain Farms:

- Burnt Ridge Lagoon (Figure 2)
- Newaukum Prairie Impoundment (Figure 3)
- Big Hanaford Bunker (Figure 4)

A composite liquid sample will also be collected from the water cap at the Burnt Ridge Lagoon. The purpose of sampling the three storage sites is to fully characterize the material currently stored at those sites. A rigorous characterization strategy is required to address the heterogeneity of the material. The sludge sample strategy will be the same at all three sites:

- A uniform grid will be staked out at each site and samples will be collected using coring devices at various locations and depths (details described below for each site). The grid will be staked out using measuring tapes. Three composited samples will be collected at each site. Each composited sample will consist of pooling together a number of subsamples collected at prescribed locations and depths within the gridded area (see details below).

- At the Burnt Ridge site, a composited sample of the water cap (liquid) will also be collected. The composited sample will consist of pooling together a number of sub-samples collected at prescribed locations and depths within the gridded area (see details below).
- Sampling equipment will be thoroughly decontaminated between sites (see below). During subsampling at each site, sample core tools will be rinsed of sludge (as described below) but not decontaminated. Since the samples are to be composited, it is not necessary to decontaminate equipment between subsamples at a particular site.

FMF personnel will be responsible for collection of actual sludge cores and liquids. FMF personnel will follow their own health and safety plan to collect the samples. PGG personnel will observe sampling work performed by FMF personnel and coordinate with sample locations. PGG will composite the core and liquid samples and fill laboratory bottles. PGG will also maintain detailed field notes including:

- Maps of site grid pattern (see below) and detailed notes on location of each subsample and associated grid coordinates.
- Take photos of sampling activity and photos of all composited samples (each photo of composited sample will have a sample ID placed next to the sample to be able identify it later).
- Visual appearance of each subsample will be noted on field sheets (color, consistency, odor, or any other notable observation).

Sludge samples from each site may be sampled with slightly different coring tools to contend with site specific conditions at each site. The coring tools recommended for each site have been field tested by FMF personnel and should be capable of collecting samples through most of the thickness of sludge materials stored at each site (see below). Although the following methods have been considerably thought-out and tested, unforeseen field conditions may warrant alteration of the methods described below. Ecology personnel will be on-site overseeing field work and will be available to consult. No deviations from the methods described below will occur without Ecology approval.

The following sections describe the necessary field equipment for conducting the sludge sampling followed by detailed sampling procedures to be conducted at each site.

## 4.1 SLUDGE AND WATER CAP SAMPLING FIELD EQUIPMENT LIST

- Sample bottles, cooler, labels, COC forms, and ice
- Packing Tape
- 3 boxes of Zip-Lock b ags
- 250 yards of heavy mil plastic sheeting
- 50 survey stakes
- Sledge hammer
- Two 50 foot measuring tape

- Fifteen foot measuring rod
- 10 stainless steel sampling spoons
- 5 stainless steel measuring cups
- 3 large (8 quarts) stainless steel mixing bowls
- 16 glass sampling jars with lids (32 oz)
- 1 gallon glass jar
- Field labels (at least 100)
- 6 black sharpie pens and 4 regular pens
- Camera
- Two boxes of nitrile sampling gloves
- Alconox detergent
- Long handled scrub brushes (including one bottle brush 1.5 inch and 2 inch diameter)
- 15 gallons of De-ionized water
- 1.5-inch sludge judge sampler
- 2-inch AMS sludge/sediment sampler with 10 ft extensions and 4 ft core catcher
- Twenty 4-ft AMS core liner/caps.
- Hand Auger with 10 ft extensions
- Post hole digger
- Shovel
- Five 5-gallon plastic buckets with lids
- Field Maps and field notebook
- Sampling forms
- Duct Tape
- Calculator, watch, and ruler

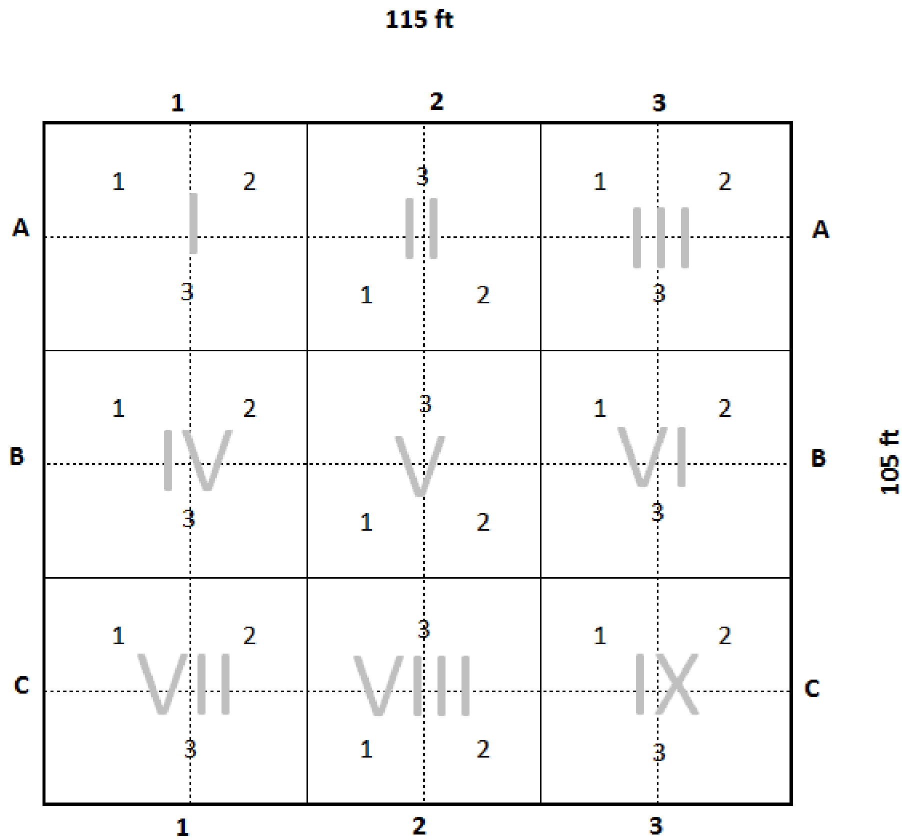
## 4.2 BURNT RIDGE SLUDGE SAMPLING PROCEDURES

The Burnt Ridge Lagoon has a water cap approximately 14 feet deep above sludge and solids stored at the bottom. The percent solids in the sludge are estimated to be 4 to 6%. The surface water dimensions of the lagoon were measured by FMF personnel on June 25, 2014 to be 215 ft by 205 ft. The lagoon's sloped interior sides extend about 50 feet from the edge indicating the bottom area of the lagoon is about 115 ft by 105 ft. Limited sludge material is currently stored at the bottom of Burnt Ridge Lagoon. The sludge material is estimated to be 3 ft thick or less.

FMF personnel will collect the core subsamples following their own guidelines and health and safety plans. It is recommended that sludge samples from the Burnt Ridge Lagoon be collected with a 1.5-inch Sludge Judge coring tool or similar device. The tool assembly comes in incremental sections that screw together and has a ball valve that allows water and sludge material into the core when lowered and seals the sample when raised. To minimize collection of water above the sludge in the sampler, a coupler with a T-valve could be added to the assembly at approximately 10 feet above the bottom of the core tool to allow water drainage while pulling the tool assembly up.

### 4.2.1 Burnt Ridge Sludge Sample Grid

A grid of 9 equal sections (labelled with roman numerals in figure below) will be staked out and coordinates labelled on all four sides of lagoon to delineate the bottom sludge extents:




Note: 1, 2, and 3 within the above grid refer to Composite Samples 1, 2, and 3 in Table 1.

Nine subsamples for each composite will be collected from a section of the grid by FMF personnel following their own health and safety plan (Table 1). This sampling pattern results in a subsample location spacing of about 20 to 35 feet.

Each subsample will be labeled based on grid location and composite number (BR-A1-1, BR-A2-1, etc.). The depth interval of the subsample will be noted on sample field sheets. Because the sludge material at the Burnt Ridge lagoon is estimated to be no more than about 3 feet thick, vertical characterization of the material at this site will not be required. About 3 ft of material will be required per subsample in order to collect 5 liters of a composite sample (total estimated volume required by the lab for a sample with 4 to 6% total solids). PGG personnel will keep detailed field notes of all sample locations, ID's, and depth intervals.

#### 4.2.2 Burnt Ridge Sludge Subsample Collection Procedure

FMF personnel will use their own health and safety plan to collect subsample cores. It is recommended that a 1.5 inch sludge judge with 1 ft incremental markings and a T-valve coupler for drainage be used to collect the samples as follows:

1. Wearing clean nitrile sampling gloves, carefully lower clean 1.5 inch sludge judge into the water and through the underlying sludge until refusal. Given the fluid loose nature of the sludge, refusal will likely be the bottom of the clay lined lagoon.

2. Pull up sludge judge tool slowly, disconnecting connections along the way. Use a T-valve coupler to drain access water above sludge sample.

3. Slowly empty sludge from core tool by tilting the end of the core slightly horizontal and using index finger to lift the ball valve as the sludge is carefully emptied into a clean 1-liter glass sample jar. Care should be taken to not let lagoon water above the sludge enter the sample jar.

4. Collect at least 1 liter of sludge material for each subsample[1]. This may require more than one core be collected for each subsample at the Burnt Ridge site. One 3-ft length core collected in a 1.5 inch core device will yield about 1 liter of material.

5. Cap and label sample jar based on composite number and grid location.

6. Rinse sludge material out of the core using a hose followed by rinse with deionized water.

7. Continue with steps #1 through #6 until all subsamples have been collected.

#### 4.2.3 Burnt Ridge Transfer of Sludge Subsamples to Lab Containers

The follow procedures will be used (in order) by PGG personnel to transfer subsamples collected in the 1 liter jars into laboratory supplied containers:

For volatile organic compounds (VOC) EPA Method 8260:

- Subsamples will be transferred directly from the 1 liter glass jar to lab containers (not mixed in field) and composited by lab to minimize disturbance and volatilization.

[1] Given the anticipated low total percent solids in the sludge (~4 to 6 %) about 4 liters of material will be required per composited sample.

- Use a clean stainless steel spoon to carefully transfer each subsample directly into laboratory supplied septa jars (Table 4). Fill material to top of jar.
- Clearly note on the lab chain-of-custody which VOC subsamples will be composited by lab

For Fecal Coliform Analysis:

- Select 7 subsamples randomly to transfer directly to lab containers[2]
- Use a clean stainless steel spoon to transfer each subsample directly into laboratory supplied jars. Fill material to top of jar.

For all other analytes, composite subsamples (Table 1) as follows:

- Use a clean stainless steel measuring cup to transfer 4.5 cups from each subsample into a clean 8 quart stainless steel bowl.
- Use a clean stainless steel sampling spoon to thoroughly mix the material in the stainless steel bowl (mix for at least 30 seconds).
- Use a clean stainless steel spoon to transfer mixed material (small portions at a time) directly into laboratory supplied jars.

All sample jars will be labeled with the following information:

  - Project name and number
  - Name of collector
  - Date and time of collection
  - Place of collection
  - The sample designation, which shall be the subsample ID
  - Analysis being requested (i.e. EPA Method 8270 VOC)
  - Presence of any preservative

Place all labelled sample containers in a cooler at 4$^{o}$C with sufficient chemical ice to retain a cold temperature for 24 hours (see below for procedures on transport of samples to lab).

## 4.3 BURNT RIDGE WATER CAP SAMPLING PROCEDURES

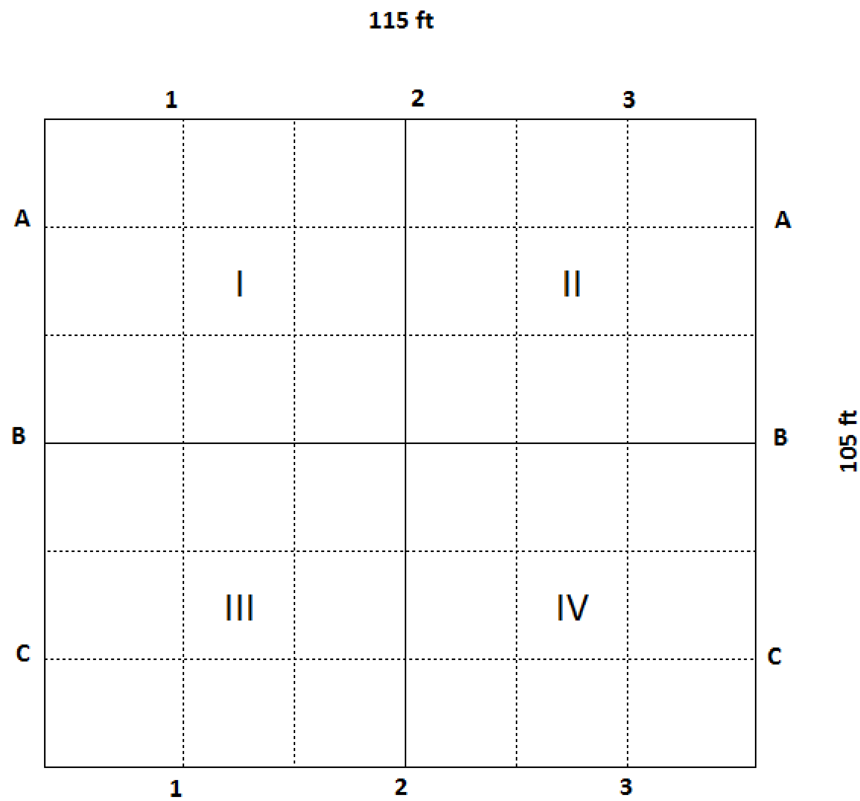
FMF personnel will collect surface water (water cap) subsamples from the Burnt Ridge Lagoon following FMF guidelines and health and safety plans. It is recommended that water samples from the Burnt Ridge Lagoon be collected with a 1.5-inch Sludge Judge coring tool or similar device and that the water samples be collected with this tool before the sludge samples are collected (see Section 5.2). The tool assembly comes in incre-

[2] In accordance with WAC 173-308-170(5) and WAC 173-308-150, a minimum of seven samples are required to be collected over a 1 year period for biosolids volume less than 320 tons dry weight. Less than 320 tons of dry weight material is stored at Burnt Ridge, therefore 7 samples will be collected with this current investigation.

mental sections that screw together and has a ball valve at the bottom that allows water into the core when lowered and seals the sample when raised. With this tool the entire 14-ft water column can be sampled. However, chemical concentrations in the water are likely to be highest near the lower part of the water column where chemical partitioning from the bottom sludge to the overlying water can occur and where volatilization of VOCs from the surface water to the atmosphere is minimal. Therefore collection of water samples will focus on the lower part of the water column (~ bottom 3 feet). Details of the sampling method are described below.

### 4.3.1 Burnt Ridge Water Sample Grid

The same grid established for sampling the sludge at the Burnt Ridge Lagoon (see Section 5.2.1) will be used to guide collection of four water subsamples within each quadrant of the Lagoon (identified with roman numerals below):




### 4.3.2 Burnt Ridge Water Subsample Collection Procedure

FMF personnel will follow the FMF health and safety plan to collect the four water subsamples. Except for VOC analysis, PGG will composite the samples and fill laboratory bottles on the shore. Subsamples for VOC analysis will be transferred directly to lab containers from the sludge judge tool and composited later by the lab to minimize disturbance and volatilization.

It is recommended that a 1.5 inch sludge judge with 1 ft incremental markings be used to collect the water subsamples as follows:

1. Using a 15-ft (or greater) measuring rod, measure the depth of the water column at the location where the sample will be collected prior to using the sludge judge to collect the sample.

2. Wearing clean nitrile sampling gloves, carefully lower clean 1.5 inch sludge judge into the water to within 6 inches of the top of the underlying sludge. A 6-inch sample separation will minimize collection of sludge into the sampler.

3. Pull up sludge judge tool slowly, disconnecting upper connections along the way, but retaining the lower 5 feet of water.

4. Using a second set of clean nitrile sampling glove, slowly transfer water from the bottom of the core tool (by tilting the end of the core slightly horizontal and using index finger to tap the ball valve) and pour sample directly into the laboratory supplied 40 mL vials for VOC analysis. Fill vials to top carefully with no headspace by forming slight meniscus before securing cap.

5. Transfer additional water from the core into a 32 oz glass jars (0.25 gallons). Approximately 3-ft of water from a 1.5-inch diameter core will fill a 32 oz glass jar.

6. Cap and label sample jar based on quadrant location for each subsample (i.e. I, II, II, or IV).

7. Empty remaining water back into the lagoon.

8. Rinse core using with de-ionized water.

9. Continue with steps #1 through #8 until all four subsamples have been collected.

### 4.3.3 Burnt Ridge Transfer of Water Subsamples to Lab Containers

The follow procedures will be used by PGG personnel to composite and transfer water subsamples collected in the 32 oz jars into laboratory supplied containers:

- Slowly pour the four 32 oz subsamples into a 1 gallon glass jar.
- Slowly swirl combined water with clean stainless steel stirring rod for at least 30 seconds.
- Transfer mixed water directly into laboratory supplied jars.

All sample jars will be labeled with the following information:

  - Project name and number
  - Name of collector
  - Date and time of collection

- Place of collection
- The sample designation, which shall be the subsample ID (i.e. BR-I, BR-II, BR-III, and BR-IV)
- Analysis being requested (i.e. EPA Method 8270 VOC)
- Presence of any preservative

Place all labelled sample containers in a cooler at 4°C with sufficient chemical ice to retain a cold temperature for 24 hours (see below for procedures on transport of samples to lab).

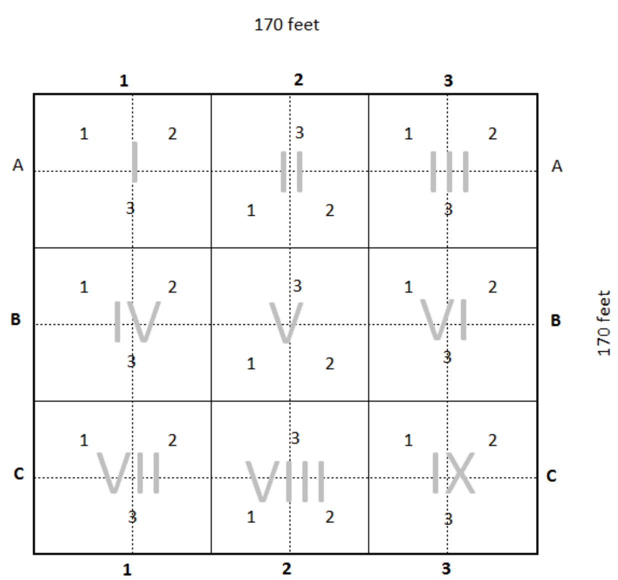
## 4.4 NEWAUKUM PRAIRIE SLUDGE SAMPLING PROCEDURES

The Newaukum Prairie lagoon was recently re-constructed and lined. The lagoon does not have a water cap. The current dimensions of the sludge are estimated to be 8 to 9 ft thick measuring roughly 100 ft by 100 ft at the bottom and 170 ft by 170 ft at the surface. The percent solids in the sludge are estimated to be about 7%.

It is recommended that sludge samples from the Newaukum Prairie Lagoon be collected with a 1.5-inch Sludge Judge coring tool. The tool assembly comes in sections that screw together and has a ball valve that allows sludge material into the core when lowered and seals the sample when raised.

### 4.4.1 Newaukum Prairie Sample Grid

A grid of 9 equal sections (labelled with roman numerals in figure below) will be staked out and coordinates labelled on all four sides of the lagoon to delineate the sludge extents:




Note: 1, 2, and 3 within the above grid refer to Composite Samples 1, 2, and 3 in Table 2.

Nine subsamples for each composite will be collected from a section of the grid by FMF personnel following their own health and safety plan (Table 2). This sampling pattern results in a subsample location spacing of about 30 to 55 feet.

Each subsample will be labeled based on grid location and composite number (i.e. A1-1, A2-1, and A3-1). The depth interval of the sampled core will be noted on sample field sheets (i.e. 0 to 3 feet, 3 to 6 feet, and 6 to 9 feet). The sludge material at the Newaukum Prarie is estimated to be 8 to 9 ft thick and will require vertical characterization.

Since at least 3 ft of material is required for each subsample[3], vertical characterization will be based on collecting 3 ft section of subsamples within the core. The sampled 3 ft interval will be chosen randomly. Selection of random depth intervals will be based on a pre-generated table of random numbers in MS Excel. PGG personnel will keep detailed field notes of all sample locations, IDs, and depth intervals.

### 4.4.2 Newaukum Prairie Subsample Collection Procedure

FMF personnel will use their own health and safety plan to collect subsample cores. It is recommended that a 1.5 inch sludge judge with 1 ft incremental markings be used to collect the samples as follows:

1. Wearing clean nitrile sampling gloves, carefully lower clean 1.5 inch sludge judge into the water and through the underlying sludge until refusal. Given the loose nature of the sludge, refusal will likely be the bottom of the plastic lined lagoon.

2. Pull up sludge judge tool slowly.

3. Slowly empty sludge from core tool by tilting the end of the core slightly horizontal and using index finger to lift the ball valve as the sludge is carefully emptied into a clean 1-liter glass sample jar. Only the material from the target depth interval will be filled into the glass sample jar, the remaining material will be slowly emptied back into the lagoon.

4. Collect at least 1 liter of sludge material for each subsample. One 3-ft length core collected in a 1.5 inch core device will yield about 1 liter of material.

5. Cap and label sample jar with composite number and grid location.

6. Rinse sludge material out of the core using a hose followed by rinse with deionized water.

7. Continue with steps #1 through #6 until all subsamples have been collected.

[3] About 3 ft of material will be required per subsample in order to collect 5 liters of a composite sample (total estimated volume required by the lab for a sample with 7% total solids)

### 4.4.3 Newaukum Prairie Transfer of Subsamples to Lab Containers

The follow procedures will be used (in order) by PGG personnel to transfer subsamples collected in the 1 liter jars into laboratory supplied containers:

For volatile organic compounds (VOC) EPA Method 8260:

- Subsamples will be transferred directly from the 1 liter glass jar to lab containers (not mixed in field) and composited by lab to minimize disturbance and volatilization.
- Use a clean stainless steel spoon to carefully transfer each subsample directly into laboratory supplied septa jars (Table 4). Fill material to top of jar.
- Clearly note on the lab chain-of-custody which VOC subsamples will be composited by lab.

For Fecal Coliform Analysis:

- Select 14 subsamples randomly to transfer directly to lab containers[4]
- Use a clean stainless steel spoon to transfer each subsample directly into laboratory supplied jars. Fill material to top of jar.

For all other analytes, composite subsamples (Table 2) as follows:

- Use a clean stainless steel measuring cup to transfer 4.5 cups from each subsample into a clean 8 quart stainless steel bowl.
- Use a clean stainless steel sampling spoon to thoroughly mix the material in the stainless steel bowl (mix for at least 30 seconds).
- Use a clean stainless steel spoon to transfer mixed material (small portions at a time) directly into laboratory supplied jars.

All sample jars will be labeled with the following information:

  - Project name and number
  - Name of collector
  - Date and time of collection
  - Place of collection
  - The sample designation, which shall be the subsample ID
  - Analysis being requested (i.e. EPA Method 8270 VOC)
  - Presence of any preservative

[4] In accordance with WAC 173-308-170(5) and WAC 173-308-150, a minimum of twenty eight samples are required to be collected over a 1 year period for biosolids volume between 320 and 1653 tons dry weight. Approximately 600 tons of dry weight material is stored at Newaukum Prairie. Seven samples were already collected in March 2014 and another 7 samples will be collected 30 days prior to application, therefore 14 samples will be collected with this current investigation.

Place all labelled sample containers in a cooler at 4°C with sufficient chemical ice to retain a cold temperature for 24 hours (see below for procedures on transport of samples to lab).

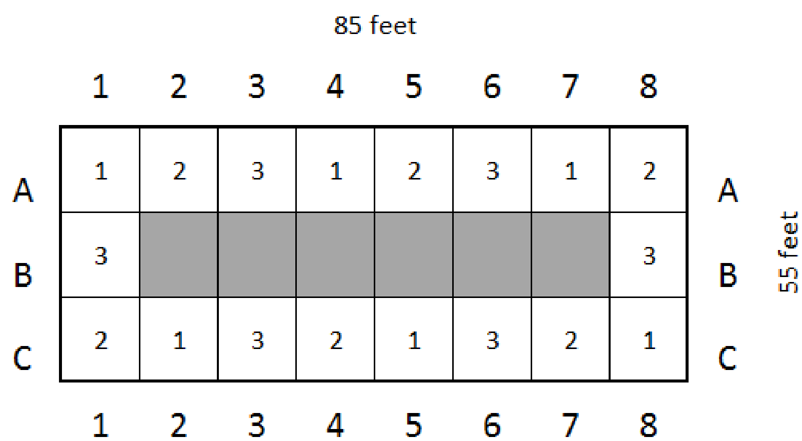
## 4.5 BIG HANAFORD BUNKER SLUDGE SAMPLING PROCEDURES

The Hanaford bunker is approximately 100 ft by 60 ft in dimension (outside of concrete wall) and stores sludge and solids estimated to be about 10 ft deep[5]. The Percent solids are estimated to be 14 to 20%.

It is recommended that sludge samples from the Hanaford bunker be collected with a combination of tools: hand augers, post hole digger, and 2-inch AMS sludge/sediment sampler with a 4 ft length core chamber and core catcher. The core chamber comes in 1 ft sections so sample cores can be collected in 1 ft increments up to 4 ft. FMF personnel have field tested the material and are able to dig a 5 ft deep hole without the material caving in. Used with the AMS sludge/sediment sampler, samples up to 9 ft deep can be collected from this site. It is also recommended that additional hand augers with 10 ft extensions and shovels be on site as well to assist with unforeseen conditions.

### 4.5.1 Big Hanaford Sample Grid

A grid measuring 8 cells by 3 cells will be staked out and coordinates labelled on all four sides of the bunker:




Note: 1, 2, and 3 within the above grid refer to Composite Samples 1, 2, and 3 in Table 3.

[5] The concrete segments used to construct the bunker are 11.5 feet tall with a 6 inch thick poured concrete slab floor, making an effective depth of 11 feet. The top of the biosolids is 6 to 12 inches from the top of the bunker - for a total biosolids thickness of 10 to 10.5 feet.

Six subsamples cores will be collected for each composite from a prescribed grid cell by FMF personnel following their own health and safety plan (Table 3). This sampling pattern results in a subsample location spacing of about 10 to 20 feet.

Each subsample core will be labeled based on grid location, composite number, and depth interval (i.e. A1-1, A4-1, and A7-1, etc.). The depth interval of the subsample will be noted on sample field sheets. The sludge material in the bunker is estimated to be 10 ft thick and will require vertical characterization.

Less than 1 ft of material is required per subsample in order to collect 1.25 liters of composite sample (total estimated volume required by the lab for a sample with 14 to 20 % total solids).

Since less than 1 ft of material is required for each subsample, vertical characterization will be based on collecting 1 ft sections of material from the cores. The target 1 ft interval will be chosen randomly based on whole numbers ranging from 1 to the total depth of the sludge (i.e. 10 ft) or to the total depth that can be sampled with equipment (i.e. 9 ft). Selection of random depth intervals will be based on a pre-generated table of random numbers in MS Excel. PGG personnel will keep detailed field notes of all sample locations, IDs, and depth intervals.

#### 4.5.2 Big Hanaford Subsample Collection Procedure

FMF personnel will use their own health and safety plan to collect subsample cores from the Bunker sludge. It is recommended that a digging tool, such as a post-hole digger, be used to make a hole and expose a desired sample interval and then a 2-inch AMS sludge/sediment sampler with a 4 ft length core catcher to collect the sample. The core chamber comes in 1 ft sections so sample cores can be collected in 1 ft increments up to 4 ft from the bottom of the dug hole. The AMS extensions should be marked with 1 ft increments to guide collection.

1. After digging to desired depth and wearing clean nitrile sampling gloves, carefully lower the clean 2-inch AMS sampler to the target interval. Pull up core tool slowly.

2. Slowly empty the core material from the desired 1-ft interval into a clean large stainless steel bowl (8 quart bowl), cover with aluminum foil, and label. Label information will include composite number, grid location, and 1-ft interval (i.e. 8 to 9 ft). PGG will transfer core material from the bowl into lab containers as described below.

3. Empty remaining core material into a bucket to later be returned to the bunker (after completion of sampling).

4. Rinse core barrel with hose and rinse with de-ionized water

5. Continue with steps #1 through #4 until all subsamples have been collected.

### 4.5.3 Big Hanaford Transfer of Subsamples to Lab Containers

PGG personnel will transfer the subsamples collected by FMF personnel into laboratory supplied containers as follows (in order):

For volatile organic compounds (VOC) EPA Method 8260:

- Subsamples will be transferred directly to lab containers (not mixed in field) and composited by lab to minimize disturbance and volatilization.
- Use a clean EnCore sampler (EPA Method 5035) to transfer each subsample directly into laboratory supplied vials.
- Clearly note on the lab chain-of-custody which VOC subsamples will be composited by lab.

For Fecal Coliform Analysis:

- Select 7 random subsamples and transfer directly to lab containers[6].
- Use a clean stainless steel spoon to transfer material from the stainless steel bowls directly into laboratory supplied jars. Fill material to top of jar.

For all other analytes, composite subsamples (Table 3) as follows:

- Use a clean stainless steel measuring cup to transfer 2 cups from each subsample into a clean 8 quart stainless steel bowl.
- Use a clean stainless steel sampling spoon to thoroughly mix the material in the stainless steel bowl (mix for at least 30 seconds).
- Use a clean stainless steel spoon to transfer mixed material (small portions at a time) directly into laboratory supplied jars.

All sample jars will be labeled with the following information:

- o Project name and number
- o Name of collector
- o Date and time of collection
- o Place of collection
- o The sample designation, which shall be the subsample ID
- o Analysis being requested (i.e. EPA Method 8270 VOC)
- o Presence of any preservative

[6] In accordance with WAC 173-308-170(5) and WAC 173-308-150, a minimum of seven samples are required to be collected over a 1 year period for biosolids volume less than 320 tons dry weight. Less than 320 tons of dry weight material is stored at Big Hanaford, therefore 7 samples will be collected with this current investigation.

Place all labelled sample containers in a cooler at 4°C with sufficient chemical ice to retain a cold temperature for 24 hours (see below for procedures on transport of samples to lab).

## 4.6 SLUDGE EQUIPMENT DECONTAMINATION PROCEDURES

Sampling equipment (spoons, bowls, jars, and coring equipment) will be decontaminated between sampling the three different sites. The decontamination equipment list is as follows:

- De-ionized (DI) water
- Low phosphate detergent (such a Alconox)
- Paper towels
- Nitrile Gloves
- Heavy duty trash bags
- 5 gallon buckets with lids
- Clean heavy mil plastic sheeting
- Long handled brushes

The decontamination procedure is as follows:

- Lay out heavy mil plastic sheeting roughly 10 x 10 feet in area and conduct decontamination on sheeting.
- Wipe off all loose materials on sampling equipment with paper towels and dispose of towels in heavy duty trash bag.
- Hold sample equipment over 5 gallon bucket and rinse with DI water.
- Mix detergent with DI water in clean 5 gallon bucket.
- Hold equipment over the bucket and use detergent mix and brushes to scrub all equipment parts (including interior of coring devices) to remove residues.
- Hold sample equipment over 5 gallon bucket and rinse with DI water.
- Hold equipment over the bucket and use detergent mix and brushes a second time to scrub all equipment parts (including interior of coring devices) to remove any remaining residues.
- Hold sample equipment over 5 gallon bucket and rinse with DI water thoroughly (at least three times).
- Wrap sampling and coring equipment in clean heavy mil plastic for transport to the next sampling site.
- Dispose of 10 ft by 10 ft heavy mil plastic sheeting in heavy duty trash bag.
- Secure rinsate water collected in 5 gallon buckets with lids. Rinsate water will be stored on site and disposed of with groundwater purge water (see below).

## 4.7 SLUDGE LABORATORY PARAMETERS AND ANALYTICAL METHODS

In accordance with the AO, samples collected from each of the three storage facilities will be analyzed for the following parameters:

- One composite sample from each site will be analyzed for EPA priority pollutants, molybdenum, cobalt, pH, total kjeldahl nitrogen (TKN), ammonia-nitrogen, nitrate-nitrogen and percent total solids (results will be reported as mass per dry weight).
- Two composite samples from each site will be analyzed for EPA method 8260 VOCs, EPA method 8270 Semi-VOCs, and metals (results will be reported as mass per dry weight).
- Subsamples from each site will be analyzed for Fecal Coliform as described above (results will be reported as Colony Forming Units per dry weight).

Additionally, the liquid sample collected from the Burnt Ridge Lagoon will be analyzed for EPA priority pollutants, molybdenum, cobalt, pH, TKN, ammonia-nitrogen, and nitrate-nitrogen (results will be reported as mass per liquid volume).

Analysis methods, holding times, and preservations are provided in Table 4 and are in accordance with Section 9.6 of the Biosolids General Permit and the lab's standard operating procedures.

## 4.8 SLUDGE SAMPLE TRANSPORT TO LAB

All samples will be secured in coolers and chilled with ice packs to $4^{o}$C directly after sample is transferred to laboratory bottles.

Fecal coliform samples will be transported to Dragon Analytical by FMF personnel within 24 hours of sample collection to meet the required holding times (Table 4). Dragon Analytical is accredited by Ecology to perform Fecal Coliform count analysis using EPA method 1680 for solid and chemical materials. EPA method 1680 is an approved analysis for Biosolids in the General Permit (Table 3 Section 9.6 General Permit for Biosolids Management).

All other samples will be transported to Analytical Resources, Inc (ARI) by PGG personnel upon completion of sampling all three facilities. ARI is accredited by Ecology to perform the remaining analyses for solid and chemical materials and for water materials.

Laboratory chain-of-custody form(s) must be completed for each set of samples sent to the labs and placed in the shipping cooler for travel with the sample shipment. These forms are provided by the analytical laboratory as a record for tracking samples from the point of collection to the laboratory. Upon transfer of sample possession to subsequent custodians, this form will be signed by the person taking custody of the sample container. As part of the chain-of-custody procedure, each sample container being delivered will be tracked by the Site name, sample number, analytical testing to be performed, and other pertinent information.

# 5.0 GROUNDWATER SAMPLING PROCEDURES

The following existing downgradient monitoring wells will be sampled at the Burnt Ridge and Newaukum Prairie Lagoons:

- Burnt Ridge: BR-W185, BR-W460, and BR-W461 (Figure 2)
- Newaukum Prairie: NP-MW485, NP-MW024, and NP-MW025 (Figure 3)

Monitoring well information is provided in Table 5. These wells are routinely sampled by PGG biannually for analysis of Fecal Coliform, Nitrate-Nitrite, and Ammonia as part of the General Permit requirements for FMF.

The purpose of sampling downgradient groundwater monitoring wells is to evaluate potential migration (in the past or currently) of contaminants from the nearby lagoons to the underlying aquifer.

Groundwater samples will be collected by PGG personnel with assistance from FMF personnel. The wells will be sampled using a portable Grundfos Redi-Flo 2 Reel E-Z pump system with disposable polyethylene discharge tubing. The REEL E-Z system is a compact convenient way to store, move, clean, and operate the Grundfos ® Rediflo-2® environmental pump. The pump is operated using a generator and a variable frequency drive control box. The entire system can be rented locally for a reasonable cost.

Wells will be purged until select field parameters reach stabilization (see following section). Field meters will be calibrated in accordance with manufacturer guidelines. Purge volumes will be measured with a graduated 5-gallon bucket. All field measurements will be recorded on field sampling forms. All purged groundwater and decontamination water will be contained in a 55 gallon drums and secured with a lid for transport and disposal at Certified Cleaning Services, Inc. in Tacoma (or similar environmental cleaning facility), unless the analytical results from the wells are approved for disposal at the lagoon by Ecology after reporting.

The following sections describe all necessary field equipment and sampling procedures in more detail.

## 5.1 GROUNDWATER SAMPLING EQUIPMENT LIST

- Grundfos Redi-Flo 2 Reel E-Z pump
- Variable frequency drive control box
- Generator
- 200 feet of 3/8-inch polyethylene tubing and extra clamps
- Sample bottles, cooler, labels, COC forms, and ice
- 100 ft electronic well sounder
- Packing Tape

- 3 boxes of Zip-Lock bags
- 6 black sharpie pens and 4 regular pens
- Camera
- Alconox detergent
- Long handled scrub brushes
- Two 55 gallon drums with lids
- One box of disposable Nitrile sampling gloves
- Oakton Field meter or similar (ph/EC/Temp)
- Calibration solutions for field meter
- 15 gallons of De-ionized water
- Three 5-gallon plastic buckets with lids
- Three 5-gallon buckets with 1 gallon increments marked on sides
- Two large clips (to hold discharge tubing in bucket)
- Field Maps and field notebook
- Sampling forms
- Duct Tape
- Calculator, watch, and ruler

## 5.2 GROUNDWATER SAMPLING COLLECTION PROCEDURE

The following steps will be followed for collection of groundwater samples:

1. Collect static water level prior to installing portable pump. Static water levels will be measured using a decontaminated electronic well sounder (see decontamination procedures below). The measuring point will be the top of the well casing. Depth to water will be recorded on sampling field form to the nearest 0.01 foot.

2. Lower clean pump and connected discharge tubing (see decontamination procedures below) slowly to the bottom of the well and tag well bottom. Once pump is at the bottom of the well, lift up the pump approximately 6 inches and lock off the reel.

3. Calculate and record casing storage volume as reference on sampling field form.

4. Begin pumping well and quickly adjust the flow rate to about 0.5 to 1 gallon per minute (gpm).

5. Collect and monitor purge water volume in 5-gallon buckets with 1-ft increments marked on side.

6. During purging, measure, and record the following field parameters every few minutes:

    - Depth to Water
    - pH
    - Electrical Conductivity
    - Temperature
    - Cumulative purge water volume

7. Sampling may begin when the field parameters are reasonably stable between two consecutive measurements as indicated below:

    - pH measurements that do not vary by more than 0.1 pH units between readings
    - Electrical conductivity and temperature do no indicate a trend (continuous increase or decrease between readings) and to not vary by more than 10 percent between readings.
    - If the field water quality parameters listed above continually change in an upward or downward trend, purge until reasonable stability is achieved (but at least three casing volumes), then sample.

8. Collect samples of water for analysis parameters listed in Table 6. Collect samples in a manner that minimizes contact of the samples with air. Collect samples in the following order: volatile organic compounds, other organics, and then inorganic constituents. Hands and clothing shall be clean when sampling. Clean, disposable, latex gloves shall be worn when filling bottles. Follow individual sample container requirements for sample collection, handling, preservation, and shipment. Sample containers for volatile organic analyses should contain no bubbles (head space) after filling.

9. Record sample identification data on container, on the sampling field data sheet, and on the sample chain of custody record. The sample label shall include at least the following information:

    - Project name and number
    - Name of collector
    - Date and time of collection
    - Place of collection
    - The sample designation which shall be the well number
    - Presence of any preservative

10. Place samples in a cooler at 4$^{o}$C with sufficient chemical ice to retain a cold temperature for 24 hours.

## 5.3 GROUNDWATER EQUIPMENT DECONTAMINATION PROCEDURES

After sampling each well, all field equipment will be decontaminated with a low phosphate detergent (such as Alconox) diluted in de-ionized water as follows:

- Electric wells sounders will be scrubbed the length of the sounder that was submerged in the well and then thoroughly rinsed three times with de-ionized water.

- The pump will be placed into a clean 5 gallon bucket filled with the detergent and de-ionized water. The outside of the pump and connecting power cables that were submerged in the well will be scrubbed with detergent water. The pump will be turned on to circulate the detergent water through the interior of the pump. The pump and cable will then be thoroughly rinsed three times with de-ionized water. The pump will be placed into a 5 gallon bucket filled with at least 2 gallons of de-ionized water and then turned on to circulate the rinse water through the interior of the pump.

## 5.4 GROUNDWATER LABORATORY PARAMETERS AND ANALYTICAL METHODS

Groundwater samples will be analyzed for VOC EPA method 8260, Semi-VOC method 8270, total metals (priority pollutants, molybdenum, and cobalt), and nitrate as nitrogen (Table 6).

## 5.5 GROUNDWATER SAMPLE TRANSPORT TO LAB

All samples will be secured in coolers and chilled with ice packs to $4^{o}$C directly after sample is collected in laboratory bottles.

All samples will be transported to Analytical Resources, Inc. by PGG personnel upon completion of sampling all wells.

Laboratory chain-of-custody form(s) must be completed for each set of samples sent to the labs and placed in the shipping cooler for travel with the sample shipment. These forms are provided by the analytical laboratory as a record for tracking samples from the point of collection to the laboratory. Upon transfer of sample possession to subsequent custodians, this form will be signed by the person taking custody of the sample container. As part of the chain-of-custody procedure, each sample container being delivered will be tracked by the Site name, sample number, analytical testing to be performed, and other pertinent information.

# 6.0 QUALITY ASSURANCE AND QUALITY CONTROL

The following sections describe the quality assurance/quality control (QA/QC) measures to be performed during the investigative work.

## 6.1 FIELD QUALITY CONTROL

In addition to field measures described above to assure clean and representative samples are collected, the following additional field quality control measures will be taken:

- For sludge samples, field duplicate composite samples are not recommended as field composite variability can be assessed from the analysis of two other composites.
- For sludge and groundwater sampling, a laboratory trip blank for EPA Method 8260 VOCs will be provided by the laboratory in order to assess cross contamination during sample transport of samples. The laboratory will prepare 40-ml VOC containers with laboratory supplied water for transport with the clean bottles from the lab to the field and back to the lab. The analytical laboratory will analyze the trip blank for the presence of volatile organic compounds.

## 6.2 LABORATORY QUALITY CONTROL

Analytical Resources, Inc. (ARI) will perform all analyses except for Fecal Coliform which will be performed by Dragon Analytical. Both ARI and Dragon Analytical are accredited in accordance with WAC 173-50 for the analyses being performed.

ARI will follow their standard QA protocol during analysis of samples:

### 6.2.1 Quality Assurance Objectives

Quality assurance objectives for analytical data are usually expressed in terms of bias and precision. The investigation data will be evaluated using the parameters discussed below.

**Bias**. A matrix spike is prepared by adding a known amount of a pure compound to the environmental sample. A blank spike is prepared by adding a known amount of a pure compound to a laboratory-prepared blank sample. The spikes check for analytical interferences. The calculated percent recovery of the spike is taken as a measure of the bias of the total analytical method. When there is no change in volume due to the spike, percent recovery is calculated as follows:

Where:

PR = percent recovery

O = measured value of analyte concentration after addition of spike

X = measured value of analyte concentration in the sample before the spike is added

T = value of the spike

Tolerance limits for the acceptable percent re-covery of matrix spikes and blank spikes are established by the lab in accordance with CLP Guidelines.

**Precision**. Laboratory replicates are used to indicate precision. Laboratory replicates are aliquots made in the laboratory of the same sample and each aliquot is treated the same throughout the analytical method. The percent difference between the values of the replicates, as calculated below, is taken as a measure of the precision of the analytical method.

Where:

RPD = relative percent difference

D1 = first aliquot value

D2 = second aliquot (replicate) value

If the precision values for the laboratory replicate are outside the laboratory tolerance limit, the laboratory should recheck the calculations and/or identify the problem. Reanalysis may be required. If the precision values for either the laboratory replicate or field duplicate are outside the tolerance limit, sample results associated with the out-of-control precision results may be qualified at the time of validation.

### 6.2.2 Laboratory Data Review

Analytical data will be evaluated by PGG with respect to the requirements and objectives of the project. PGG will evaluate the data following Level III data validation guidelines. These guidelines require the lab to report method blank, matrix spike and lab replicate results, but not raw data or instrument calibration information. These guidelines are found in the CLP Guidelines (USEPA 2008 and 2010).

## 7.0 DATA EVALUATION AND REPORTING

Sludge analytical results will be evaluated under the Land Disposal Restriction Code (Chapter 173-303-140 WAC) and the Biosolids Management code (Chapter 173-308 WAC).

Groundwater results will be evaluated under the groundwater quality standards for the State of Washington (Chapter 173-200 WAC).

Results will be summarized in a technical report with comparison to project objectives and quality control.

## 8.0 REFERENCES

USEPA. 2008. USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review

USEPA. 2010. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review.

**Table 1. Burnt Ridge Lagoon Sludge and Water Sample Scheme**

| **Sludge Composite Sample 1** | **Sludge Composite Sample 2** | **Sludge Composite Sample 3** | **Water Composite Sample 1** |
|---|---|---|---|
| Composite of 9 separate "subsamples" collected from grid sections A1, A2, A3, B1, B2, B3, C1, C2, and C3 (within those sections as shown in Section 5.2.1 of main text) | Composite of 9 separate "subsamples" collected from grid sections A1, A2, A3, B1, B2, B3, C1, C2, and C3 (within those sections as shown in Section 5.2.1 of main text) | Composite of 9 separate "subsamples" collected from grid sections A1, A2, A3, B1, B2, B3, C1, C2, and C3 (within those sections as shown in Section 5.2.1 of main text) | Composite of 4 separate "subsamples" collected from each quadrant I, II, III, IV (as shown in Section 5.3.1 of main text) |
| EPA Priority Pollutants, molybdenum, cobalt, pH, TKN, ammonia-nitrogen, nitrate-nitrogen, and percent total solids | VOCs (EPA Method 8260), SVOCs (EPA Method 8270), EPA Priority Pollutant Metals, Molybdenum and Cobalt | VOCs (EPA Method 8260), SVOCs (EPA Method 8270), EPA Priority Pollutant Metals, Molybdenum and Cobalt | VOCs (EPA Method 8260), SVOCs (EPA Method 8270), EPA Priority Pollutant Metals, Molybdenum and Cobalt, and nitrate-nitrogen |

Notes:

For the sludge, 7 randomly selected subsamples will also be analyzed for Total Fecal Coliform in accordace with WAC 173-308-170(5) and WAC 173-308-150.

For VOC Method 8260 Anlaysis, subsamples will be transferred directly into lab containers (not mixed in field) and composited by the lab to minimize distrubance and volatilization.

**Table 2. Newaukum Prairie Impoundment (Lagoon) Sludge Sample Scheme**

| Composite Sample 1 | Composite Sample 2 | Composite Sample 3 |
|---|---|---|
| Composite of 9 separate "subsamples" collected from grid sections A1, A2, A3, B1, B2, B3, C1, C2, and C3 (within those sections as shown in Section 5.3.1 of main text) | Composite of 9 separate "subsamples" collected from grid sections A1, A2, A3, B1, B2, B3, C1, C2, and C3 (within those sections as shown in Section 5.3.1 of main text) | Composite of 9 separate "subsamples" collected from grid sections A1, A2, A3, B1, B2, B3, C1, C2, and C3 (within those sections as shown in Section 5.3.1 of main text) |
| EPA Priority Pollutants, molybdenum, cobalt, pH, TKN, ammonia-nitrogen, nitrate-nitrogen, and percent total solids | VOCs (EPA Method 8260), SVOCs (EPA Method 8270), EPA Priority Pollutant Metals, Molybdenum and Cobalt | VOCs (EPA Method 8260), SVOCs (EPA Method 8270), EPA Priority Pollutant Metals, Molybdenum and Cobalt |

Notes:

For the sludge, 14 randomly selected subsamples will also be analyzed for Total Fecal Coliform in accordace with WAC 173-308-170(5) and WAC 173-308-150.

For VOC Method 8260 Anlaysis, subsamples will be transferred directly into lab containers (not mixed in field) and composited by the lab to minimize distrubance and volatilization.

**Table 3. Big Hanaford Bunker Sludge Sample Scheme**

| Composite Sample 1 | Composite Sample 2 | Composite Sample 3 |
|---|---|---|
| Composite of 6 separate "subsamples" collected from grid sections A1, A4, A7, C8, C5, C2 (as shown in Section 5.4.1 of main text) | Composite of 6 separate "subsamples" collected from grid sections A2, A5, A8, C7, C4, C1 (as shown in Section 5.4.1 of main text) | Composite of 6 separate "subsamples" collected from grid sections A3, A6, B8, C6, C3, B1 (as shown in Section 5.4.1 of main text) |
| EPA Priority Pollutants, molybdenum, cobalt, pH, TKN, ammonia-nitrogen, nitrate-nitrogen, and percent total solids | VOCs (EPA Method 8260), SVOCs (EPA Method 8270), EPA Priority Pollutant Metals, Molybdenum and Cobalt | VOCs (EPA Method 8260), SVOCs (EPA Method 8270), EPA Priority Pollutant Metals, Molybdenum and Cobalt |

Notes:

For the sludge, 7 randomly selected subsamples will also be analyzed for Total Fecal Coliform in accordace with WAC 173-308-170(5) and WAC 173-308-150.

For VOC Method 8260 Anlaysis, subsamples will be transferred directly into lab containers (not mixed in field) and composited by the lab to minimize distrubance and volatilization.

**Table 4. Sludge/Biosolids Analytical Parameters List**

| Analytical Parameters | Priorotiy Pollutant (Yes/No) | Units | Method | Hold Time | Standard No of Bottles (see note) | Bottles | Preservative |
|---|---|---|---|---|---|---|---|
| Volatile Organic Compounds | | | | | | | |
| 1,1,1-trichloroethane | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| 1,1,2,2-tetrachloroethane | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| 1,1,2-trichloroethane | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| 1,1-dichloroethane | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| 1,1-dichloroethylene | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| 1,2,4-trichlorobenzene | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| 1,2-dichlorobenzene | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| 1,2-dichloroethane | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| 1,2-dichloropropane | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| 1,2-trans-dichloroethylene | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| 1,3-dichlorobenzene | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| 1,3-dichloropropylene | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| 1,4-dichlorobenzene | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| 2-chloroethyl vinyl ethers | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| Acrolein | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| Acrylonitrile | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| Benzene | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| Bromoform | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| Bromomethane | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| Carbon tetrachloride | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| Chlorobenzene | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| Chloroethane | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| Chloroform | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| Chloromethane | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| Ethylbenzene | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| Methylene chloride | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| Naphthalene | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| Tetrachloroethylene | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| Toluene | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| Trichloroethylene | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| Vinyl chloride | YES | ug/kg | EPA 8260 | 14 days OR 2 days (unpreserved) | 3 OR 2 | 40 mL GV OR 2 oz septa jar | NaHSO4 (2), Methanol (2) OR None |
| Semi-Volatile Organic Compounds | | | | | | | |
| 2,2-Oxybis(1-Chloropropane) | YES | ug/kg | EPA 8270 | 14 Days | 1-Jan | 8 oz WMG | 4°C |
| 2,4,6-trichlorophenol | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | 4°C |
| 2,4-dichlorophenol | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | 4°C |
| 2,4-dimethylphenol | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | 4°C |
| 2,4-dinitrophenol | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | 4°C |
| 2,4-dinitrotoluene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | 4°C |
| 2,6-dinitrotoluene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | 4°C |
| 2-chloronaphthalene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | 4°C |
| 2-chlorophenol | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | 4°C |
| 2-nitrophenol | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | 4°C |
| 3,3-dichlorobenzidine | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | 4°C |

**Table 4. Sludge/Biosolids Analytical Parameters List**

| Analytical Parameters | Priorotiy Pollutant (Yes/No) | Units | Method | Hold Time | Standard No of Bottles (see note) | Bottles | Preservative |
|---|---|---|---|---|---|---|---|
| Semi-Volatile Organic Compounds (cont.) | | | | | | | |
| 4-bromophenyl phenyl ether | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| 4-chlorophenyl phenyl ether | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| 4-nitrophenol | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Acenaphthene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Acenaphthylene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Anthracene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Azobenzene/1,2-diphenyl hydrazine | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Benzidine | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| benzo(a) anthracene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Benzo(a)pyrene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Benzo(b) fluoranthene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Benzo(ghi) perylene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Benzo(k) fluoranthene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Bis(2-chloroethoxy) methane | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Bis(2-chloroethyl) ether | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Bis(2-ethylhexyl) phthalate | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Butyl benzyl phthalate | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Chrysene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Dibenzo(,h) anthracene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Diethyl Phthalate | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Dimethyl phthalate | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Di-N-Butyl Phthalate | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Di-n-octyl phthalate | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Fluoranthene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Fluorene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Hexachlorobenzene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Hexachlorobutadiene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Hexachlorocyclopentadiene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Hexachloroethane | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Indeno (1,2,3-cd) pyrene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Isophorone | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Nitrobenzene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| N-nitrosodimethylamine | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| N-nitrosodi-n-propylamine | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| N-nitrosodiphenylamine | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Pentachlorophenol | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Phenanthrene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Phenol | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Pyrene | YES | ug/kg | EPA 8270 | 14 Days | 1 | 8 oz WMG | $4^oC$ |

**Table 4. Sludge/Biosolids Analytical Parameters List**

| Analytical Parameters | Priorotiy Pollutant (Yes/No) | Units | Method | Hold Time | Standard No of Bottles (see note) | Bottles | Preservative |
|---|---|---|---|---|---|---|---|
| Pesticides | | | | | | | |
| 4,4-DDD | YES | ug/kg | EPA 8081B | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| 4,4-DDE | YES | ug/kg | EPA 8081B | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| 4,4-DDT | YES | ug/kg | EPA 8081B | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Aldrin | YES | ug/kg | EPA 8081B | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Alpha-BHC | YES | ug/kg | EPA 8081B | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Alpha-endosulfan | YES | ug/kg | EPA 8081B | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Beta-BHC | YES | ug/kg | EPA 8081B | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Beta-endosulfan | YES | ug/kg | EPA 8081B | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Chlordane | YES | ug/kg | EPA 8081B | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Delta-BHC | YES | ug/kg | EPA 8081B | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Dieldrin | YES | ug/kg | EPA 8081B | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Endosulfan sulfate | YES | ug/kg | EPA 8081B | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Endrin | YES | ug/kg | EPA 8081B | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Endrin aldehyde | YES | ug/kg | EPA 8081B | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Gamma-BHC | YES | ug/kg | EPA 8081B | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Heptachlor | YES | ug/kg | EPA 8081B | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Heptachlor epoxide | YES | ug/kg | EPA 8081B | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Toxaphene | YES | ug/kg | EPA 8081B | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| PCBs | | | | | | | |
| PCB–1016 (Arochlor 1016) | YES | ug/kg | EPA 8082A | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| PCB–1221 (Arochlor 1221) | YES | ug/kg | EPA 8082A | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| PCB–1232 (Arochlor 1232) | YES | ug/kg | EPA 8082A | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| PCB–1242 (Arochlor 1242) | YES | ug/kg | EPA 8082A | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| PCB–1248 (Arochlor 1248) | YES | ug/kg | EPA 8082A | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| PCB–1254 (Arochlor 1254) | YES | ug/kg | EPA 8082A | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| PCB–1260 (Arochlor 1260) | YES | ug/kg | EPA 8082A | 14 Days | 1 | 8 oz WMG | $4^oC$ |
| Dioxin | | | | | | | |
| 2,3,7,8-TCDD | YES | ug/kg | EPA 1613B | 1 year | 2 | 8 oz WMG (amber) | $4^oC$ |

**Table 4. Sludge/Biosolids Analytical Parameters List**

| Analytical Parameters | Priorotiy Pollutant (Yes/No) | Units | Method | Hold Time | Standard No of Bottles (see note) | Bottles | Preservative |
|---|---|---|---|---|---|---|---|
| Metals | | | | | | | |
| Antimony | YES | mg/kg | EPA 6010 | 6 months | 1 | 4 oz. WMG | 4°C |
| Arsenic | YES | mg/kg | EPA 6010 | 6 months | 1 | 4 oz. WMG | 4°C |
| Beryllium | YES | mg/kg | EPA 6010 | 6 months | 1 | 4 oz. WMG | 4°C |
| Cadmium | YES | mg/kg | EPA 6010 | 6 months | 1 | 4 oz. WMG | 4°C |
| Chromium | YES | mg/kg | EPA 6010 | 6 months | 1 | 4 oz. WMG | 4°C |
| Copper | YES | mg/kg | EPA 6010 | 6 months | 1 | 4 oz. WMG | 4°C |
| Cyanide, Total | YES | mg/kg | EPA 6010 | 6 months | 1 | 4 oz. WMG | 4°C |
| Lead | YES | mg/kg | EPA 6010 | 6 months | 1 | 4 oz. WMG | 4°C |
| Mercury | YES | mg/kg | EPA Method 7470 or 7471 | 6 months | 1 | 4 oz. WMG | 4°C |
| Nickel | YES | mg/kg | EPA 6010 | 6 months | 1 | 4 oz. WMG | 4°C |
| Selenium | YES | mg/kg | EPA 6010 | 6 months | 1 | 4 oz. WMG | 4°C |
| Silver | YES | mg/kg | EPA 6010 | 6 months | 1 | 4 oz. WMG | 4°C |
| Thallium | YES | mg/kg | EPA 6010 | 6 months | 1 | 4 oz. WMG | 4°C |
| Zinc | YES | mg/kg | EPA 6010 | 6 months | 1 | 4 oz. WMG | 4°C |
| Molybdenum | NO | mg/kg | EPA 6010 | 6 months | 1 | 4 oz. WMG | 4°C |
| Cobalt | NO | mg/kg | EPA 6010 | 6 months | 1 | 4 oz. WMG | 4°C |
| Conventionals | | | | | | | |
| pH | NO | Standard | EPA Method 9045D | NA | 1 | 4 oz. WMG | 4°C |
| TKN | NO | mg/kg | EPA Method 4500 | 28 days | 1 | 4 oz. WMG | 4°C |
| Ammonia-Nitrogen | NO | mg/kg | EPA Method 4500 | 28 days | 1 | 4 oz. WMG | 4°C |
| Nitrate Nitrogen | NO | mg/kg | EPA Method 4500 | 7 Days | 1 | 4 oz. WMG | 4°C |
| Total Solids | NO | Percent | EPA Method 2540 | 7 Days | 1 | 4 oz. WMG | 4°C |
| Coliform | | | | | | | |
| Total Fecal Coliform | NO | CFU per dry weight | EPA Method 1680 | 24 hours | 1 | 100 mL Glass | 4°C |

Note: Unpreserved septa jars (2 oz each) will be used for samples collected from Newaukum Prairie Impoundment and Burnt Ridge Lagoon (percent solids < 10%)
Preserved vials (40 mL each) will be used for samples collected from Big Hanaford Bunker (percent solids > 10%)

For all samples collected at the Newaukum Prairie Impoundment and Burnt Ridge Lagoon collect 4 times the standard number of bottles (due to lower total percent solids)
The standard number of bottles may be used for samples collected at the Big Hanaford Bunker site.

**Table 5. Monitoring Well Information for Fire Mountain Farms Impoundments**

| Monitoring Well Name | Washington Unique Well Number | Well Depth (feet) | Measuring Point (feet, arbitrary datum) | Measuring Point Description |
|---|---|---|---|---|
| BR-MW184 | AHM 184 | 46.5 | | Top of 2-inch PVC casing, north side |
| BR-MW185 | AHM 185 | 24 | | Top of 2-inch PVC casing, north side |
| BR-MW460 | ACF 460 | 18.8 | 97.56 | Top of 2-inch PVC casing, north side |
| BR-MW461 | ACF 461 | 15.5 | 99.88 | Top of 2-inch PVC casing, north side |
| BR-MW038 | AKL 038 | 67 | | Top of 2-inch PVC casing, north side |
| NP-MW024 | AHL 024 | 24 | 99.39 | Top of 2-inch PVC casing, north side |
| NP-MW025 | AHL 025 | 24 | | Top of 2-inch PVC casing, north side |
| NP-MW485 | AEK 485 | 31 | 100.25 | Top of 6-inch steel casing, north side |
| NP-MW487 | AEK 487 | 37 | 101.03 | Top of 6-inch steel casing, north side |
| NP-PW620 | AEF 620 | 43 | 104.67 | Top of 6-inch steel casing, north side |
| W1-MW186 | AHM 186 | 16.5 | | Top of 2-inch PVC casing, north side |
| W1-MW187 | AHM 187 | 16.5 | | Top of 2-inch PVC casing, north side |

Wells to be sampled are highlighted
Depth in feet below ground surface

**Table 6. Groundwater and Burnt Ridge Water Analytical Parameters List**

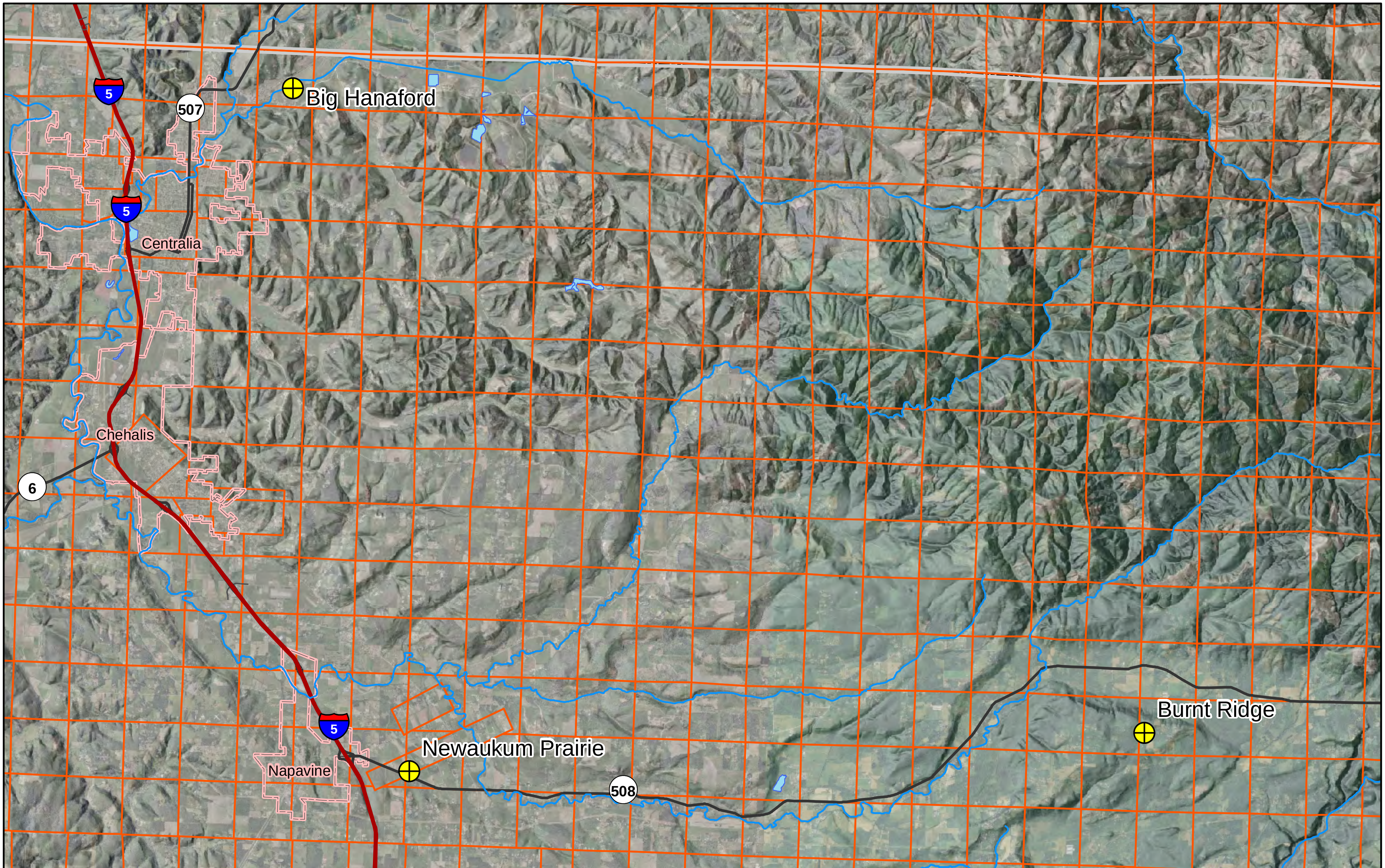
| Analytical Parameters | Priorotiy Pollutant (Yes/No) | Method | Hold Time | No of Bottles | Bottles | Preservative |
|---|---|---|---|---|---|---|
| Volatile Organic Compounds | | | | | | |
| 1,1,1-trichloroethane | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| 1,1,2,2-tetrachloroethane | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| 1,1,2-trichloroethane | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| 1,1-dichloroethane | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| 1,1-dichloroethylene | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| 1,2,4-trichlorobenzene | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| 1,2-dichlorobenzene | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| 1,2-dichloroethane | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| 1,2-dichloropropane | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| 1,2-trans-dichloroethylene | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| 1,3-dichlorobenzene | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| 1,3-dichloropropylene | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| 1,4-dichlorobenzene | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| 2-chloroethyl vinyl ethers | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| Acrolein | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| Acrylonitrile | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| Benzene | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| Bromoform | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| Bromomethane | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| Carbon tetrachloride | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| Chlorobenzene | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| Chloroethane | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| Chloroform | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| Chloromethane | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| Ethylbenzene | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| Methylene chloride | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| Naphthalene | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| Tetrachloroethylene | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| Toluene | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| Trichloroethylene | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| Vinyl chloride | YES | EPA 8260 | 7 Days | 3 | 40 mL GV | HCl |
| Semi-Volatile Organic Compounds | | | | | | |
| 2,2-Oxybis(1-Chloropropane) | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | 4$^o$C |
| 2,4,6-trichlorophenol | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | 4$^o$C |
| 2,4-dichlorophenol | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | 4$^o$C |
| 2,4-dimethylphenol | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | 4$^o$C |
| 2,4-dinitrophenol | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | 4$^o$C |
| 2,4-dinitrotoluene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | 4$^o$C |
| 2,6-dinitrotoluene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | 4$^o$C |
| 2-chloronaphthalene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | 4$^o$C |
| 2-chlorophenol | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | 4$^o$C |
| 2-nitrophenol | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | 4$^o$C |
| 3,3-dichlorobenzidine | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | 4$^o$C |

**Table 6. Groundwater and Burnt Ridge Water Analytical Parameters List**

| Analytical Parameters | Priorotiy Pollutant (Yes/No) | Method | Hold Time | No of Bottles | Bottles | Preservative |
|---|---|---|---|---|---|---|
| Semi-Volatile Organic Compounds (cont.) | | | | | | |
| 4-bromophenyl phenyl ether | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| 4-chlorophenyl phenyl ether | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| 4-nitrophenol | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Acenaphthene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Acenaphthylene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Anthracene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Azobenzene/1,2-diphenyl hydrazine | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Benzidine | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| benzo(a) anthracene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Benzo(a)pyrene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Benzo(b) fluoranthene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Benzo(ghi) perylene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Benzo(k) fluoranthene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Bis(2-chloroethoxy) methane | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Bis(2-chloroethyl) ether | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Bis(2-ethylhexyl) phthalate | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Butyl benzyl phthalate | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Chrysene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Dibenzo(,h) anthracene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Diethyl Phthalate | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Dimethyl phthalate | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Di-N-Butyl Phthalate | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Di-n-octyl phthalate | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Fluoranthene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Fluorene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Hexachlorobenzene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Hexachlorobutadiene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Hexachlorocyclopentadiene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Hexachloroethane | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Indeno (1,2,3-cd) pyrene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Isophorone | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Nitrobenzene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| N-nitrosodimethylamine | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| N-nitrosodi-n-propylamine | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| N-nitrosodiphenylamine | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Pentachlorophenol | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Phenanthrene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Phenol | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |
| Pyrene | YES | EPA 8270 | 7 Days | 2 | 500 mL (Amber) | $4^oC$ |

**Table 6. Groundwater and Burnt Ridge Water Analytical Parameters List**

| Analytical Parameters | Priorotiy Pollutant (Yes/No) | Method | Hold Time | No of Bottles | Bottles | Preservative |
|---|---|---|---|---|---|---|
| Metals | | | | | | |
| Antimony | YES | EPA 6010 | 6 months | 1 | 500 mL HDPE | $HNO_3$ |
| Arsenic | YES | EPA 6010 | 6 months | 1 | 500 mL HDPE | $HNO_3$ |
| Beryllium | YES | EPA 6010 | 6 months | 1 | 500 mL HDPE | $HNO_3$ |
| Cadmium | YES | EPA 6010 | 6 months | 1 | 500 mL HDPE | $HNO_3$ |
| Chromium | YES | EPA 6010 | 6 months | 1 | 500 mL HDPE | $HNO_3$ |
| Copper | YES | EPA 6010 | 6 months | 1 | 500 mL HDPE | $HNO_3$ |
| Cyanide, Total | YES | EPA 6010 | 6 months | 1 | 500 mL HDPE | $HNO_3$ |
| Lead | YES | EPA 6010 | 6 months | 1 | 500 mL HDPE | $HNO_3$ |
| Mercury | YES | EPA Method 7470 or 7471 | 6 months | 1 | 500 mL HDPE | $HNO_3$ |
| Nickel | YES | EPA 6010 | 6 months | 1 | 500 mL HDPE | $HNO_3$ |
| Selenium | YES | EPA 6010 | 6 months | 1 | 500 mL HDPE | $HNO_3$ |
| Silver | YES | EPA 6010 | 6 months | 1 | 500 mL HDPE | $HNO_3$ |
| Thallium | YES | EPA 6010 | 6 months | 1 | 500 mL HDPE | $HNO_3$ |
| Zinc | YES | EPA 6010 | 6 months | 1 | 500 mL HDPE | $HNO_3$ |
| Molybdenum | NO | EPA 6010 | 6 months | 1 | 500 mL HDPE | $HNO_3$ |
| Cobalt | NO | EPA 6010 | 6 months | 1 | 500 mL HDPE | $HNO_3$ |
| Conventionals | | | | | | |
| Nitrate Nitrogen | NO | EPA Method 4500 | 48 hours | 1 | 500 mL HDPE | $4^oC$ |




0 Feet 10,000

0 Miles 2

N

Figure 1
Fire Mountain Farm
Sampling Sites

PgG

K:\Linton\FireMtn_JW99901\GIS\FireMtFarmSites.mxd 6/18/2014

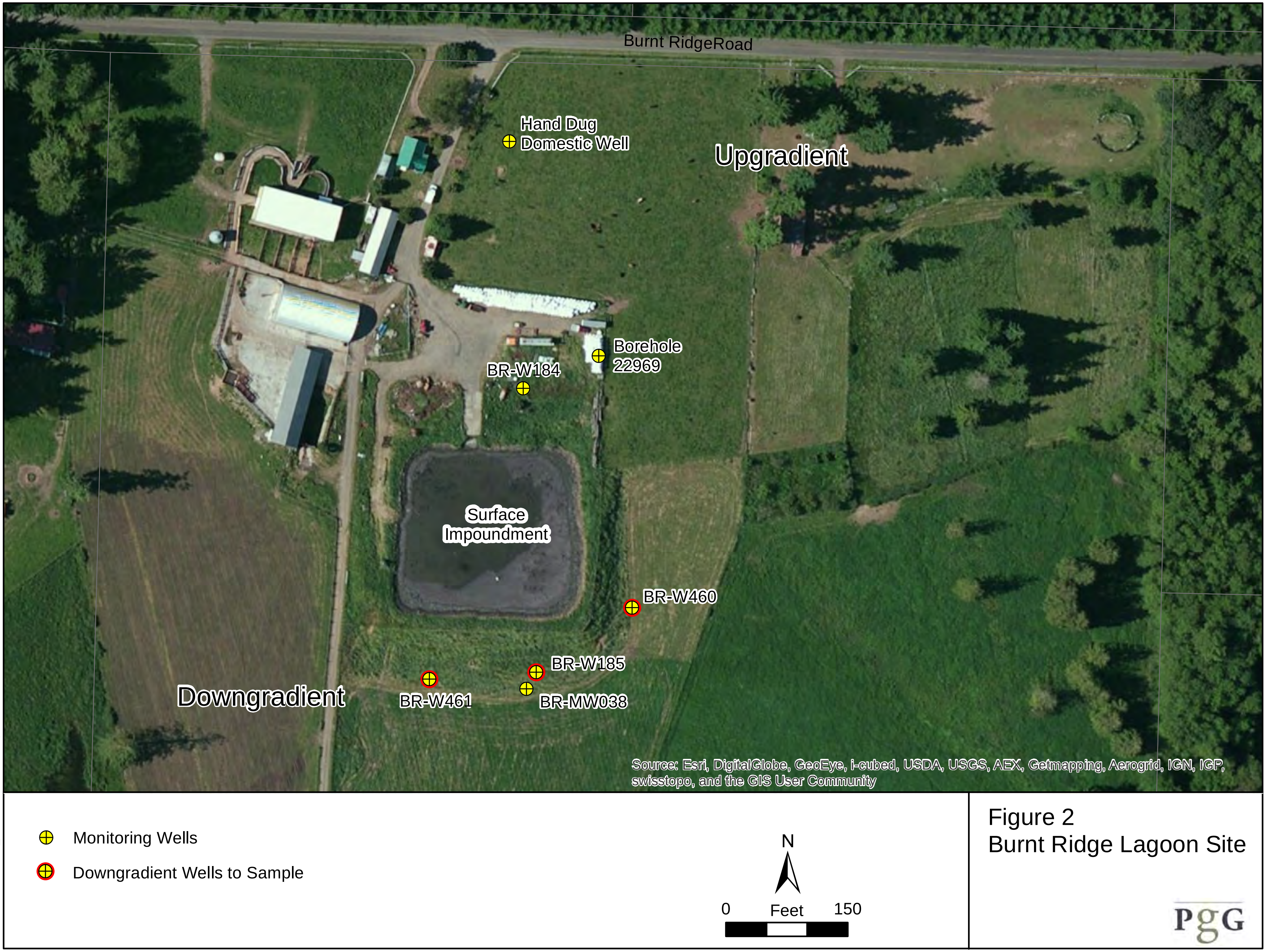



Figure 2
Burnt Ridge Lagoon Site

PGG

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Monitoring Wells

Downgradient Wells to Sample

N

0 Feet 150

Figure 3
Newaukum Prairie
Lagoon Site

PGG

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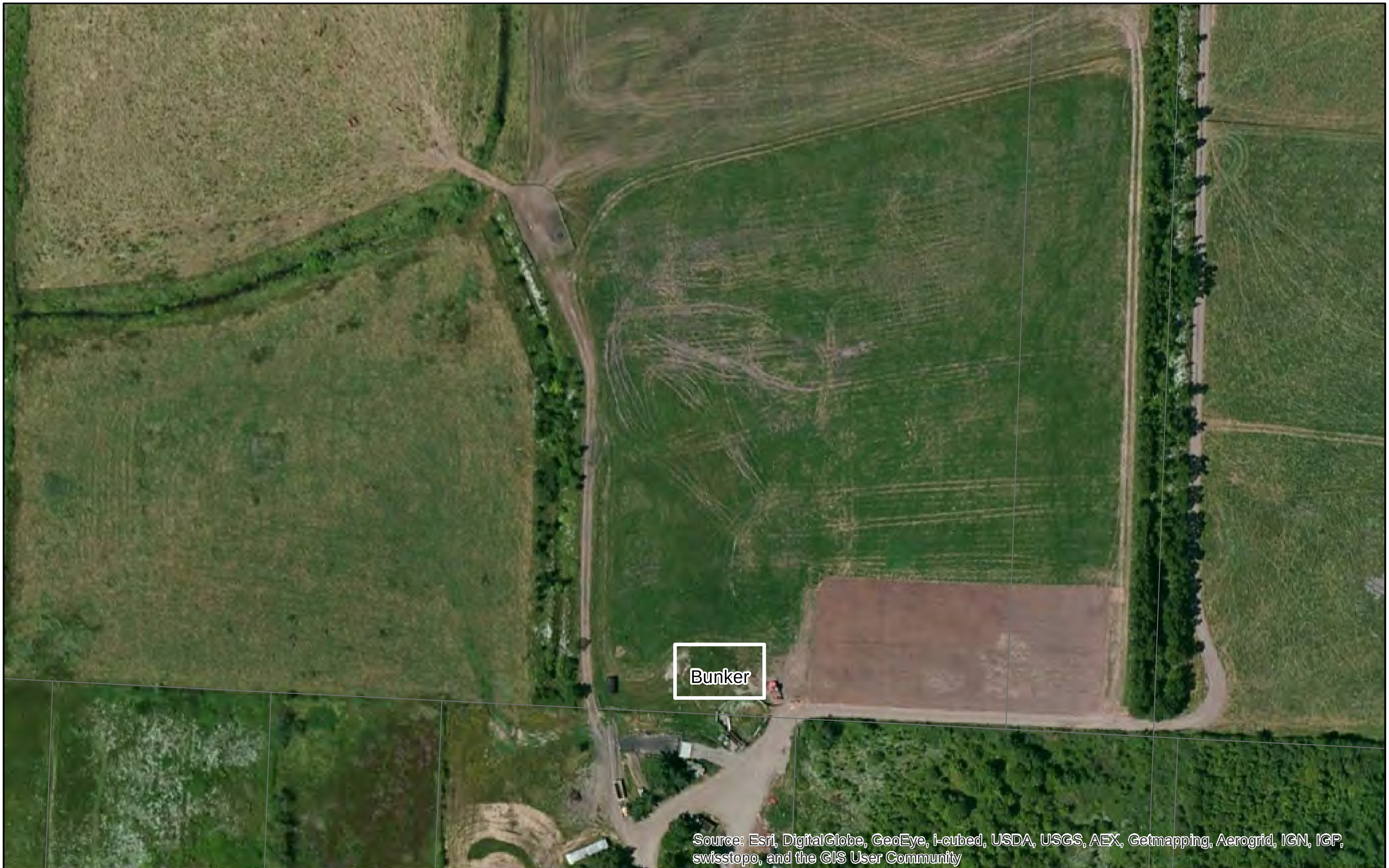



Figure 4
Big Hanaford
Bunker Site

PGG

K:\Linton\FireMtn_JW9901\GIS\BigHanford.mxd 6/30/2014

APPENDIX C

# Cobalt Characterization Report, Fire Mountain Farms Newaukum Prairie & Burnt Ridge Impoundments, Lewis County, Washington

# Cobalt Characterization Report
# Fire Mountain Farms
# Newaukum Prairie & Burnt Ridge Impoundments
# Lewis County, Washington

June 2, 2017

Prepared for

Emerald Kalama Chemical, LLC
Perkins Coie, LLP

LANDAU ASSOCIATES

130 2nd Avenue South
Edmonds, WA 98020
(425) 778-0907

# Cobalt Characterization Report
# Fire Mountain Farms
# Newaukum Prairie & Burnt Ridge Impoundments
# Lewis County, Washington

This document was prepared by, or under the direct supervision of, the technical professionals noted below.


Document prepared by: [signature] Ken Reid, LEG
Senior Geologist

Document reviewed by: [signature] Kristy Hendrickson, PE
Principal



Date: June 2, 2017
Project No.: 0066045.060
File path: \\edmdata01\projects\066\045\R\Cobalt Characterization\FMF_Newaukum & Burnt Ridge Cobalt Data Rpt_052617.docx
Project Coordinator: kes

# TABLE OF CONTENTS



# FIGURES



# TABLES



# APPENDICES

# LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| Administrative Order | Administrative Order No. 10938 |
| Ecology | Washington State Department of Ecology |
| Emerald | Emerald Kalama Chemical, LLC |
| EPA | US Environmental Protection Agency |
| FMF | Fire Mountain Farms, Inc. |
| ft | feet/foot |
| IWBS | industrial wastewater treatment biological solids |
| mg/kg | milligrams per kilogram |
| mg/L | milligrams per liter |
| TCLP | toxicity characteristic leaching procedure |

# INTRODUCTION

This document describes the investigation activities performed to evaluate the cobalt concentration in Fire Mountain Farms, Inc. (FMF) Newaukum Prairie and Burnt Ridge surface impoundments located in Lewis County, Washington (Figure 1) in support of the plan to manage mixed biosolids/industrial wastewater treatment biological solids (known as "mixed material") per Administrative Order No. 10938 (Administrative Order) issued by the Washington State Department of Ecology (Ecology) to Emerald Kalama Chemical, LLC (Emerald) and FMF on September 11, 2014.

## Background

The Newaukum Prairie and Burnt Ridge impoundments are each approximately 48,400 square feet (220 feet [ft] by 220 ft) with constructed berms on each side. The Newaukum Prairie impoundment's berm is elevated above the surrounding topography on all sides and was constructed with a synthetic liner. The Burnt Ridge impoundment's berm is elevated above the surrounding topography on the east, west, and southern sides and has a clay liner and soil cap. Both impoundments contain a mixture of Emerald industrial wastewater treatment biological solids (IWBS) and biosolids from other sources (jointly referred to as mixed material) and overlying accumulated precipitation.

Landau Associates was contracted to sample the mixed material and help Emerald determine the cobalt concentration in each impoundment prior to conducting a more thorough mixed material characterization currently planned to occur later in 2017.

## Cobalt Characterization Sampling

Landau Associates staff arrived at the impoundment in the early morning on May 1, 2017 and met with FMF employees. Three cores of mixed material, which ranged from 3 to 5 ft in length, were collected from each of the two impoundments (for a total of six cores) using FMF's biosolids sampling equipment. The approximate location of each core is shown on Figures 2 and 3. Each set of three cores was composited to make two analytical samples that represent the mixed material in each impoundment. Composite samples were created by homogenizing equivalent volumes from each set of three cores with stainless steel bowls and spoons. The homogenized composite samples were placed into laboratory supplied jars and labeled with appropriate site and sampling location information. The sample identification nomenclature was as follows:

<u>F</u>ire <u>M</u>ountain <u>F</u>arms_ <u>New</u>aukum Prairie <u>Sed</u>iment_Month Day Year

FMF_Newsed_050117

and

<u>F</u>ire <u>M</u>ountain <u>F</u>arms_ <u>Burnt</u> Ridge <u>Sed</u>iment_Month Day Year

FMF_Burntsed_050117

The sample jars were placed on ice immediately after being filled and delivered to the analytical laboratory (Analytical Resources, Inc. of Tukwila, Washington) by Landau Associates under standard chain-of-custody procedures. The samples were analyzed on a standard turnaround time. Both composite samples were analyzed for the following chemical constituents:

- Cobalt by US Environmental Protection Agency (EPA) Method 6010C
- Toxicity Characteristic Leaching Procedure (TCLP) Cobalt by EPA Method 6010C on TCLP extracts.

The analytical results underwent standard data validation and quality assurance checks by Landau Associates and are provided in Table 1. The laboratory report is provided as Appendix A.

## Cobalt Characterization Analytical Results

Preliminary Delisting Levels were calculated using EPA's Hazardous Waste Delisting Risk Assessment Software, as identified by the Washington State Department of Ecology in a September 23, 2016 letter to Mr. Jarrod Kocin, Emerald Kalama Chemical, LLC, re: EPA and Ecology comments to Waste Characterization Plan.

The analytical results for the composite samples presented in Table 1 are briefly summarized below:

- **Newaukum Prairie Impoundment**:
  - Cobalt was detected at 78.1 milligrams per kilogram (mg/kg), which is less than the calculated Preliminary Delisting Level of 8,710 mg/kg.
  - TCLP Cobalt was detected at 0.184 milligrams per liter (mg/L), which is less than the calculated TCLP Preliminary Delisting Level of 0.59 mg/L.
- **Burnt Ridge Impoundment**:
  - Cobalt was detected at 28.3 mg/kg, which is less than the calculated Preliminary Delisting Level of 15,900 mg/kg.
  - TCLP Cobalt was detected at 0.108 mg/L, which is less than the calculated TCLP Preliminary Delisting Level of 1.27 mg/L.

## Waste Management

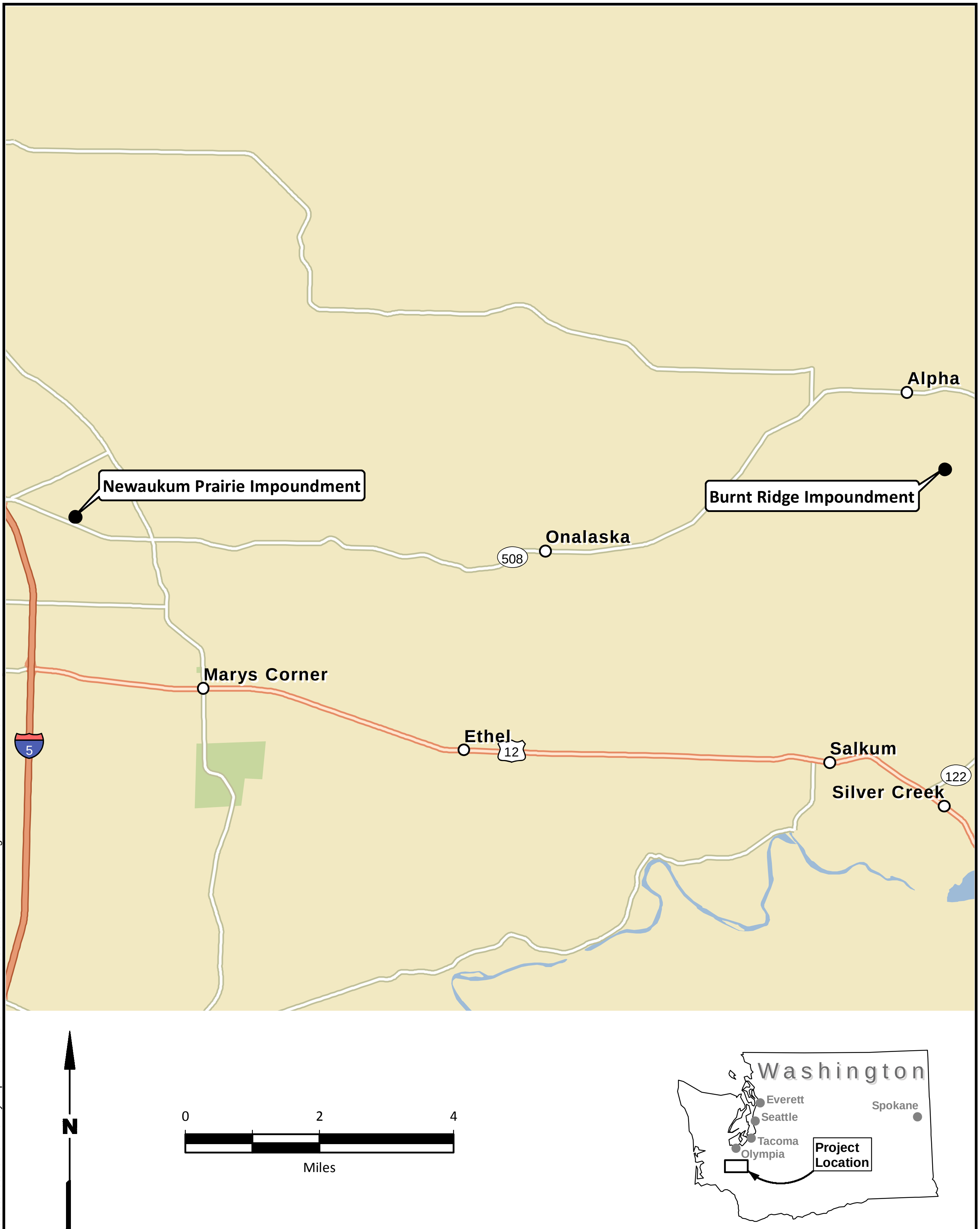
The stainless steel bowls and spoons and Fire Mountain Farms' biosolids sampling device were decontaminated with Alconox and double-rinsed using deionized water and tap water prior to sampling each impoundment. The accumulated decontamination water along with the unused mixed material sample were discharged back to each impoundment after sampling activities were complete.

## Use of this Report

This cobalt characterization report has been prepared for the exclusive use of Perkins Coie LLP and their client, Emerald Kalama Chemical, LLC, and applicable regulatory agencies for specific application to the Fire Mountain Farms Newaukum Prairie and Burnt Ridge Impoundments. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of Landau Associates. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau Associates, shall be at the user's sole risk. Landau Associates warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. We make no other warranty, either express or implied.

# REFERENCES

Ecology. 2016. Letter: EPA and Ecology Comments to Waste Characterization Plan. From Laurie G. Davies, Waste 2 Resources Program, Washington State Department of Ecology, to Jarrod Kocin, Emerald Kalama Chemical, LLC. September 23.




Data Source: Esri 2012

G:\Projects\066\045\060\F01VicinityMap.mxd 5/15/2017 NAD 1983 StatePlane Washington North FIPS 4601 Feet

Landau Associates

| Fire Mountain Farms<br>Newaukum Prairie and<br>Burnt Ridge Impoundments<br>Lewis County, Washington | **Vicinity Map** | Figure<br>1 |
|---|---|---|


Legend

Mixed Material Sampling Locations (composited into one sample)

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 50 100

Scale in Feet

Data Source: Google Earth Pro.

G:\Projects\066\045\060\F02CobaltSamplingLocationsNP.mxd 5/15/2017

LANDAU ASSOCIATES

| Fire Mountain Farms<br>Newaukum Prairie Impoundment<br>Lewis County, Washington | **Cobalt Characterization<br>Sampling Locations** | Figure<br>2 |
|---|---|---|


Legend

Mixed Material Sampling Locations (composited into one sample)

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 50 100

Scale in Feet

Data Source: Esri World Imagery.

G:\Projects\066\045\060\F03CobaltSamplingLocationsBR.mxd 5/15/2017

Landau Associates

| Fire Mountain Farms<br>Burnt Ridge Impoundment<br>Lewis County, Washington | **Cobalt Characterization Sampling Locations** | Figure<br>3 |
|---|---|---|

# Table 1
## Cobalt Characterization Results
## Fire Mountain Farms Newaukum Prairie and Burnt Impoundments
## Lewis County, Washington

### Newaukum Prairie Storage Unit

| Analyte | CAS No. | Preliminary Delisting Level (a) | TCLP-Preliminary Delisting Level (a) | Newaukum Prairie Sample ID and Sample Date | | | |
|---|---|---|---|---|---|---|---|
| | | | | NP-Comp-1 7/7/2014 | NP-Comp-2 7/7/2014 | NP-Comp-3 7/7/2014 | FMF_Newsed 5/1/2017 |
| **Metals (mg/kg; EPA Method 6010C)** | | | | | | | |
| Cobalt | 7440-48-4 | **8710** | -- | **76** | **87** | **89** | **78.1** |
| | | | | | | | |
| **TCLP Metals (mg/L; EPA Method 6010C)** | | | | | | | |
| Cobalt | 7440-48-4 | -- | **0.59** | NA | NA | NA | **0.184** |

### Burnt Ridge Storage Unit

| Analyte | CAS No. | Preliminary Delisting Level (a) | TCLP-Preliminary Delisting Level (a) | Burnt Ridge Sample ID and Sample Date | | | |
|---|---|---|---|---|---|---|---|
| | | | | BR-Comp-1 7/9/2014 | BR-Comp-2 7/9/2014 | BR-Comp-3 7/9/2014 | FMF_Burntsed 5/1/2017 |
| **Metals (mg/kg; EPA Method 6010C)** | | | | | | | |
| Cobalt | 7440-48-4 | **15900** | -- | **43** | **48** | **37** | **28.3** |
| | | | | | | | |
| **TCLP Metals (mg/L; EPA Method 6010C)** | | | | | | | |
| Cobalt | 7440-48-4 | -- | **1.27** | NA | NA | NA | **0.108** |

(a) Preliminary Delisting Level calculated using EPA's Hazardous Waste Delisting Risk Assessment Software, as identified by the Washington State Department of Ecology (September 23, 2016 letter to Mr. Jarrod Kocin, Emerald Kalama Chemical, LLC, re: EPA and Ecology Comments to Waste Characterization Plan).

**Bold** = Detected concentration.
NA = Not Analyzed.
--- = screening level not available

EPA = US Environmental Protection Agency
ID = identification
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
TCLP = Toxicity Characteristic Leaching Procedure

APPENDIX A

# Laboratory Reports

Analytical Resources, Incorporated
Analytical Chemists and Consultants

09 May 2017

Ken Reid
Landau Associates, Inc.
130 2nd Avenue S.
Edmonds, WA 98020

RE: FMF Cobalt Sampling

Please find enclosed sample receipt documentation and analytical results for samples from the project referenced above.

Sample analyses were performed according to ARI's Quality Assurance Plan and any provided project specific Quality Assurance Plan. Each analytical section of this report has been approved and reviewed by an analytical peer, the appropriate Laboratory Supervisor or qualified substitute, and a technical reviewer.

Should you have any questions or problems, please feel free to contact us at your convenience.

| Associated Work Order(s) | Associated SDG ID(s) |
|---|---|
| 17E0026 | N/A |

-----

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed in the enclose Narrative. ARI, an accredited laboratory, certifies that the report results for which ARI is accredited meets all the reqirements of the accrediting body. A list of certified analyses, accreditations, and expiration dates is included in this report.

Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or his/her designee, as verified by the following signature.

Analytical Resources, Inc.

*The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.*

ACCREDITED IN ACCORDANCE WITH nelac
Cert# 100006

PJLA Testing
Accreditation # 66169

17E0026

LANDAU ASSOCIATES

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☐ **Tacoma** (253) 926-2493
☐ **Spokane** (509) 327-9737
☐ **Portland** (503) 542-1080
☐ ______

Date 5/1/17
Page 1 of 1

# Chain-of-Custody Record

Project Name FMF Cobalt Sampling  Project No. 66045
Project Location/Event ______
Sampler's Name Ken Reid
Project Contact " " , Kris Hendrickson
Send Results To " " , " " , Kristy Schultz

Turnaround Time
☑ Standard
☐ Accelerated
☐ ______

| Sample I.D. | Date | Time | Matrix | No. of Containers | Cobalt by EPA 6010C | TCLP Cobalt by EPA 6010C on TCLP extracts |
|---|---|---|---|---|---|---|
| FMF_Newsed_050117 | 5/1/17 | 1000 | sed | 3 | x | x |
| FMF_Burntsed_050117 | 5/1/17 | 1300 | ↓ | 3 | x | x |

Observations/Comments
X Allow water samples to settle, collect aliquot from clear portion
X NWTPH-Dx - run acid wash/silica gel cleanup
___ run samples standardized to ______ product
___ Analyze for EPH if no specific product identified
VOC/BTEX/VPH (soil):
___ non-preserved
___ preserved w/methanol
___ preserved w/sodium bisulfate
___ Freeze upon receipt
___ Dissolved metal water samples field filtered
Other ______

Special Shipment/Handling or Storage Requirements on ice

Method of Shipment

| Relinquished by | Received by | Relinquished by | Received by |
|---|---|---|---|
| Signature [signature] | Signature [signature] | Signature | Signature |
| Printed Name Ken Reid | Printed Name Paul Mark | Printed Name | Printed Name |
| Company LAI | Company ARI | Company | Company |
| Date 5/1/17 Time ~~1530~~ 1550 | Date 5/1/2017 Time 15:50 | Date Time | Date Time |

Analytical Resources, Incorporated
Analytical Chemists and Consultants

# Cooler Receipt Form

ARI Client: Landau Associates

Project Name: FMF Cobalt Sampling

COC No(s): ______ NA

Delivered by: Fed-Ex UPS Courier (Hand Delivered) Other: ______

Assigned ARI Job No: 17E0026

Tracking No: ______ NA

**Preliminary Examination Phase:**

| | | |
|---|---|---|
| Were intact, properly signed and dated custody seals attached to the outside of to cooler? | YES | (NO) |
| Were custody papers included with the cooler? | (YES) | NO |
| Were custody papers properly filled out (ink, signed, etc.) | (YES) | NO |

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry) 5.8
Time: ______

If cooler temperature is out of compliance fill out form 00070F

Temp Gun ID#: D005266

Cooler Accepted by: PM Date: 5/1/2017 Time: 15:50

*Complete custody forms and attach all shipping documents*

## Log-In Phase:

Was a temperature blank included in the cooler? YES (NO)

What kind of packing material was used? ... (Bubble Wrap) (Wet Ice) Gel Packs Baggies Foam Block Paper Other: ______

| | NA | YES | NO |
|---|---|---|---|
| Was sufficient ice used (if appropriate)? | NA | (YES) | NO |
| Were all bottles sealed in individual plastic bags? | | YES | (NO) |
| Did all bottles arrive in good condition (unbroken)? | | (YES) | NO |
| Were all bottle labels complete and legible? | | (YES) | NO |
| Did the number of containers listed on COC match with the number of containers received? | | (YES) | NO |
| Did all bottle labels and tags agree with custody papers? | | (YES) | NO |
| Were all bottles used correct for the requested analyses? | | (YES) | NO |
| Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)... | (NA) | YES | NO |
| Were all VOC vials free of air bubbles? | (NA) | YES | NO |
| Was sufficient amount of sample sent in each bottle? | | (YES) | NO |
| Date VOC Trip Blank was made at ARI | (NA) | | |

Was Sample Split by ARI : (NA) YES Date/Time: ______ Equipment: ______ Split by: ______

Samples Logged by: PM Date: 5/1/2017 Time: 16:49

*** Notify Project Manager of discrepancies or concerns ***

| Sample ID on Bottle | Sample ID on COC | Sample ID on Bottle | Sample ID on COC |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

*Additional Notes, Discrepancies, & Resolutions:*

By: Date:

| Small Air Bubbles ~2mm | Peabubbles' 2-4 mm | LARGE Air Bubbles > 4 mm |
|---|---|---|

| |
|---|
| Small → "sm" (< 2 mm) |
| Peabubbles → "pb" ( 2 to < 4 mm ) |
| Large → "lg" ( 4 to < 6 mm ) |
| Headspace → "hs" ( > 6 mm ) |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: FMF Cobalt Sampling | |
| 130 2nd Avenue S. | Project Number: 66045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 09-May-2017 15:13 |

## ANALYTICAL REPORT FOR SAMPLES

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| FMF_Newsed_050117 | 17E0026-01 | Solid | 01-May-2017 10:00 | 01-May-2017 15:50 |
| FMF_Burntsed_050117 | 17E0026-02 | Solid | 01-May-2017 13:00 | 01-May-2017 15:50 |

| | | |
|---|---|---|
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# Case Narrative

**Total and TCLP Metals -**

The sample(s) were digested and analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

The method blank(s) were clean at the reporting limits.

The LCS percent recoveries were within control limits.

# Analytical Report

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: FMF Cobalt Sampling | |
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## FMF_Newsed_050117
### 17E0026-01 (Solid)

**Metals and Metallic Compounds**

Method: EPA 6010C — Sampled: 05/01/2017 10:00
Instrument: ICP2 — Analyzed: 08-May-2017 15:49

Sample Preparation: Preparation Method: SWC EPA 3050B
Preparation Batch: BFE0136 — Sample Size: 1.01 g (wet) — Dry Weight:0.10 g
Prepared: 04-May-2017 — Final Volume: 50 mL — % Solids: 9.68

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Cobalt | 7440-48-4 | 2 | 0.293 | 3.07 | **78.1** | mg/kg | |

# Analytical Report

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: FMF Cobalt Sampling | |
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**FMF_Newsed_050117**

**17E0026-01 (Solid)**

## Metals and Metallic Compounds

Method: SM 2540 G-97 — Sampled: 05/01/2017 10:00

Instrument: N/A — Analyzed: 09-May-2017 10:12

Sample Preparation: Preparation Method: No Prep-Metals
Preparation Batch: BFE0202 — Sample Size: 10 g (wet)
Prepared: 08-May-2017 — Final Volume: 10 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Total Solids | | 1 | 0.04 | **9.68** | % | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: FMF Cobalt Sampling | |
| 130 2nd Avenue S. | Project Number: 66045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 09-May-2017 15:13 |

## FMF_Newsed_050117
### 17E0026-01 (Solid)

**TCLP Metals and Metallic Compounds**

Method: EPA 6010C — Sampled: 05/01/2017 10:00

Instrument: ICP2 — Analyzed: 04-May-2017 11:36

Sample Preparation:
Preparation Method: LEN Digestion of EPA 1311 Elutriate
Preparation Batch: BFE0092 — Sample Size: 25 mL (wet)
Prepared: 03-May-2017 — Final Volume: 25 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Cobalt | 7440-48-4 | 5 | 0.0014 | 0.0150 | **0.184** | mg/L | |

# Analytical Report

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: FMF Cobalt Sampling | |
| 130 2nd Avenue S. | Project Number: 66045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 09-May-2017 15:13 |

**FMF_Burntsed_050117**

**17E0026-02 (Solid)**

## Metals and Metallic Compounds

Method: EPA 6010C — Sampled: 05/01/2017 13:00

Instrument: ICP2 — Analyzed: 08-May-2017 15:53

| Sample Preparation: | | | |
|---|---|---|---|
| | Preparation Method: SWC EPA 3050B | | |
| | Preparation Batch: BFE0136 | Sample Size: 1.069 g (wet) | Dry Weight:0.20 g |
| | Prepared: 04-May-2017 | Final Volume: 50 mL | % Solids: 18.50 |

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Cobalt | 7440-48-4 | 2 | 0.145 | 1.52 | **28.3** | mg/kg | |



*The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.*

# Analytical Report

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: FMF Cobalt Sampling | |
| 130 2nd Avenue S. | Project Number: 66045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 09-May-2017 15:13 |

**FMF_Burntsed_050117**

**17E0026-02 (Solid)**

**Metals and Metallic Compounds**

Method: SM 2540 G-97 — Sampled: 05/01/2017 13:00

Instrument: N/A — Analyzed: 09-May-2017 10:12

Sample Preparation: Preparation Method: No Prep-Metals
Preparation Batch: BFE0202 — Sample Size: 10 g (wet)
Prepared: 08-May-2017 — Final Volume: 10 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Total Solids | | 1 | 0.04 | **18.50** | % | |

# Analytical Report

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: FMF Cobalt Sampling | |
| 130 2nd Avenue S. | Project Number: 66045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 09-May-2017 15:13 |

**FMF_Burntsed_050117**

**17E0026-02 (Solid)**

## TCLP Metals and Metallic Compounds

Method: EPA 6010C — Sampled: 05/01/2017 13:00

Instrument: ICP2 — Analyzed: 08-May-2017 14:56

Sample Preparation: Preparation Method: LEN Digestion of EPA 1311 Elutriate
Preparation Batch: BFE0093 — Sample Size: 25 mL (wet)
Prepared: 03-May-2017 — Final Volume: 25 mL

| Analyte | CAS Number | Dilution | Detection Limit | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|---|
| Cobalt | 7440-48-4 | 5 | 0.0014 | 0.0150 | **0.108** | mg/L | |





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| | | |
|---|---|---|
| Landau Associates, Inc. | Project: FMF Cobalt Sampling | |
| 130 2nd Avenue S. | Project Number: 66045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 09-May-2017 15:13 |

## Metals and Metallic Compounds - Quality Control

### Batch BFE0136 - SWC EPA 3050B

Instrument: ICP2 Analyst: TCH

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BFE0136-BLK1)** | | | | | Prepared: 04-May-2017 Analyzed: 08-May-2017 15:33 | | | | | | |
| Cobalt | ND | 0.0287 | 0.300 | mg/kg | | | | | | | U |
| **LCS (BFE0136-BS1)** | | | | | Prepared: 04-May-2017 Analyzed: 08-May-2017 15:12 | | | | | | |
| Cobalt | 50.1 | 0.0287 | 0.300 | mg/kg | 50.0 | | 100 | 80-120 | | | |

## TCLP Metals and Metallic Compounds - Quality Control

### Batch BFE0092 - LEN Digestion of EPA 1311 Elutriate

Instrument: ICP2 Analyst: TCH

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BFE0092-BLK1)** | | | | Prepared: 03-May-2017 Analyzed: 04-May-2017 11:01 | | | | | | | |
| Cobalt | 0.0018 | 0.0014 | 0.0150 | mg/L | | | | | | | J |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: FMF Cobalt Sampling | |
| 130 2nd Avenue S. | Project Number: 66045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 09-May-2017 15:13 |

## TCLP Metals and Metallic Compounds - Quality Control

### Batch BFE0093 - LEN Digestion of EPA 1311 Elutriate

Instrument: ICP2 Analyst: TCH

| QC Sample/Analyte | Result | Detection Limit | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BFE0093-BLK1)** | | | | Prepared: 03-May-2017 Analyzed: 08-May-2017 14:35 | | | | | | | |
| Cobalt | ND | 0.0014 | 0.0150 | mg/L | | | | | | | U |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: FMF Cobalt Sampling | |
| 130 2nd Avenue S. | Project Number: 66045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 09-May-2017 15:13 |

## Certified Analyses included in this Report

| Analyte | Certifications |
|---|---|
| ***EPA 6010C in Solid*** | |
| Cobalt | NELAP,WADOE,DoD-ELAP |
| Cobalt | NELAP,WADOE,DoD-ELAP |

| Code | Description | Number | Expires |
|---|---|---|---|
| ADEC | Alaska Dept of Environmental Conservation | UST-033 | 05/06/2017 |
| CALAP | California Department of Public Health CAELAP | 2748 | 02/28/2018 |
| DoD-ELAP | DoD-Environmental Laboratory Accreditation Program | 66169 | 03/30/2017 |
| NELAP | ORELAP - Oregon Laboratory Accreditation Program | WA100006 | 05/11/2017 |
| WADOE | WA Dept of Ecology | C558 | 06/30/2017 |
| WA-DW | Ecology - Drinking Water | C558 | 06/30/2017 |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: FMF Cobalt Sampling | |
| 130 2nd Avenue S. | Project Number: 66045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 09-May-2017 15:13 |

## Notes and Definitions

| | |
|---|---|
| U | This analyte is not detected above the applicable reporting or detection limit. |
| J | Estimated concentration value detected below the reporting limit. |
| D | The reported value is from a dilution |
| B | This analyte was detected in the method blank. |
| DET | Analyte DETECTED |
| ND | Analyte NOT DETECTED at or above the reporting limit |
| NR | Not Reported |
| dry | Sample results reported on a dry weight basis |
| RPD | Relative Percent Difference |
| [2C] | Indicates this result was quantified on the second column on a dual column analysis. |

APPENDIX D

# Health and Safety Plan

**WORK LOCATION PERSONNEL PROTECTION AND SAFETY EVALUATION FORM**

**Attach Pertinent Documents/Data**
**Fill in Blanks As Appropriate**

| | | | |
|---|---|---|---|
| Job No.: | 006645.030.031 | | |
| Prepared by: | Christel Olsen | Reviewed by: | Christine Kimmel |
| Date: | July 7, 2016 | Date: | July 13, 2016 |

## A. WORK LOCATION DESCRIPTION

1. **Project Name:** Emerald Kalama Mixed Material Characterization Sampling
2. **Location:** Mixed material sampling at three locations (Burnt Ridge, Newaukum Prairie, and Big Hanaford) in Lewis County, Washington
3. **Anticipated Activities:**
   - Mixed material depth and thickness measurements.
   - Mixed material sampling using either a sludge judge or hand auger.

   Big Hanaford activities will be performed at an elevation of approximately 6 to 8 feet above ground surface to access the mixed material contained within the storage unit. This access will be gained by a ladder and sampling will be performed on a platform. Fall protection will be implemented for all work where a fall of greater than 4 feet in height is possible. Newaukum Prairie and Burnt Ridge activities will be on water with access by row boat. The boat will be tied-in from multiple points at the shoreline to stabilize boat during sampling (because an anchor cannot be used). Mixed material will be collected from the bottom of the storage unit using a sludge judge with extension rods.
4. **Size:** Each site is approximately 2 acres in total area; Newaukum Prairie is approximately 1.2 acres; Burnt Ridge is approximately 1.1 acres; Big Hanaford is approximately 6,000 square feet in area.
5. **Surrounding Population:** Agricultural and forested properties
6. **Buildings/Homes/Industry:** Dispersed farm houses and agricultural facilities
7. **Topography:** The area topography is generally flat agricultural land with some rolling hills in the vicinity.
8. **Anticipated Weather:** Work is outdoors, Spring-Summer 2017; Sunny, cloudy, or rainy, 40 to 80˚F
9. **Unusual Features:** Mixed material density in the Big Hanaford storage unit is unknown, extreme caution should be used when working around and on the mixed material.

**10. Site History:** Industrial wastewater treatment biological solids (IWBS) generated during the wastewater treatment process by Emerald Kalama Chemical, LLC (Emerald) were stored in the storage units by Fire Mountain Farms (FMF) together with mixed material from other locations. The mixed material is considered by the Washington Department of Ecology (Ecology) to be a dangerous waste. Emerald is working with Ecology and the US Environmental Protection Agency (EPA) to delist the mixed material. The Newaukum Prairie storage unit was originally designed and constructed in 1998 and relined in 2013. The Burnt Ridge storage unit was designed and constructed in 1998. Little is known about the history of the Big Hanaford storage unit. No facility has accepted new waste since 2014.

## B. HAZARD DESCRIPTION

**1. Background Review:** ☐ Complete ☒ Partial

If partial, why? Available information regarding constituent concentrations in mixed material in the storage units was reviewed.

**2. Hazardous Level:** ☐ B ☐ C ☒ D ☐ Unknown

**Justification:** Limited potential for exposure due to types of compounds used onsite, low anticipated concentrations, and sampling methodology.

**3. Types of Hazards:** (Attach additional sheets as necessary)

A. ☒ Chemical ☒ Inhalation ☐ Explosive

☐ Biological ☒ Ingestion ☐ O2 Def. ☒ Skin Contact

Describe:

Possible contact with mixed material, inhalation of vapors, or ingestion of mixed material or water. Disposable gloves will be worn and face will be washed prior to eating lunch or stopping work for the day.

B. ☒ Physical ☒ Cold Stress ☐ Noise ☒ Heat Stress ☐ Other

Describe:

Physical hazards associated with working outside and around heavy equipment at the site. Appropriate clothing will be worn to mitigate heat or cold stress. Drowning hazard may be present at the Burnt Ridge and Newaukum Prairie storage units. Life vest must be worn at all times during sampling at these locations. Slips, trips, and falls in boat, on platform, and on HDPE liner (at Newaukum Prairie). Do not walk or stand on storage unit liner. Fall protection devices will be worn when working on elevated platforms greater than 4 ft.

C. ☐ Radiation

Describe:

**4. Nature of Hazards:**

☒ Air — Describe: Potential for volatile constituents to be released from mixed material during sampling activities.

☒ Mixed Material — Describe: Possible chemical exposure during sampling. Potential for contact with or ingestion of mixed material. Potential for submersion and suffocation in unstable mixed material storage unit.

☒ Surface Water — Describe: Potential for drowning at the Burnt Ridge and Newaukum Prairie storage units. Potential for contact with or ingestion of potentially contaminated water.

☐ Groundwater — Describe:

☐ Other — Describe:

## 5. Chemical Contaminants of Concern ☐ N/A

| Contaminant | PEL (ppm) | I.D.L.H. (ppm) | Source/Quantity Characteristics | Route of Exposure | Symptoms of Acute Exposure | Instruments Used to Monitor Contaminant |
|---|---|---|---|---|---|---|
| **Benzene** | 1 | 500 | Unknown concentrations in mixed material. | Inhalation, absorption, ingestion, and dermal contact | Irritated eyes, skin, nose and respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude; dermatitis; bone marrow depression [carcinogenic] | PID meter |
| **Toluene** | 200 | 500 | Unknown concentrations in mixed material. | Inhalation, absorption, ingestion, and dermal contact | Irritated eyes and nose; lassitude, confusion, euphoria, dizziness, headache; dilated pupils, lacrimation; anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver failure, kidney damage | PID meter |
| **Phenol** | 5 | 250 | Unknown concentrations in mixed material | Inhalation, skin absorption, ingestion, and dermal contact | Irritated eyes, nose, throat; anorexia; lassitude; liver, kidney damage; skin burns; convulsions | PID meter |
| **4-Methylphenol** | 2.3 | 250 | Unknown concentrations in mixed material | Inhalation, skin absorption, ingestion, and dermal contact | Irritated eyes, skin, mucous membrane; central nervous system effects; confusion, depression, respiratory failure; skin burns; lung, liver, kidney, pancreas damage | PID meter |

Notes: PEL = Permissible exposure limit.
IDLH = Immediately dangerous to life and health [National Institute for Occupational Safety and Health (NIOSH)].
STEL=Short Term Exposure Limit
PID= Photoionization Detector mobile meter

**6. Physical Hazards of Concern** ☐ N/A

| Hazard | Description | Location | Procedures Used to Monitor Hazard |
|---|---|---|---|
| Vehicles and heavy equipment used at the site | Any area | Any area | Alert observation of surroundings, use of brightly colored safety vest. Stand clear of equipment and avoid pinch points. Make eye contact with operator prior to advancing. Verify working backup alarms on equipment. |
| Slips, trips, and falls | Any area | Any area<br>The storage unit liner at Newaukum Prairie is known to be extremely slippery. | The HDPE liner at Newaukum Prairie is very slippery. Do not walk on storage unit liners. Alert observation of surroundings; awareness of uneven ground and ditches. |
| Drowning | While navigating the boat and walking near storage unit | Newaukum Prairie and Burnt Ridge storage units | Wear life vest at all times and stay in the boat during storage unit sampling. |

| | | | |
|---|---|---|---|
| Suffocation | Mixed material stability and depth of storage unit is unknown. | Big Hanaford | Stay on sampling platform. Do not walk directly on mixed material. Use fall protection (safety recovery harness and clip on retrieval line) when working at heights greater than 4 ft around the mixed material storage unit. Wear secured recovery harness at all times when on the sampling platform. |
| Heat Stress/Cold Stress | Heat exhaustion, heat stress, and heat cramps | Any area | Wear appropriate clothing and layers, take breaks as needed, drink water and eat food throughout the work day, avoid caffeine. |
| Biological hazards | Snakes, rats, spiders, bees, and ticks | Area surrounding storage units | Identify if members of sampling crew are allergic to any insects and identify proper emergency procedure; wear long pants and long sleeved shirt; inspect clothing and body for insects or insect bites/stings. |
| Electrocution | Wiring of aerating units | Storage unit areas | Confirm aerators have been disconnected from power source use a Lockout/Tag out method to eliminate potential energizing of equipment during sampling activities. |

**7. Work Location Instrument Readings** ☒ N/A

Location: ______________

| | |
|---|---|
| Percent $O_2$: ______________ | Percent LEL: ______________ |
| Radioactivity: ______________ | PID: ______________ |
| FID: ______________ | Other: ______________ |
| Other: ______________ | Other: ______________ |
| Other: ______________ | Other: ______________ |

---

Location: ______________

| | |
|---|---|
| Percent $O_2$: ______________ | Percent LEL: ______________ |
| Radioactivity: ______________ | PID: ______________ |
| FID: ______________ | Other: ______________ |
| Other: ______________ | Other: ______________ |
| Other: ______________ | Other: ______________ |

---

Location: ______________

| | |
|---|---|
| Percent $O_2$: ______________ | Percent LEL: ______________ |
| Radioactivity: ______________ | PID: ______________ |
| FID: ______________ | Other: ______________ |
| Other: ______________ | Other: ______________ |
| Other: ______________ | Other: ______________ |

---

Location: ______________

| | |
|---|---|
| Percent $O_2$: ______________ | Percent LEL: ______________ |
| Radioactivity: ______________ | PID: ______________ |
| FID: ______________ | Other: ______________ |
| Other: ______________ | Other: ______________ |
| Other: ______________ | Other: ______________ |

**8. Hazards Expected In Preparation for Work Assignment** ☒ N/A

<u>Describe:</u>

## C. PERSONAL PROTECTIVE EQUIPMENT

**1. Level of Protection**

☐ A ☐ B ☐ C ☒ D

Location/Activity: All site activities, skin cover, gloves, boots, eye protection, hard hat.

☐ A ☐ B ☒ C ☐ D

Location/Activity: Based on air monitoring results for all locations. See Attachment A for action levels.

**2. Protective Equipment (specify probable quantity required)**

**Respirator** ☐ N/A

- ☐ SCBA, Airline
- ☐ Full-Face Respirator
- ☒ Half-Face Respirator (Cart. organic vapor) (Only if upgrade to Level C)
- ☐ Escape mask
- ☐ None
- ☐ Other:
- ☐ Other:

**Clothing** ☐ N/A

- ☐ Fully Encapsulating Suit
- ☐ Chemically Resistant Splash Suit
- ☐ Apron, Specify:
- ☒ Tyvek Coverall (only if upgrade to Level C)
- ☐ Saranex Coverall
- ☒ Reflective Safety Vest
- ☒ Other: Work clothes, long pants and sleeved shirt, sunblock, and life safety vest

**Head & Eye** ☐ N/A

- ☒ Hard Hat
- ☐ Goggles
- ☐ Face Shield
- ☒ Safety Eyeglasses
- ☒ Other: hearing protection if heavy sampling equipment is utilized

**Hand Protection** ☐ N/A

- ☐ Undergloves; Type: Nitrile
- ☒ Gloves; Type: Nitrile and leather gloves when using sampling equipment
- ☐ Overgloves; Type:
- ☐ None
- ☐ Other:

**Foot Protection** ☐ N/A

- ☐ Neoprene Safety Boots with Steel Toe/Shank
- ☐ Disposable Overboots
- ☒ Other: Steel-toe work boots

**3. Monitoring Equipment** ☐ N/A

☐ CGI
☒ PID
☐ $O^2$ Meter
☐ FID
☐ Rad Survey
☐ Other Visible indicates of dust
☒ Detector Tubes (benzene

Type:

## D. PERSONNEL DECONTAMINATION (ATTACH DIAGRAM)

☒ Required
☐ Not Required

Wash hands and face prior to stopping for eating or drinking and at the end of the shift prior to leaving the site. Replace PPE on a frequent basis. Rinse off boots and other non-disposable gear with tap water.

**EQUIPMENT DECONTAMINATION (ATTACH DIAGRAM)**

☒ Required
☐ Not Required

***If required, describe and list equipment:***

Non-dedicated or non-disposable sampling equipment will be decontaminated between sampling locations using a tap water and alconox soap mixture, followed by a tap water rinse, followed with a distilled water rinse.

## E. PERSONNEL

| | Name | Work Location Title/Task | Medical Current | Fit Test Current |
|---|---|---|---|---|
| 1. | **Ken Reid** | **Site Senior Geologist** | ☒ | ☒ |
| 2. | **Devan Brandt** | **Senior Staff Geologist** | ☒ | ☒ |
| 3. | | | ☐ | ☐ |
| 4. | | | ☐ | ☐ |
| 5. | | | ☐ | ☐ |
| 6. | | | ☐ | ☐ |
| 7. | | | ☐ | ☐ |
| 8. | | | ☐ | ☐ |
| 9. | | | ☐ | ☐ |
| 10. | | | ☐ | ☐ |

**Site Safety Coordinator:** **Ken Reid**

## F. ACTIVITIES COVERED UNDER THIS PLAN

| Task No. | Description | Preliminary Schedule |
|---|---|---|
| 1 | Big Hanaford: Mixed material sampling from storage unit using a hand auger. | Spring-Summer 2017 |
| 2 | Newaukum Prairie: Mixed material sampling from row boat using sludge judge with extension to reach mixed material at bottom of the storage unit. Anchor from shore. | Spring-Summer 2017 |
| 3 | Burnt Ridge: Mixed material sampling from row boat using sludge judge with extension to reach mixed material at bottom of the storage unit. Anchor from shore. | Spring-Summer 2017 |

## G. SUBCONTRACTOR'S HEALTH AND SAFETY PROGRAM EVALUATION

☒ N/A

Name and Address of Subcontractor:

**EVALUATION CRITERIA**

| Item | Adequate | Inadequate | Comments |
|---|---|---|---|
| Medical Surveillance Program | ☐ | ☐ | |
| Personal Protective Equipment Availability | ☐ | ☐ | |
| Onsite Monitoring Equipment Availability | ☐ | ☐ | |
| Safe Working Procedures Specification | ☐ | ☐ | |
| Training Protocols | ☐ | ☐ | |
| Ancillary Support Procedures (if any) | ☐ | ☐ | |
| Emergency Procedures | ☐ | ☐ | |
| Evacuation Procedures Contingency Plan | ☐ | ☐ | |
| Decontamination Procedures Equipment | ☐ | ☐ | |
| Decontamination Procedures Personnel | ☐ | ☐ | |

**GENERAL HEALTH AND SAFETY PROGRAM EVALUATION**: ☐ Adequate ☐ Inadequate

Additional Comments:

Evaluation Conducted By: ______________________________ Date: ______________

## EMERGENCY FACILITIES AND NUMBERS

Hospital: Providence Centralia Hospital
914 S Scheuber Rd
Centralia, WA 98531
(425) 261-2000

Directions from **Newaukum Prairie**:

| | |
|---|---|
| Head SOUTHWEST on E Forest Napavine Rd towards Kirkland Rd | 0.4 miles |
| Turn LEFT onto Forest Rd | 150 ft |
| Turn RIGHT onto Main Ave | 440 ft |
| Turn RIGHT to merge onto I-5 N toward Seattle | 0.4 miles |
| MERGE onto 1-5 N | 9.4 miles |
| Take EXIT 81 for WA-507N/Mellen St toward City Center | 0.6 miles |
| Continue on to Ellsbury St | 0.3 miles |
| Turn LEFT on Mellen St | 0.2 miles |
| Continue onto Cooks Hill Rd | 0.4 miles |
| Turn Left onto S Scheuber Rd | 0.4 miles |
| Destination on the LEFT | 0.1 miles |
| Total Estimated Time: 14 minutes | Total Estimated Distance: 12 miles |

Directions from **Burnt Ridge**:

| | |
|---|---|
| Head WEST on Burnt Ridge Rd toward Tillie Rd | 3.9 miles |
| Turn RIGHT onto Jorgensen Rd | 2.7 miles |
| Turn LEFT onto WA-508 W/Main Ave | 9.5 miles |
| Turn RIGHT to merge onto I-5 N toward Seattle | 9.8 miles |
| Take EXIT 81 for WA-507N/Mellen St toward City Center | 0.6 miles |
| Continue on to Ellsbury St | 0.3 miles |
| Turn LEFT on Mellen St | 0.2 miles |
| Continue onto Cooks Hill Rd | 0.4 miles |
| Turn Left onto S Scheuber Rd | 0.4 miles |
| Destination on the LEFT | 0.1 miles |
| Total Estimated Time: 36 minutes | Total Estimated Distance: 27.5 miles |

Directions from **Big Hanaford**:

| | |
|---|---|
| Head WEST on Big Hanaford Rd/Hanaford Valley Rd toward Blue Rd | 1.1 miles |
| Turn LEFT onto WA-507 S | 3.6 miles |
| Turn RIGHT onto W Cherry St | 0.2 miles |
| Turn LEFT onto Alder St | 0.3 miles |
| Turn RIGHT onto Mellen St | 0.6 miles |
| Continue onto Cooks Hill Rd | 0.4 miles |
| Turn Left onto S Scheuber Rd | 0.4 miles |
| Destination on the LEFT | 0.1 miles |
| Total Estimated Time: 15 minutes | Total Estimated Distance: 6.3 miles |

**Emergency Transportation Systems (Fire, Police, Ambulance) – 911**

Emergency Contacts:

| | Offsite | Onsite |
|---|---|---|
| Kris Hendrickson | Landau Associates<br>Project Manager | 425-778-0907 office<br>206-910-1378 cell |
| Allison Bergseng | Landau Associates<br>Task Manager | 425-329-0253 office<br>503-459-8124 cell |
| Christine Kimmel | Landau Associates<br>Health and Safety Manager | 425-778-0907 office<br>206-786-3801 cell |

**In the event of an emergency, do the following:**

1. Call for help as soon as possible. Call 911. Give the following information:
   - WHERE the emergency is – use cross streets or landmarks
   - PHONE NUMBER you are calling from
   - WHAT HAPPENED – type of injury
   - WHAT is being done for the victim(s)
   - YOU HANG UP LAST – let the person you called hang up first.

2. If the victim can be moved, paramedics will transport to the hospital. If the injury or exposure is not life threatening, decontaminate the individual first. If decontamination is not feasible, wrap the individual in a blanket or sheet of plastic prior to transport.

3. Notify the Project Manager (Kris Hendrickson 206-910-1378).

**Emergency Routes – Maps – See last 3 pages**

**HEALTH AND SAFETY PLAN**
**APPROVAL/SIGN OFF FORMAT**

I have read, understood, and agreed with the information set forth in this Health and Safety Plan (and attachments) and discussed in the Personnel Health and Safety briefing.

| Name | Signature | Date |
|---|---|---|
| Name | Signature | Date |
| Name | Signature | Date |
| Name | Signature | Date |
| Name | Signature | Date |
| Ken Reid<br>Site Safety Coordinator | Kenneth D. Reid<br>Signature | 7/13/16<br>Date |
| Christine Kimmel<br>Landau Health and Safety Manager | Christine Kimmel<br>Signature | 7/13/16<br>Date |
| Kris Hendrickson<br>Project Manager | Kristy A. Hendrickson<br>Signature | 7/13/16<br>Date |

Personnel Health and Safety Briefing Conducted By:

| Name | Signature | Date |
|---|---|---|

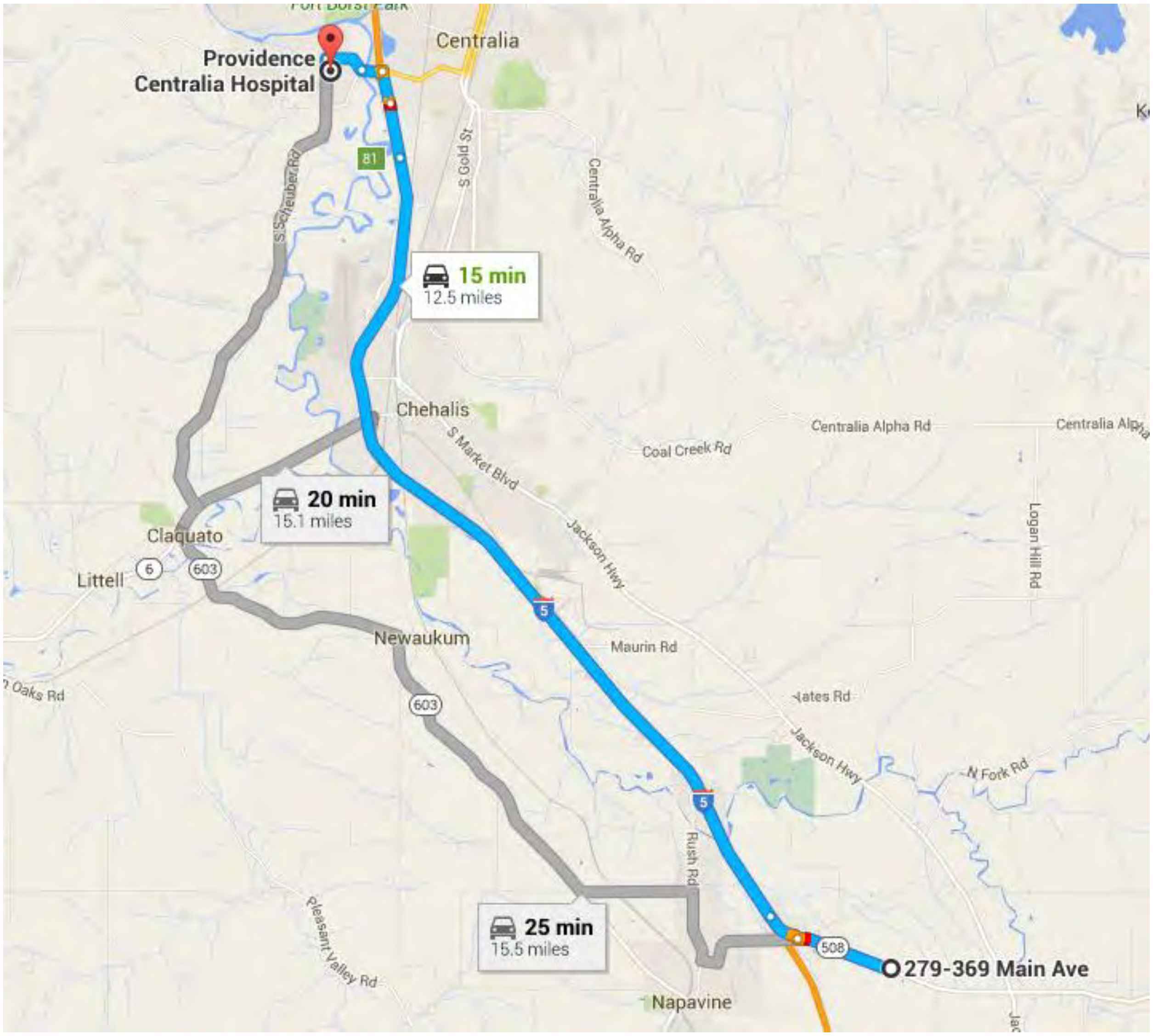
**ATTACHMENT A**

**ACTION LEVELS FOR RESPIRATORY PROTECTION**

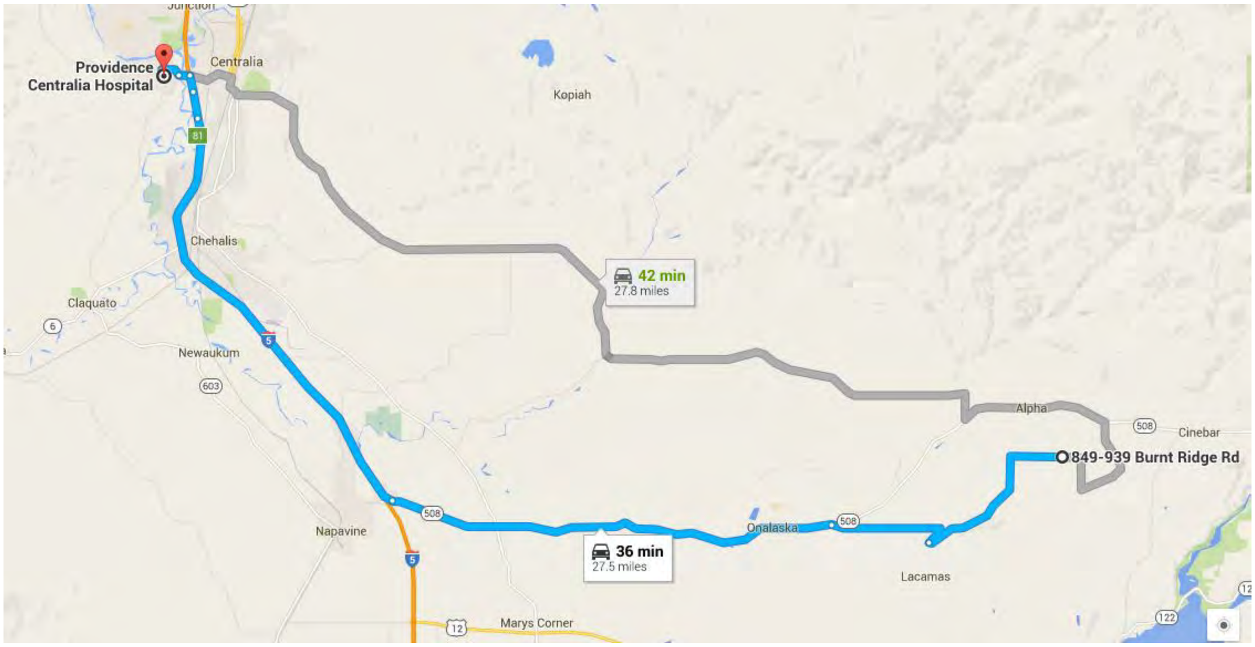
| Monitoring Parameter | Reading | Level of Protection |
|---|---|---|
| VOC's` | PID reading >10 ppm in breathing zone for more than 15 minutes or >35 ppm for momentary peak. | Evacuate the area or upgrade to Level C - half-face respirator with organic vapor / HEPA cartridge. |
| VOC's | >10 ppm and <50 ppm | Temporarily stop work to allow vapors to return to baseline- proceed with upgrade to Level C |
| VOC's | >50 ppm | Stop Work, contact H&S Manager |

Emergency Routes – Maps

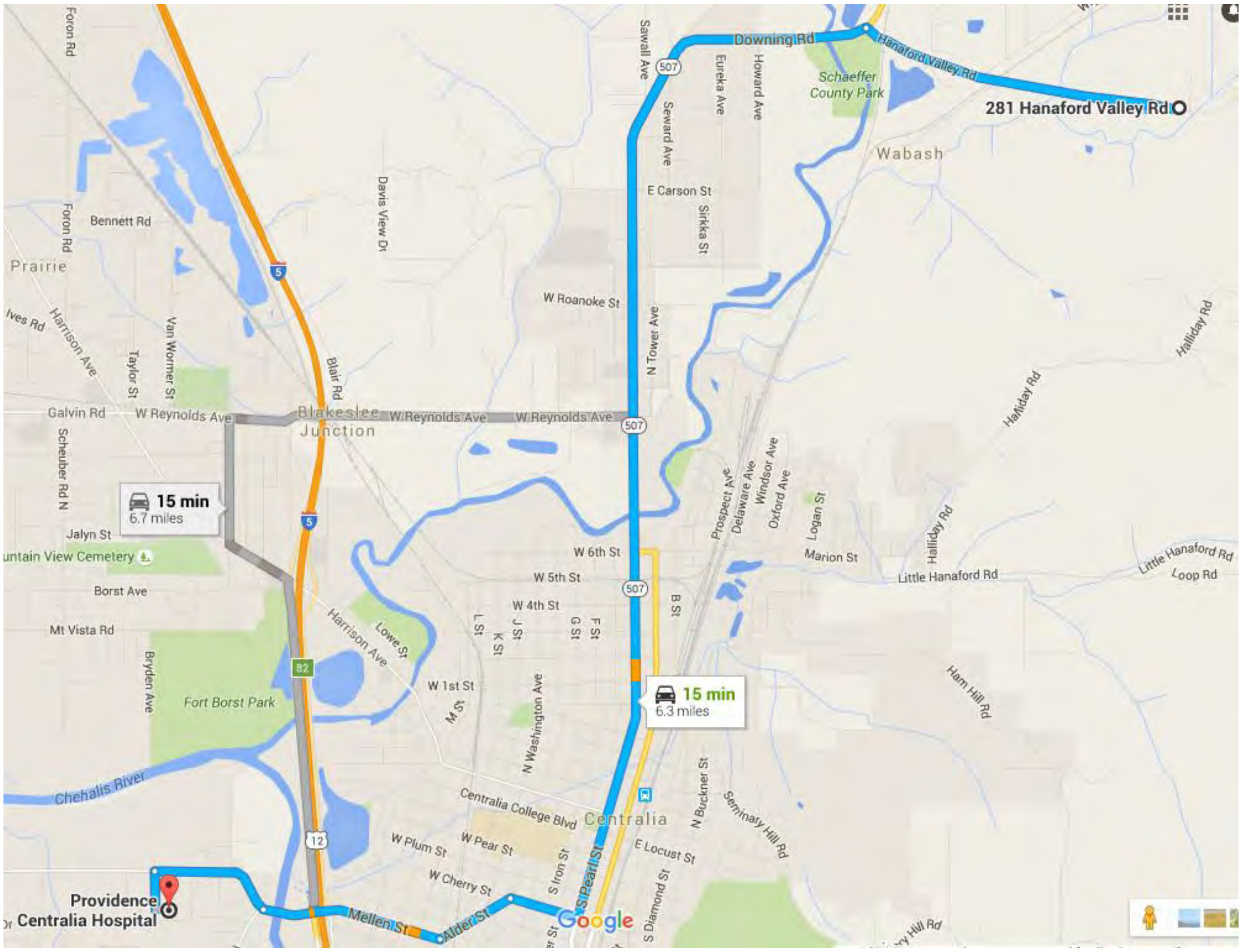
Directions from **Newaukum Prairie**:



Directions from **Burnt Ridge**:



Directions from **Big Hanaford**:



APPENDIX E

# Quality Assurance Project Plan

# Quality Assurance Project Plan
# Waste Characterization Plan
# Fire Mountain Farms
# Mixed Material Storage Units
# Lewis County, Washington

July 27, 2017

Prepared for

Perkins Coie LLP
Emerald Kalama Chemical, LLC

LANDAU ASSOCIATES

130 2nd Avenue South
Edmonds, WA 98020
(425) 778-0907

# TABLE OF CONTENTS

# TABLES



# LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| ARI | Analytical Resources, Inc. |
| COC | chain-of-custody |
| DQO | data quality objective |
| DQI | data quality indicator |
| Ecology | Washington State Department of Ecology |
| EDD | electronic data deliverable |
| EPA | US Environmental Protection Agency |
| ISO | International Organization for Standardization |
| IEC | International Electrochemical Commission |
| LAI | Landau Associates, Inc. |
| LOQ | limit of quantitation |
| LCS | laboratory control sample |
| LCSD | laboratory control sample duplicate |
| MQO | measurement quality objective |
| MS | matrix spike |
| MSD | matrix spike duplicate |
| PCB | polychlorinated biphenyl |
| QAPP | quality assurance project plan |
| QA/QC | quality assurance/quality control |
| RPD | relative percent difference |
| TCLP | toxicity characteristic leaching procedure |
| TNI | The NELAC Institute |

# 1.0 INTRODUCTION

This quality assurance project plan (QAPP) establishes the quality assurance/quality control (QA/QC) procedures to support the waste characterization at the Fire Mountain Farms mixed material storage units located in Lewis County, Washington. This QAPP is an appendix to the Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units, Lewis County, Washington. The primary objective of this QAPP is to provide QA/QC procedures consistent with accepted procedures such that the data collected will be adequate for use in delisting decisions for the mixed material in the Fire Mountain Farms storage units. This QAPP was prepared using the Washington State Department of Ecology's (Ecology's) Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies (Ecology 2004) and the US Environmental Protection Agency's (EPA's) Guidance for Quality Assurance Project Plans (EPA 2002).The planned scope of the waste characterization, as described in the plan, includes collection of mixed material samples from the Burnt Ridge, Newaukum Prairie, and Big Hanaford storage units, and submittal of the samples to a laboratory for analysis. This QAPP presents the project quality objectives, laboratory methods, QA/QC requirements, corrective actions, and data management procedures for the waste characterization.

# 2.0 PROJECT TEAM ORGANIZATION AND RESPONSIBILITIES

The project team organizational structure was developed based on the requirements of the field and laboratory activities. The key positions and associated responsibilities are described below:

- Emerald Kalama Project Manager — Responsible for overseeing the implementation of the Administrative Order and Agreement and communicating status and issues related to the waste characterization to Ecology and EPA.
- Landau Associates, Inc. (LAI) Project Manager — Responsible for implementation of all aspects of the waste characterization plan. Specific responsibilities include review and approval of revisions to waste characterization documentation, overseeing that all technical procedures are followed, reporting of deviations from the Ecology-approved Waste Characterization Plan including this QAPP to the Emerald Kalama Project Manager, and overseeing that data collected will satisfy the QA objectives discussed in Section 3.0 of this document.
- LAI Quality Assurance Manager – Responsible for insuring that data is of sufficient quality to achieve the Data Quality Objectives (DQOs) presented in this QAPP.
- Ecology Project Manager — Responsible for overseeing the implementation of the Administrative Order and the Agreement, both with Emerald Kalama and Fire Mountain Farms.
- Analytical Laboratory Project Manager — Responsible for providing sample bottles, performing chemical analyses per the QAPP, and reporting of data as required by the QAPP. The analytical laboratory at the date of this report is Analytical Resources, Inc. (ARI), located in Tukwila, Washington.

# 3.0 QUALITY ASSURANCE OBJECTIVES

This section presents the QA/QC objectives and processes including DQOs, Data Quality Indicators (DQIs), Measurement Quality Objectives (MQOs), and QC procedures for field and laboratory work.

DQOs are established when the data will be used to make a critical decision, such as to determine compliance with a standard. MQOs specify how good the data must be in order to fulfill the project's objectives; they are the acceptance thresholds for DQIs. The DQIs used to assess the acceptability of the data are precision, accuracy, representativeness, comparability, and completeness.

## 3.1 Data Quality Objectives

DQOs specify the environmental decisions that the data will support and the corresponding level of data quality required to ensure decisions are based on sound scientific data. The DQOs for this project are in support of the overall objective of the waste characterization plan, which is to provide sufficient data, analysis, and evaluations to determine if the mixed material in the three storage units meets the federal and state hazardous waste delisting criteria. To achieve the overall objective, the DQOs will be to obtain data that are representative of mixed material characteristics and that are comparable to selected screening criteria, as described below.

## 3.2 Data Quality Indicators

Data quality indicators are discussed in the following sections; their associated MQOs are presented in Table E-1.

### 3.2.1 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent an actual condition or characteristic of a population. Representativeness can be evaluated using replicate samples, representative sampling locations, and blanks. Representativeness for the waste characterization sampling will be accomplished using appropriate selection of sampling locations for the mixed material at each storage unit. A detailed description of sample locations is provided in Section 2.2.1 of the waste characterization plan. To determine that the analytical results are representative of the sampled item and not influenced by cross-contamination, method blanks will be analyzed with each analysis as described in Section 5.0.

### 3.2.2 Comparability

Comparability expresses the confidence with which one data set can be evaluated in relation to another data set. For this work, comparability of data will be established through the use of standard analytical methodologies with analytical limits of quantitation (LOQs) that can meet delisting and Land Disposal Restriction criteria to the extent practicable, standard reporting formats, and common traceable calibration and reference materials. Methods to be used for analysis of samples are discussed in Section 4.0.

### 3.2.3 Precision

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average values. Analytical precision is measured through matrix spike/matrix spike duplicate (MS/MSD) and/or through laboratory control sample/laboratory control sample duplicate (LCS/LCSD) samples for organic analyses and through laboratory duplicate samples for inorganic analyses.

Analytical precision measurements will be carried out on project-specific samples at a minimum frequency of 1 per sample analysis group or 1 in 20 samples, whichever is more frequent, as practicable. Laboratory precision will be evaluated against quantitative relative percent difference (RPD) performance criteria provided by the laboratory.

Field precision will be evaluated by the collection of field duplicates, where collection of the additional volume needed is practical, at a minimum frequency of 1 per sampling event or 1 in 20 samples, per facility per method. Materials such as soil, sediment, and sludge are typically more heterogeneous than materials such as groundwater. For this reason, control limits for the field duplicates and replicates will be 50 percent unless the duplicate sample values are within five times the reporting limit, in which case the control limit interval will be plus or minus three times the reporting limit. In the event the control limit is exceeded, the sample results may be qualified as estimated, in accordance with EPA National Functional Guidelines (EPA 2016a, b) before being compared to the regulatory criteria.

Precision measurements can be affected by the nearness of a chemical concentration to the method detection limit, where the percent error (expressed as RPD) increases. The equation used to express precision is as follows:

$$RPD = \left| \frac{C_1 - C_2}{(C_1 + C_2)/2} \right| x\ 100$$

| | | | |
|---|---|---|---|
| where: | $C_1$ | = | first sample value |
| | $C_2$ | = | second sample value (duplicate) |
| | RPD | = | relative percent difference. |

### 3.2.4 Accuracy

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Field accuracy is controlled by adherence to sample collection procedures as outlined in the waste characterization plan.

Analytical accuracy may be assessed by analyzing “spiked” samples with known standards (surrogates, laboratory control samples, and/or matrix spike) and measuring the percent recovery. To the extent where collection of the additional volume is practical, project samples will be selected for matrix spike/matrix spike duplicate analyses. Accuracy measurements on matrix spike samples will be carried out at a minimum frequency of 1 per laboratory analysis group. Surrogate recoveries will be determined for every sample analyzed for organics.

Laboratory accuracy will be evaluated against quantitative matrix spike and surrogate spike recovery performance criteria provided by the laboratory. Accuracy can be expressed as a percentage of the true or reference value, or as a percent recovery in those analyses where reference materials are not available and spiked samples are analyzed. The equation used to express accuracy is as follows:

$$\text{Percent Recovery} = \frac{(\text{Spiked Sample Result} - \text{Unspiked Sample Result})}{\text{Amount of Spike Added}} \times 100$$

Control limits for percent recovery for samples will be laboratory acceptance limits. Laboratory control limits reflect the performance of the instrument for the matrix being analyzed and are established in accordance with US Department of Defense/US Department of Energy Quality Systems Manual (QSM 5.0), in addition to International Organization for Standardization (ISO)/International Electrochemical Commission (IEC) 17025:2005(E) and the NELAC Institute (TNI) Standards (2009), and are considered during data validation. Data may be qualified and considered biased high if the recovery is greater than the upper recovery control limit or considered biased low if the recovery is less than the lower recovery control limit. An example of recovery control limits is the control limits determined by the analytical laboratory based on the TNI Standards for the cobalt analysis in the Cobalt Characterization Report included as Appendix C to the Waste Characterization Plan. The recovery control limits were 80-120 percent.

### 3.2.5 Bias

Bias is the systematic or persistent distortion of a measured process that causes errors in one direction. Bias of the laboratory results will be evaluated based on analysis of method blanks and matrix spike samples as described in Section 5.5.

### 3.2.6 Sensitivity

Sensitivity is the ability to discern the difference between very small amounts of a substance. For the purposes of this project, sensitivity is the lowest concentration that can be accurately detected by the analytical method. The analytical method will be considered sufficiently sensitive if the laboratory reporting limits are below project screening levels. Proposed method and LOQs are discussed in Section 4.0.

### 3.2.7 Completeness

Field completeness is calculated as the number of actual samples collected divided by the number of planned samples. Analytical completeness is calculated as the number of valid data points divided by the total number of data points requested. Data points are considered invalid if they are rejected during data validation. The data validation approach for this project is provided in Section 7.0. The QA objectives for field and analytical completeness during this project will be 90 percent, which is supported by the sample design described in Section 2.2 of the Waste Characterization Plan. Ninety percent completeness would be 10 valid samples from the Burnt Ridge storage unit, 16 valid samples from the Newaukum Prairie storage unit, and 17 valid samples from the Big Hanaford storage unit, which will provide adequate information for evaluation of compliance with regulatory requirements to support delisting. Completeness will be routinely determined and compared to this control criterion.

# 4.0 LABORATORY METHODS

Mixed material samples from the storage units at Burnt Ridge, Newaukum Prairie, and Big Hanaford will be analyzed for selected volatile organic compounds (acetone, benzene, methanol, and toluene), total solids, and pH. Samples from Big Hanaford will be analyzed for total acrylonitrile; cobalt; 4-methylphenol; 2,4-dinitrotoluene; 2,6-dinitrotoluene; and naphthalene as well. For Big Hanaford, additional sample volume will be collected and archived by the laboratory for analysis of polychlorinated biphenyls (PCBs); acrylonitrile; cobalt; 4-methylphenol; 2,4-dinitrotoluene; 2,6-dinitrotoluene; and naphthalene with toxicity characteristic leaching procedure (TCLP) extraction, if necessary. Samples will be selected for additional analysis as described in Section 3.0 of the Waste Characterization Plan. Specific analytes, laboratory methods, method detection limits, and reporting limits are summarized in Table E-2 of this QAPP.

Descriptions of sample containers, preservation, and holding times are provided in Tables 15, 16, and 17 of the Waste Characterization Plan.

# 5.0 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

This section describes the procedures that will be implemented to: 1) ensure sample integrity from the time of sample collection to the time of analysis in the laboratory, 2) obtain the appropriate chemical and physical data, 3) collect field and laboratory quality control samples, 4) monitor performance of the laboratory measurement systems, 5) correct any deviations from the methods or QA requirements established in this QAPP, and 6) report and validate the data.

## 5.1 Laboratory Instrument Calibration

The Analytical Laboratory Project Manager is responsible for maintaining laboratory instruments in proper working order including routine maintenance and calibration, and training of personnel in maintenance and calibration procedures. Laboratory instruments will be properly calibrated with appropriate check standards and calibration blanks for each parameter before beginning each analysis. Instrument performance check standards, where required, and calibration blank results will be recorded in a laboratory logbook dedicated to each instrument. At a minimum, the preventive maintenance schedules outlined in the EPA methods and in the equipment manufacturers' instructions will be followed. Laboratory calibration procedures and schedules will be as described in the laboratory quality systems manual.

## 5.2 Field Equipment Calibration

No field measurements using equipment requiring calibration are planned for this waste characterization.

## 5.3 Field Documentation

A complete record of all field activities will be maintained for the duration of the field phase of the work. Documentation will include the following:

- Daily recordkeeping by field personnel of all field activities
- Recordkeeping of all samples collected for analysis (field sampling forms)
- Use of sample labels and tracking forms for all samples collected for analysis.

The field logs will provide a description of all sampling activities, sampling personnel, weather conditions, and a record of all modifications to the procedures and plans identified in the Waste Characterization Plan. The field logs are intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the sampling period.

Sample possession and handling will also be documented so that it is traceable from the time of sample collection to the laboratory and data analysis. Sample chain-of-custody (COC) forms and procedures are described in Section 2.2.4 of the Waste Characterization Plan and Section 5.4 of this QAPP.

## 5.4 Sample Handling Procedures and Transfer of Custody

Samples submitted to the analytical laboratory will be collected in the appropriate sample containers and preserved as specified in Tables 15, 16, and 17 of the Waste Characterization Plan. The storage temperatures and maximum holding times for physical/chemical analyses are also provided in Tables 15, 16, and 17 of the Waste Characterization Plan.

The transportation and handling of samples will be accomplished in a manner that not only protects the integrity of the sample, but also prevents any detrimental effects due to release of samples. Samples will be logged on a COC form and will be kept in coolers on ice until delivery to the analytical laboratory. The project laboratory is located in Tukwila, Washington and therefore, samples may be shipped to the laboratory, delivered by courier, or may be hand delivered at the end of a sampling week, if sample holding times can still be met. The laboratory will provide appropriate packing material for shipping the samples so that damage to the samples is avoided. Samples may be sent to the project analytical laboratory in batches, if appropriate based on sample holding times. The COC will accompany each cooler in a shipment of samples to the laboratory. Each cooler will also have custody seals placed on the outside to indicate if tampering has taken place during shipment. Cooler receipt forms will be filled out by the analytical laboratory. Upon receipt, custody seals will be inspected and the COC form signed and dated by laboratory personnel. Laboratory personnel will verify sample numbers and the condition of each sample. Shipping manifests and COC forms signed and dated by laboratory personnel will be considered sufficient documentation of sample custody transfer from the sampler, through the shipping agent, to the analytical laboratory. A copy of each COC form will be retained by the sampling team for the project file and the duplicate copies will be sent with the samples. Bills of lading will also be retained as part of the documentation for the COC records. In conjunction with data reporting, the laboratory will return the original COC forms to the LAI Project Manager for inclusion in the central project file.

## 5.5 Field and Laboratory Quality Control Samples

Field and analytical laboratory QC samples will be collected to evaluate data precision, accuracy, representativeness, completeness, and comparability of the analytical results for this investigation. QC samples are described below. The frequency at which they will be collected and/or analyzed is also described. The performance-based laboratory control limits, developed in accordance with US Department of Defense/US Department of Energy Quality Systems Manual (QSM 5.0) in addition to ISO/ IEC 17025:2005(E) and TNI Standards, will be used in the evaluation of laboratory data quality. QC limits will be evaluated both as part of the reporting process by the laboratory and as a component of the Level IIA verification and validation process. If QC limits are exceeded, corrective actions will be implemented as detailed in Section 6.0 and analytical results will be qualified in accordance with the validation guidance listed in Section 7.0. In the event that QC issues are identified, LAI's Quality Assurance Manager will notify the LAI Project Manager. The LAI Project Manager will notify Emerald Kalama and Fire Mountain Farms, who will in turn discuss and determine the potential impacts to data quality and the appropriate corrective action with the Ecology and EPA Project Managers. Possible corrective actions are presented in Section 6.0.

### 5.5.1 Field Duplicates

A field duplicate will be collected at a frequency of at least 1 per 20 samples per chemical analysis and per facility, not including QC samples, but not less than one field duplicate per sampling event (any continuous sampling period not interrupted by more than 5 days) for mixed material samples. The field duplicate will consist of a split sample collected at a single sample location. Field duplicates will be collected by alternately filling sample containers for both the original and the corresponding duplicate sample at the same location to decrease variability between the duplicates. Field duplicate sample results will be used to evaluate data precision. MQOs for field duplicates are presented in Table E-1. These QC results will be evaluated in accordance with the data validation guidelines presented in Section 7.0 of this QAPP.

### 5.5.2 Field Trip Blanks

Field trip blanks will consist of de-ionized or distilled water sealed in a sample container provided by the analytical laboratory. The trip blank will accompany samples collected for the analysis of volatile organic compounds during transportation to and from the field, and then will be returned to the laboratory with each shipment. The trip blank will remain unopened until submitted to the laboratory for analysis. One trip blank per cooler containing samples for volatile organic compound analysis will be evaluated to determine possible sample contamination during transport. MQOs for field trip blanks are presented in Table E-1. These QC results will be evaluated in accordance with the corrective actions and data validation guidelines presented in Sections 6.0 and 7.0 of this QAPP, respectively.

### 5.5.3 Laboratory Matrix Spike

A minimum of one laboratory MS per 20 samples, or one MS sample per batch of samples if fewer than 20 samples are obtained in a sample event, will be collected for all organic and inorganic analyses, to the extent where collecting extra volume is practical. The matrix spikes will be analyzed using project samples. These analyses will be conducted to provide information on accuracy and to verify that extraction and concentration levels are acceptable. The laboratory spikes will follow EPA guidance for matrix spikes.

### 5.5.4 Laboratory Matrix Spike Duplicate

A minimum of one laboratory MSD per 20 samples, or one MSD sample per batch of samples if fewer than 20 samples are obtained in a sample event, will be collected for all organic and inorganic analyses, to the extent where collecting extra volume is practical. The analysis of MSD samples will be conducted to provide information on the precision of chemical analyses. The laboratory spikes will follow EPA guidance for matrix spike duplicates.

### 5.5.5 Laboratory Duplicates

A minimum of one laboratory duplicate per 20 samples, or one laboratory duplicate sample per batch of samples if fewer than 20 samples are obtained in a sample event, will be analyzed for metals. These analyses will be conducted to provide information on the precision of chemical analyses. The laboratory duplicates will follow EPA guidance in the analytical method.

### 5.5.6 Laboratory Method Blanks

A minimum of one laboratory method blank per 20 samples, one every 12 hours, or one per batch of samples analyzed (if fewer than 20 samples are analyzed in a sample event) will be analyzed for all parameters to assess possible laboratory contamination. De-ionized water will be used whenever possible. Method blanks will contain all reagents used for analysis. The generation and analysis of additional method, reagent, and glassware blanks may be necessary to verify that laboratory procedures do not contaminate samples. MQOs for laboratory method blanks are presented in Table E-1. These QC results will be evaluated in accordance with the corrective actions and data validation guidelines presented in Sections 6.0 and 7.0 of this QAPP, respectively.

### 5.5.7 Laboratory Control Sample

A minimum of one laboratory control sample per 20 samples, or one laboratory control sample per sample batch if fewer than 20 samples are obtained in a sample event, will be analyzed for all parameters. MQOs for laboratory control samples are presented in Table E-1.

### 5.5.8 Surrogate Spikes

All project samples analyzed for organic compounds will be spiked with appropriate surrogate compounds as defined by the analytical methods. MQOs for surrogate spikes are presented in Table E-1.

## 5.6 Laboratory QA/QC for Chemical and Conventional Analyses

QA/QC for chemical testing includes laboratory instrument and analytical method QA/QC. Instrument QA/QC monitors the performance of the instrument and method QA/QC monitors the performance of sample preparation procedures. The analytical laboratory will be responsible for instrument and method QA/QC. QA/QC procedures to be conducted by the laboratory for analysis of samples will be in accordance with methods specified in Table E-2.

When an instrument or method control limit is exceeded, the laboratory will contact the LAI Project Manager immediately. The laboratory will be responsible for correcting the problem and will reanalyze the samples within the sample holding time if sample reanalysis is appropriate. Corrective actions are described further in Section 6.0.

# 6.0 CORRECTIVE ACTIONS

Corrective actions will be needed for two categories of nonconformance:

- Deviations from the methods or QA requirements established in this QAPP
- Equipment or analytical malfunctions.

Corrective action procedures to be implemented based on detection of unacceptable data are developed on a case-by-case basis. Such actions may include one or more of the following:

- Altering procedures in the field
- Using a different batch of sample containers
- Performing an audit of field or laboratory procedures
- Reanalyzing samples (if holding times allow)
- Resampling and analyzing
- Evaluating sampling and analytical procedures to determine possible causes of the discrepancies
- Accepting the data without action, acknowledging the level of uncertainty
- Rejecting the data as unusable.

During field activities and sample collection, the field personnel will be responsible for conducting and reporting required corrective actions. A description of any action taken will be entered in the daily field notebook. The LAI Project Manager will be consulted immediately if field conditions are such that conformance with this QAPP is not possible.

During laboratory analysis, the laboratory QA officer will be responsible for taking required corrective actions in response to equipment malfunctions. If an analysis does not meet DQOs outlined in this QAPP, corrective action will follow the guidelines in the noted EPA analytical methods and the EPA guidelines for data validation for organics (EPA 2016b) and inorganics analyses (EPA 2016a). At a minimum, the laboratory will be responsible for monitoring the following:

- Calibration check compounds must be within performance criteria specified in the EPA method or corrective action must be taken prior to initiation of sample analyses. No analyses may be performed until these criteria are met.
- Before processing any samples, the analyst should demonstrate, through analysis of a reagent blank that interferences from the analytical system, glassware, and reagents are within acceptable limits. Each time a set of samples is extracted or there is a change in reagents, a reagent blank should be processed as a safeguard against chronic laboratory contamination. The blank samples should be carried through all stages of the sample preparation and measurement steps.
- Method blanks should, in general, be below instrument detection limits. If contaminants are present, then the source of contamination must be investigated, corrective action taken and

documented, and all samples associated with a contaminated blank reanalyzed. If, upon reanalysis, blanks do not meet these requirements, the LAI Project Manager will be notified immediately to discuss whether analyses may proceed.

- Surrogate spike analysis must be within the specified range for recovery limits for each analytical method used or corrective action must be taken and documented. Corrective action includes: 1) reviewing calculations, 2) checking surrogate solutions, 3) checking internal standards, and 4) checking instrument performance. Subsequent action could include recalculating the data and/or reanalyzing the sample if any of the above-described checks reveal a problem. If the problem is determined to be caused by matrix interference, reanalysis may be waived if so directed following consultation with the LAI Project Manager. If the problem cannot be corrected through reanalysis, the laboratory will notify the LAI Project Manager prior to data submittal so that additional corrective action can be taken, if appropriate.
- If the recovery of a surrogate compound in the method blank is outside the recovery limits, the blank will be reanalyzed along with all samples associated with that blank. If the surrogate recovery is still outside the limits, the LAI Project Manager will be notified immediately to discuss whether analyses may proceed.
- If quantitation limits or matrix spike control limits cannot be met for a sample, the LAI Project Manager will be notified immediately to discuss corrective action required.
- With the exception of TCLP analyses, if holding times are exceeded, all positive and undetected results may need to be qualified as estimated concentrations. If holding times are grossly exceeded, the LAI Project Manager may determine the data to be unusable.

If analytical conditions are such that nonconformance with this QAPP is indicated, the LAI Project Manager will be notified as soon as possible so that any additional corrective actions can be taken. The Analytical Laboratory Project Manager will then document the corrective action by a memorandum submitted to LAI. A narrative describing the anomaly; the steps taken to identify and correct the anomaly; and any recalculation, re-analyses, or re-extractions will be submitted with the data package in the form of a cover letter.

# 7.0 DATA VERIFICATION AND VALIDATION

All data will be verified and validated to determine that the results are acceptable and meet the quality objectives described in Section 3.0. Prior to submitting a laboratory report, the laboratory will verify that all the data are consistent, correct, and complete, with no errors or omissions.

Validation of the data will be performed in accordance with guidance from applicable portions of the National Functional Guidelines for Inorganic Superfund Methods Data Review (EPA 2016a), the National Functional Guidelines for Organic Superfund Methods Data Review (EPA 2016b), analytical methods, LAI data validation standard operating procedures, and this QAPP. LAI will conduct an EPA Level IIA-equivalent validation and verification, the components of which are listed below. Level IIA validation is performed primarily from information contained on sample result forms and sample related QC summary forms; raw data is not reviewed during this process.

- Verification that the laboratory data package contained all necessary documentation (including chain-of-custody records; identification of samples received by the laboratory; date and time of receipt of the samples at the laboratory; sample conditions upon receipt at the laboratory; date and time of sample analysis; and, if applicable, date of extraction, definition of laboratory data qualifiers, all sample-related quality control data, and quality control acceptance criteria).
- Verification that all requested analyses, special cleanups, and special handling methods were conducted.
- Verification that quality control samples were analyzed as specified in this QAPP and the Waste Characterization Plan.
- Evaluation of sample holding times. Ecology and EPA have agreed that, due to the length of time the mixed material has been in the storage units, TCLP samples held longer than the method holding time will be considered valid with respect to the holding time as long as they were stored in the appropriate containers at the required temperature.
- Evaluation of quality control data compared to acceptance criteria, including method blanks, surrogate recoveries, laboratory duplicate and/or replicate results, and laboratory control sample results. Due to the inherent heterogeneity of the sample matrix and in accordance with National Functional Guidelines for Organic Data Review (EPA 2016b) and the National Functional Guidelines for Inorganic Data Review (EPA 2016a), field duplicate results that exceed the specified control limit will not be rejected, rather they will be qualified as estimated.
- Evaluation of reporting limits compared to target reporting limits specified in the QAPP and the Waste Characterization Plan.

In the event that a portion of the data is outside the DQO limits or the EPA guidance (EPA 2016a, b), or sample collection and/or documentation practices are deficient, corrective action(s) will be initiated. Corrective action, as described in Section 6.0, will be determined by the LAI's QA officer in consultation with the LAI Project Manager and may include any of the following:

- Rejection of the data and resampling

- Qualification of the data
- Modified field and/or laboratory procedures.

If the available data for use in decision making is less than the completeness MQO of 90 percent, the LAI Project Manager will notify Emerald Kalama and Fire Mountain Farms, who will in turn discuss and determine the potential impacts to decision making and the appropriate corrective action with the Ecology and EPA Project Managers.

# 8.0 DATA MANAGEMENT PROCEDURES

All laboratory analytical results, including QC data, will be submitted electronically to LAI by the analytical laboratory. Analytical data will be provided by the laboratory in an electronic (pdf) report format and an Electronic Data Deliverable (EDD). Project EDDs will be compared to the laboratory report for accuracy and completeness. Laboratory deliverables will be saved in the project folder, which is on a secure server that is routinely backed up. The LAI quality reviewer for this project is responsible to the LAI Project Manager for conducting checks for internal consistency, transmittal errors, laboratory protocols, and for complete adherence to the QC elements in this work plan.

# 9.0 REFERENCES

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NELAC. 2009. 2009 TNI Standard, Volume 1: Management and Technical Requirements for Laboratories Performing Environmental Analysis. The NELAC Institute. September 8.

**Table E-1**
**Measurement Quality Objectives**
**Quality Assurance Project Plan**
**Fire Mountain Farms Storage Units**
**Lewis County, Washington**

| DQI | QC Sample or Activity Used to Assess MQO | MQO | Frequency | Sampling or Analytical DQI |
|---|---|---|---|---|
| **Mixed Material Samples Analyzed for Volatile Organic Compounds by SW-846 8260C or 8015C** | | | | |
| Representativeness | Cooler Temperature | < 6°C | All project samples | S |
| Bias | Surrogates | Recoveries within laboratory-specified control limits | All project and QA samples | A |
| Accuracy | LCS/LCSD | Recoveries within laboratory-specified control limits | 1 per 20 samples or one per analytical batch | A |
| Precision | LCS/LCSD and MS/MSD | RPDs within laboratory-specified control limits | 1 per 20 samples or one per analytical batch | A |
| Method performance for matrix, bias | MS/MSD | Recoveries within laboratory-specified control limits | 1 per 20 samples or one per analytical batch | S&A |
| Precision | Field Duplicates | RPD <50% | 1 per 20 samples or one per analytical group | S&A |
| Bias/Contamination | Method Blank, Trip Blank | Target analytes not detected at concentrations > 1/2 the RL | 1 method blank per 20 samples, 1 every 12 hours, or 1 per analytical batch | S&A |
| Analytical Completeness | Number of usable (not rejected) results out of total number of results | 90% | N/A | S&A |
| Field Completeness | Number of samples collected out of planned samples | 90% | N/A | S |

**Table E-1**
**Measurement Quality Objectives**
**Quality Assurance Project Plan**
**Fire Mountain Farms Storage Units**
**Lewis County, Washington**

| DQI | QC Sample or Activity Used to Assess MQO | MQO | Frequency | Sampling or Analytical DQI |
|---|---|---|---|---|
| **Mixed Material Samples Analyzed for Total or TCLP Semivolatile Organic Compounds by SW-846 8270D** | | | | |
| Representativeness | Cooler Temperature | < 6°C | All project samples | S |
| Bias | Surrogates | Recoveries within laboratory-specified control limits | All project and QA samples | A |
| Accuracy | LCS/LCSD | Recoveries within laboratory-specified control limits | 1 per 20 samples or one per analytical batch | A |
| Precision | LCS/LCSD and MS/MSD | RPDs within laboratory-specified control limits | 1 per 20 samples or one per analytical batch | A |
| Method performance for matrix, bias | MS/MSD | Recoveries within laboratory-specified control limits | 1 per 20 samples or one per analytical batch | S&A |
| Precision | Field Duplicates | RPD <50% | 1 per 20 samples or one per analytical group | S&A |
| Bias/Contamination | Method Blank | Target analytes not detected at concentrations > 1/2 the RL | 1 method blank per 20 samples, 1 every 12 hours, or 1 per analytical batch | S&A |
| Analytical Completeness | Number of usable (not rejected) results out of total number of results | 90% | N/A | S&A |
| Field Completeness | Number of samples collected out of planned samples | 90% | N/A | S |

**Table E-1**
**Measurement Quality Objectives**
**Quality Assurance Project Plan**
**Fire Mountain Farms Storage Units**
**Lewis County, Washington**

| DQI | QC Sample or Activity Used to Assess MQO | MQO | Frequency | Sampling or Analytical DQI |
|---|---|---|---|---|
| **Mixed Material Samples Analyzed for Polychlorinated Biphenyls by SW-846 8082A** | | | | |
| Representativeness | Cooler Temperature | < 6°C | All project samples | S |
| Bias | Surrogates | Recoveries within laboratory-specified control limits | All project and QA samples | A |
| Accuracy | LCS/LCSD | Recoveries within laboratory-specified control limits | 1 per 20 samples or one per analytical batch | A |
| Precision | LCS/LCSD and MS/MSD | RPDs within laboratory-specified control limits | 1 per 20 samples or one per analytical batch | A |
| Method performance for matrix, bias | MS/MSD | Recoveries within laboratory-specified control limits | 1 per 20 samples or one per analytical batch | S&A |
| Precision | Field Duplicates | RPD <50% | 1 per 20 samples or one per analytical group | S&A |
| Bias/Contamination | Method Blank | Target analytes not detected at concentrations > 1/2 the RL | 1 method blank per 20 samples, 1 every 12 hours, or 1 per analytical batch | S&A |
| Analytical Completeness | Number of usable (not rejected) results out of total number of results | 90% | N/A | S&A |
| Field Completeness | Number of samples collected out of planned samples | 90% | N/A | S |

**Table E-1**
**Measurement Quality Objectives**
**Quality Assurance Project Plan**
**Fire Mountain Farms Storage Units**
**Lewis County, Washington**

| DQI | QC Sample or Activity Used to Assess MQO | MQO | Frequency | Sampling or Analytical DQI |
|---|---|---|---|---|
| **Mixed Material Samples Analyzed for Total or TCLP Metals by SW-846 6010C** | | | | |
| Representativeness | Cooler Temperature | < 6°C | All project samples | S |
| Accuracy | LCS | Recoveries within laboratory-specified control limits | 1 per 20 samples or one per analytical batch | A |
| Precision | LCS and MS/Laboratory Duplicate | RPDs within laboratory-specified control limits | 1 per 20 samples or one per analytical batch | A |
| Method performance for matrix, bias | MS/Laboratory Duplicate | Recoveries within laboratory-specified control limits | 1 per 20 samples or one per analytical batch | S&A |
| Precision | Field Duplicates | RPD <50% | 1 per 20 samples or one per analytical group | S&A |
| Bias/Contamination | Method Blank | Target analytes not detected at concentrations > 1/2 the RL | 1 method blank per 20 samples, 1 every 12 hours, or 1 per analytical batch | S&A |
| Analytical Completeness | Number of usable (not rejected) results out of total number of results | 90% | N/A | S&A |
| Field Completeness | Number of samples collected out of planned samples | 90% | N/A | S |

**Abbreviations/Acronyms:**

A = analytical
°C = degrees Celsius
DQI = data quality indicator
LCS = laboratory control spike
LCSD = laboratory control spike
MQO = measurement quality
MS = matrix spike
MSD = matrix spike duplicate
N/A = not applicable
QC = quality control
RL = reporting limit
RPD = relative percent difference
S = sampling
TCLP = toxicity characteristic leaching procedure

**Table E-2**
**Method Detection Limits and Reporting Limits**
**Quality Assurance Project Plan**
**Fire Mountain Farms Storage Units**
**Lewis County, Washington**

| Analytes | ARI Method Detection Limit | ARI Reporting Limit[1] | ARI TCLP Reporting Limit[2] |
|---|---|---|---|
| **VOCs by SW-846 8260C** | | | |
| Acetone | 45.2 µg/kg | 250 µg/kg | -- |
| Benzene | 8.20 µg/kg | 50.0 µg/kg | -- |
| Toluene | 8.60 µg/kg | 50.0 µg/kg | -- |
| Acrylonitrile | 14.7 µg/kg | 250 µg/kg | 10 µg/L |
| **VOCs by SW-846 8015C** | | | |
| Methanol | 3.84 mg/kg | 10.0 mg/kg | -- |
| **SVOCs by SW-846 8270D** | | | |
| 4-Methylphenol | 22.4 µg/kg | 67.0 µg/kg | 20 µg/L |
| 2,4-Dinitrotoluene | 96 µg/kg | 330 µg/kg | 30 µg/L |
| 2,6-Dinitrotoluene | 96 µg/kg | 330 µg/kg | 30 µg/L |
| Naphthalene | 14.9 µg/kg | 67.0 µg/kg | 10 µg/L |
| **PCBs by SW-846 8082A** | | | |
| Aroclor 1016 | 8.00 µg/kg | 20.0 µg/kg | 10 µg/L |
| Aroclor 1221 | 8.00 µg/kg | 20.0 µg/kg | 10 µg/L |
| Aroclor 1232 | 8.00 µg/kg | 20.0 µg/kg | 10 µg/L |
| Aroclor 1242 | 8.00 µg/kg | 20.0 µg/kg | 10 µg/L |
| Aroclor 1248 | 8.00 µg/kg | 20.0 µg/kg | 10 µg/L |
| Aroclor 1254 | 8.00 µg/kg | 20.0 µg/kg | 10 µg/L |
| Aroclor 1260 | 9.28 µg/kg | 20.0 µg/kg | 10 µg/L |
| **Metals by SW-846 6010C** | | | |
| Cobalt | 0.0439 mg/kg | 0.300 mg/kg | 0.0150 mg/L |

1. Project samples will be reported on an as-received basis. Reporting limits may be elevated as a result of sample dilution required due to presence of other chemicals.
2. Reporting limits may be elevated as a result of sample dilution required due to the presence of other chemicals.

**Abbreviations/Acronyms:**
ARI = Analytical Resources, Inc.
µg/kg = micrograms per kilogram
µg/L = micrograms per liter
mg/kg = milligram per kilogram
mg/L = milligram per liter
PCB = polychlorinated biphenyl
SVOC = semivolatile organic compound
TCLP = toxicity characteristic leaching procedure
VOC = volatile organic compound

Waste Characterization Report, Fire Mountain Farms Burnt Ridge Storage Unit, Lewis County, Washington (Landau Associates, Inc. November 2017)

# Waste Characterization Report
# Fire Mountain Farms
# Burnt Ridge Storage Unit
# Lewis County, Washington

November 29, 2017

Prepared for

Perkins Coie LLP
Emerald Kalama Chemical, LLC

LANDAU ASSOCIATES

130 2nd Avenue South
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(425) 778-0907

# Waste Characterization Report
# Fire Mountain Farms
# Burnt Ridge Storage Unit
# Lewis County, Washington

This document was prepared by, or under the direct supervision of, the technical professionals noted below.

Document prepared by: Kenneth J. Reid (signed)
Senior Geologist, LEG

Document reviewed by: Kristy J. Hendrickson (signed)
Quality Reviewer

| | |
|---|---|
| Date: | November 29, 2017 |
| Project No.: | 0066045.040.041 |
| File path: | P:\066\045\R\Waste Characterization Report - Burnt Ridge\FMF_BR Waste Char Data Rpt_112917.docx |
| Project Coordinator: | kes |

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# APPENDIX

# INTRODUCTION

This report documents the waste characterization activities conducted in October and November 2017 to evaluate the mixed material present in the Fire Mountain Farms, Inc. (FMF) Burnt Ridge storage unit located in Lewis County, Washington (Figure 1). The data collection, sampling, and analysis discussed in this report was conducted in accordance with the July 27, 2017 Waste Characterization Plan (LAI 2017b) approved by the Washington State Department of Ecology (Ecology) and US Environmental Protection Agency (EPA) (Ecology 2017).

Landau Associates, Inc. (LAI) was retained by Perkins Coie LLP (Perkins) on behalf of Emerald Kalama Chemical, LLC (Emerald), to provide technical support and environmental services related to Administrative Order No. 10938 (Administrative Order) issued by Ecology to Emerald and FMF (Ecology 2014) and the Agreement for Conditional Compliance with Ecology Administrative Order No 10938 During Judicial Review (Agreement) between Ecology, Emerald, and FMF, dated June 3, 2016 (Ecology 2016a).

The FMF Burnt Ridge storage unit is located at 856 Burnt Ridge Road, in Onalaska, Washington (Figure 1). The approximately square storage unit is contained by an embankment constructed into sloping natural terrain (Figure 2). According to the original design drawing, each side of the storage unit is approximately 220 feet (ft) in length with a total depth of 14 ft (Thode 1998). The level-top embankment matches existing grades on the north side, with perimeter berms on the south, east, and west sides that extend above surrounding grades. According to the design (Thode 1998), the internal slopes of the unit are 3 horizontal to 1 vertical (3H:1V), the external slopes of the perimeter berms are 2H:1V. According to the design drawing, the unit is lined with Claymax 600CL geosynthetic clay liner (GCL) material manufactured by Colloid Environmental Technologies Company. LAI assumes that approximately 12 inches of soil was placed on top of the liner in accordance with typical manufacturer recommendations for GCL installations. According to estimates made by PGG, and confirmed during the land application event in December 2014, the accumulated mixed material is 3 ft or less in thickness (PGG 2014). At the time of the sampling conducted in this report, the surface of the mixed material was not level apparently due to occasional hydraulic mixing by FMF, so the thickness of the material was variable.

The Burnt Ridge storage unit was used to hold biosolids, industrial wastewater treatment biological solids (IWBS), and wastewater-generated material from other sources. This material will be referred to in this report as "mixed material." The sources of the mixed material are listed in Table 1. According to Ecology, the IWBS received from Emerald are a listed dangerous/hazardous waste. Ecology alleges that Emerald's IWBS carry two listed hazardous waste codes: U019 (benzene) and U220 (toluene). As part of the Agreement, Emerald and FMF will petition Ecology and the EPA to delist the mixed material in this storage unit. The work completed in this report supports this delisting objective.

Ecology developed preliminary delisting levels for the Burnt Ridge storage unit based on maximum allowable total concentrations (PDLs) and maximum allowable toxicity characteristic leaching procedure (TCLP) concentrations (TCLP-PDLs) using EPA's Hazardous Waste Delisting Risk Assessment Software and provided them to Emerald (Ecology 2016b). As described in the Waste Characterization Plan, the previously existing analytical data from a 2014 investigation conducted by Pacific Groundwater Group (PGG) for FMF (PGG 2014) and a 2017 analysis of total and TCLP cobalt (LAI 2017a) demonstrate that concentrations in the material in the Burnt Ridge storage unit are below the PDLs and TCLP-PDLs.

The sampling described in this report was conducted to provide analytical data for comparison to the concentration-based Land Disposal Restriction (LDR) levels for the purpose of evaluating compliance with these criteria in the event the waste is delisted. The samples were analyzed for the waste codes corresponding to acetone (F003), benzene (U019), methanol (U154), and toluene (U220), as requested by the EPA and Ecology. The analytical data from this sampling demonstrate that the mixed material concentrations in the Burnt Ridge storage unit are below the LDR levels for each of these parameters.

## MIXED MATERIAL SAMPLING

LAI staff collected the mixed material samples from the Burnt Ridge storage unit on October 26, 2017 in accordance with the Waste Characterization Plan. In the Waste Characterization Plan, the storage unit was divided into 25 ft by 25 ft grids and 11 grid squares to be sampled were determined using the simple random sampling strategy. A Trimble global positioning system (GPS) with a sub-meter accuracy was used to navigate to each sampling location using 12-ft aluminum row boat. As shown on Figure 2, a sample was collected in each of the 11 grid locations identified in the Waste Characterization Plan. Each sample was collected in the approximate center of the grid. All grids identified for sampling had a total depth of mixed material of greater than 2 ft; therefore, no sample locations were moved from the identified location due to insufficient sludge in the grid.

At the time of sample collection, the water cap covering the mixed material was greater than 1 ft in all sampling locations. Because the sampling boat was protected from the wind by the storage unit berm, ropes were not necessary to hold it in place during sampling. This is a minor deviation from the work plan; however, the work was completed consistent with the intent of the plan.

At each sampling location, LAI field staff recorded the grid location, sample name, date and time of sample collection, and thickness of the water cap, calculated the thickness of the mixed material, and described the color, viscosity, density, odor, and the presence of any debris. This information is presented in Table 2.

The mixed material was sampled with a custom-made, 2-inch-diameter, clear sludge sampler with a flapper valve to maximize sample retention (developed and constructed by FMF). Following collection in the sampling tube, mixed material was placed in a stainless steel bowl and samples for volatile organic compounds (VOC) analysis were immediately collected. The mixed material in the bowl was then homogenized and collection of the samples for determination of pH and total solids was completed. Samples were placed in laboratory supplied jars, filled to minimize headspace in the container, and labeled with appropriate site and sampling location information. The sample identification nomenclature was as follows:

Burnt Ridge - Grab – Grid Number

⇓

BR-G-A1

The samples were placed in a cooler on ice immediately after sampling and delivered to the analytical laboratory, Analytical Resources, Inc. of Tukwila, Washington, by LAI under standard chain-of-custody procedures within 12 hours of sample collection.

## MIXED MATERIAL ANALYTICAL RESULTS

As described in the Introduction section of this report, the previously existing analytical data demonstrate that concentrations in the material in the Burnt Ridge storage unit are below the PDLs and TCLP-PDLs. Therefore, the sample results described below provide analytical data for comparison to LDR levels for the purpose of evaluating compliance with these criteria in the event the waste is delisted.

All 11 samples (and one duplicate sample) were analyzed for the following chemical constituents:

- Benzene, toluene, acetone by EPA Method 8020C
- Methanol by EPA Method 8015C
- Total Solids by EPA Method SM 2540G
- pH by EPA 9045D.

The analytical results underwent data validation and verification by LAI, were compared to the Land Disposal Restriction Levels (LDRs) for non-wastewater, and are provided in Table 3. The data is considered acceptable with minor data qualifications (see Appendix A) and the data completeness is 100 percent. Results are reported on an as-received basis in accordance with section 8.2 of the EPA Delisting Guidance (EPA 1993). The laboratory report and data validation report are provided as Appendix A.

The analytical results for mixed material samples are presented in Table 3 and are briefly summarized below:

- VOCs:

   - Benzene was detected in sample BR-G-A1 at a concentration of 1.01 micrograms per kilogram (µg/kg). Benzene was not detected in any other samples. The detected benzene concentration and all benzene reporting limits are less than the benzene LDR of 10,000 µg/kg.
   - Toluene was detected at concentrations ranging from 5.75 to 13.2 µg/kg. All measured concentrations are less than the toluene LDR of 10,000 µg/kg.
   - Acetone was detected at concentrations ranging from 116 to 422 µg/kg. All measured concentrations are less than the acetone LDR of 160,000 µg/kg.
- Methanol:
   - Methanol was not detected above the laboratory reporting limit, which ranged from 8.8 to 10.0 milligrams per kilogram (mg/kg). Although the methanol LDR is identified as a TCLP concentration, analytical limitations would produce a reporting limit greater than the LDR limit. As described in the Waste Characterization Plan, samples were analyzed for total methanol and the results are compared to the TCLP LDR using the rule of 20. All reporting limits are less than the methanol LDR multiplied by 20 (rule of 20) of 15 mg/kg.
- Total Solids:
   - Total solids ranged from 8.34% to 19.98%. There are no regulatory criteria for total solids.
- pH:
   - pH ranged from 6.89 to 7.28. The pH demonstrates the mixed material does not exhibit the characteristic of corrosivity.

## DECONTAMINATION AND WASTE MANAGEMENT

Before the initial sampling and between every sample collected, all sampling equipment was rinsed with tap water to remove the solids, washed with Alconox soap, rinsed in tap water to remove the Alconox, and then rinsed in DI water.

All decontamination water and unused mixed material collected during this sampling effort was discharged to the storage unit at the toe of the loading ramp. No sampling locations were near enough to the ramp to be impacted by decontamination activities.

## CONCLUSIONS

All mixed material samples were collected and analyzed in accordance with the Waste Characterization Plan. No deviations from the Waste Characterization Plan were necessary, except as described previously in this report. All samples meet the LDRs for acetone, benzene, toluene, and methanol. No additional sampling or hot spot delineation is necessary.

## USE OF THIS REPORT

This waste characterization report has been prepared for the exclusive use of Perkins Coie LLP and their client, Emerald Kalama Chemical, LLC, and applicable regulatory agencies for specific application to the Fire Mountain Farms Burnt Ridge storage unit. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of LAI. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by LAI, shall be at the user's sole risk. LAI warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. We make no other warranty, either express or implied.

## REFERENCES

Ecology. 2014. Letter: Administrative Order No. 10938. From Laurie G. Davies, Waste 2 Resources Program Manager, Washington State Department of Ecology, to Jarrod Kocin, Emerald Kalama Chemical, LLC. September 11.

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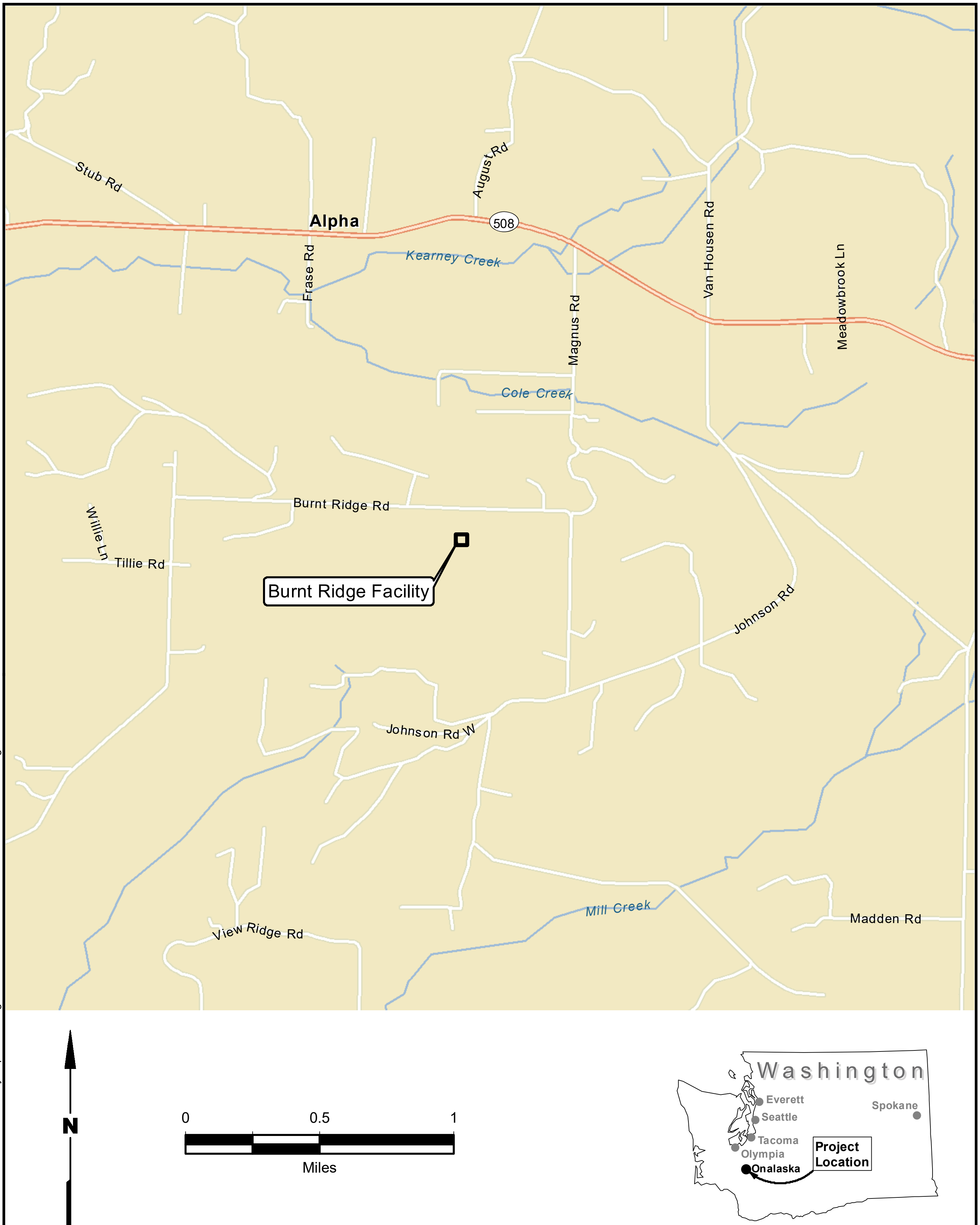


Data Source: Esri 2012

G:\Projects\066\045\010\014\F01 VicinityMap BurntRidge.mxd 11/16/2017 NAD 1983 StatePlane Washington North FIPS 4601 Feet

LANDAU ASSOCIATES

| Emerald Kalama<br>Waste Characterization Report<br>Fire Mountain Farms Storage Units | **Burnt Ridge Vicinity Map** | Figure<br>1 |
|---|---|---|


Legend

A1 Sampling Grid

A1 Sampling Point

0 50 100

Feet

Data Source: Esri 2012; Esri World Imagery

G:\Projects\066\045\010\014\F02 SampleLocationsBR.mxd 11/16/2017 NAD 1983 StatePlane Washington South FIPS 4602 Feet

LANDAU ASSOCIATES

| Emerald Kalama<br>Waste Characterization Report<br>Fire Mountain Farms Storage Units | **Burnt Ridge Storage Unit<br>Sample Locations** | Figure<br>2 |
|---|---|---|

# Table 1
## Mixed Material Sources
## Fire Mountain Farms Burnt Ridge Mixed Material Storage Unit
## Lewis County, Washington

| Biosolids Source | Amount (tons) |
|---|---|
| Emerald Kalama Chemical, LLC | 9.8 |
| Kitsap Municipal Wastewater Treatment Plant | 26.5 |
| Castle Rock Municipal Wastewater Treatment Plant | 0.8 |
| West Sound Utility District Wastewater Treatment Plant | 17.0 |
| Camas Municipal Wastewater Treatment Plant | 8.1 |
| McCleary Municipal Wastewater Treatment Plant | 1.2 |
| Aberdeen Municipal Wastewater Treatment Plant | 19.7 |
| Kalama Municipal Wastewater Treatment Plant | 0.8 |
| Gig Harbor Municipal Wastewater Treatment Plant | 13.8 |
| Grand Mound Municipal Wastewater Treatment Plant | 3.2 |
| Darigold - Wastewater Treatment Plant | 8.4 |
| Ocean Shores Municipal Wastewater Treatment Plant | 12.3 |
| Lewis County Water Sewer District 6 Municipal Wastewater Treatment Plant | 0.5 |
| Cow Manure (Fire Mountain Farms water runoff from barn lot) | 3.8 |
| **Total** | 126.0 |

**Table 2**
**Mixed Material Sample Collection Log**
**Fire Mountain Farms Burnt Ridge Mixed Material Storage Unit**
**Lewis County, Washington**

| Grid | Sample ID | Sample Date | Sample Time | Water Depth (ft) | Mixed Material Thickness* (ft) | Sampling Tube Length (ft) | Sample Tube Stickup (above water surface at full push depth) (ft) | Sample Description | Comments |
|---|---|---|---|---|---|---|---|---|---|
| A1 | BR-G-A1 | 10/26/2017 | 11:30 | 1.3 | 3.5 | 6.2 | 1.4 | Black to dark gray, fine-grained organics; sewage-like odor (very soft, wet) | |
| A2 | BR-G-A2 | 10/26/2017 | 12:00 | 1.3 | 5.7 | 8.4 | 1.4 | Black to dark gray, fine-grained organics; sewage-like odor (very soft, wet) | BR-G-Dup1 |
| B1 | BR-G-B1 | 10/26/2017 | 13:00 | 1.4 | 6.0 | 8.4 | 1.0 | Black to dark gray, fine-grained organics; sewage-like odor (very soft, wet) | |
| B3 | BR-G-B3 | 10/26/2017 | 13:15 | 2.9 | 4.2 | 8.4 | 1.3 | Black to dark gray, fine-grained organics; sewage-like odor (very soft, wet) | |
| C2 | BR-G-C2 | 10/26/2017 | 13:40 | 2.1 | 7.0 | 12.2 | 3.1 | Black to dark gray, fine-grained organics; sewage-like odor (very soft, wet) | |
| D4 | BR-G-D4 | 10/26/2017 | 14:05 | 1.7 | 6.9 | 12.2 | 3.6 | Black to dark gray, fine-grained organics; sewage-like odor (very soft, wet) | |
| D5 | BR-G-D5 | 10/26/2017 | 14:30 | 1.5 | 6.7 | 12.2 | 4.0 | Black to dark gray, fine-grained organics; sewage-like odor (very soft, wet) | |
| E2 | BR-G-E2 | 10/26/2017 | 15:00 | 1.5 | 7.3 | 12.2 | 3.4 | Black to dark gray, fine-grained organics; sewage-like odor (very soft, wet) | |
| E4 | BR-G-E4 | 10/26/2017 | 15:25 | 1.2 | 7.2 | 12.2 | 3.8 | Black to dark gray, fine-grained organics; sewage-like odor (very soft, wet) | |
| E5 | BR-G-E5 | 10/26/2017 | 15:50 | 1.2 | 7.0 | 12.2 | 4.0 | Black to dark gray, fine-grained organics; sewage-like odor (very soft, wet) | |
| E6 | BR-G-E6 | 10/26/2017 | 16:15 | 1.3 | 3.4 | 12.2 | 7.5 | Black to dark gray, fine-grained organics; sewage-like odor (very soft, wet) | |

**Notes:**

* Calculated Mixed Materials Thickness = Sampling Tube Length - Sample Tube Stickup - Water Depth

A1 = Grid Location

ft = Feet

G = Grab Sample

BR = Burnt Ridge

# Table 3
## Waste Characterization Analytical Results
## Fire Mountain Farms Burnt Ridge Mixed Material Storage Unit
## Lewis County, Washington

| Analyte | CAS No. | Land Disposal Restriction Level (non-wastewater) | Land Disposal Restriction Level x 20 | Grid Location, Sample Location, Laboratory Sample ID, and Sample Date | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Grid A1 | | Grid A2 | | | | Grid B1 | | Grid B3 | | Grid C2 | |
| | | | | | | | | Dup of BR-G-A2 | | | | | | | |
| | | | | BR-G-A1 | | BR-G-A2 | | BR-G-DUP1 | | BR-G-B1 | | BR-G-B3 | | BR-G-C2 | |
| | | | | 17J0506-01 | | 17J0506-02 | | 17J0506-12 | | 17J0506-03 | | 17J0506-04 | | 17J0506-05 | |
| | | | | 10/26/2017 | | 10/26/2017 | | 10/26/2017 | | 10/26/2017 | | 10/26/2017 | | 10/26/2017 | |
| **Volatile Organic Compounds (ug/kg; EPA Method 8260C)** | | | | | | | | | | | | | | | |
| Acetone | 67-64-1 | 160,000 | -- | **422** | | **284** | **J** | **166** | **J** | **278** | | **116** | | **288** | |
| Benzene | 71-43-2 | 10,000 | -- | **1.01** | | 0.87 | U | 0.98 | U | 0.97 | U | 0.90 | U | 0.86 | U |
| Toluene | 108-88-3 | 10,000 | -- | **8.93** | | **7.05** | | **9.11** | | **5.99** | | **8.47** | | **10.1** | |
| | | | | | | | | | | | | | | | |
| **Volatile Organic Compounds (mg/kg; EPA Method 8015C)** | | | | | | | | | | | | | | | |
| Methanol | 67-56-1 | 0.75 mg/L (a) | 15 mg/kg | 9.6 | U | 9.5 | U | 9.5 | U | 10.0 | U | 9.9 | U | 9.9 | U |
| | | | | | | | | | | | | | | | |
| **Conventionals** | | | | | | | | | | | | | | | |
| pH (std units; EPA Method 9045D) | -- | -- | -- | **7.26** | | **7.28** | | **7.17** | | **7.16** | | **6.89** | | **7.26** | |
| Total Solids (%; SM2540 G-97) | -- | -- | -- | **16.76** | | **14.19** | | **14.20** | | **12.77** | | **8.34** | | **15.34** | |

# Table 3
## Waste Characterization Analytical Results
## Fire Mountain Farms Burnt Ridge Mixed Material Storage Unit
## Lewis County, Washington

| Analyte | CAS No. | Land Disposal Restriction Level (non-wastewater) | Land Disposal Restriction Level x 20 | Grid Location, Sample Location, Laboratory Sample ID, and Sample Date | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Grid D4<br>BR-G-D4<br>17J0506-06<br>10/26/2017 | Grid D5<br>BR-G-D5<br>17J0506-07<br>10/26/2017 | Grid E2<br>BR-G-E2<br>17J0506-08<br>10/26/2017 | Grid E4<br>BR-G-E4<br>17J0506-09<br>10/26/2017 | Grid E5<br>BR-G-E5<br>17J0506-10<br>10/26/2017 | Grid E6<br>BR-G-E6<br>17J0506-11<br>10/26/2017 |
| **Volatile Organic Compounds (ug/kg; EPA Method 8260C)** | | | | | | | | | |
| Acetone | 67-64-1 | 160,000 | -- | **380** | **201** | **232** | **341** | **251** | **279** |
| Benzene | 71-43-2 | 10,000 | -- | 0.96 U | 0.97 U | 0.93 U | 0.96 U | 0.98 U | 0.99 U |
| Toluene | 108-88-3 | 10,000 | -- | **10.3 J** | **5.75** | **7.30** | **10.1** | **13.2** | **6.42** |
| | | | | | | | | | |
| **Volatile Organic Compounds (mg/kg; EPA Method 8015C)** | | | | | | | | | |
| Methanol | 67-56-1 | 0.75 mg/L (a) | 15 mg/kg | 9.1 U | 9.4 U | 9.4 U | 9.6 U | 9.5 U | 8.8 U |
| | | | | | | | | | |
| **Conventionals** | | | | | | | | | |
| pH (std units; EPA Method 9045D) | -- | -- | -- | **7.22** | **7.26** | **7.12** | **7.22** | **7.28** | **7.23** |
| Total Solids (%; SM2540 G-97) | -- | -- | -- | **17.28** | **17.53** | **11.44** | **15.56** | **19.98** | **10.58** |

**Notes:**

(a) This LDR is a TCLP level; analytical limitations would produce a reporting limit greater than the LDR. The total methanol concentration is compared to the TCLP LDR using the rule of 20.

U = Indicates the compound was not detected at the reported concentration.

**Bold** = Detected concentration

-- = not applicable

**Abbreviations and Acronyms:**

EPA = US Environmental Protection Agency
ID = identification
ug/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
mg/L = milligrams per liter

APPENDIX A

# Laboratory Report and Data Validation Memorandum

**Analytical Resources, Incorporated**
Analytical Chemists and Consultants

08 November 2017

Ken Reid
Landau Associates, Inc.
130 2nd Avenue S.
Edmonds, WA 98020

RE: Fire Mountain Farms- Burnt Ridge

Please find enclosed sample receipt documentation and analytical results for samples from the project referenced above.

Sample analyses were performed according to ARI's Quality Assurance Plan and any provided project specific Quality Assurance Plan. Each analytical section of this report has been approved and reviewed by an analytical peer, the appropriate Laboratory Supervisor or qualified substitute, and a technical reviewer.

Should you have any questions or problems, please feel free to contact us at your convenience.

| Associated Work Order(s) | Associated SDG ID(s) |
|---|---|
| 17J0506 | N/A |

-----

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed in the enclose Narrative. ARI, an accredited laboratory, certifies that the report results for which ARI is accredited meets all the reqirements of the accrediting body. A list of certified analyses, accreditations, and expiration dates is included in this report.

Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or his/her designee, as verified by the following signature.

Analytical Resources, Inc.

*The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.*

Cert# 100006

PJLA Testing
Accreditation # 66169

4611 S. 134th Place, Suite 100 • Tukwila, WA 98168 • Ph: (206) 695-6200 • Fax: (206) 695-6202

17J0506

LANDAU ASSOCIATES

- ☒ **Seattle/Edmonds** (425) 778-0907
- ☐ **Tacoma** (253) 926-2493
- ☐ **Spokane** (509) 327-9737
- ☐ **Portland** (503) 542-1080
- ☐ ______

# Chain-of-Custody Record

Date 10/26/17
Page 1 of 1

Project Name Fire Mountain Farms - Burnt Ridge  Project No. 0060045

Project Location/Event Onalaska, WA

Sampler's Name Ken Reid

Project Contact " ", Kris Hendrickson, Kristi Schultz

Send Results To " " " " " "

Turnaround Time
- ☒ Standard
- ☐ Accelerated
- ☐ ______

Testing Parameters

| Sample I.D. | Date | Time | Matrix | No. of Containers | VOCs (SW8260C) *report only toluene, Benzene, Acetone | Methanol (8015C) | Total Solids (SM2540G) | pH (SW9045) |
|---|---|---|---|---|---|---|---|---|
| BR-G-A1 | 10/26/17 | 11:30 | Sed * | 5 | X | X | X | X |
| BR-G-A2 | ↓ | 12:00 | ↓ | 5 | X | X | X | X |
| BR-G-B1 | ↓ | 13:00 | ↓ | 5 | X | X | X | X |
| BR-G-B3 | ↓ | 13:15 | ↓ | 6 | X | X | X | X |
| BR-G-C2 | ↓ | 13:40 | ↓ | 5 | X | X | X | X |
| BR-G-D4 | ↓ | 14:05 | ↓ | 5 | X | X | X | X |
| BR-G-D5 | ↓ | 14:30 | ↓ | 5 | X | X | X | X |
| BR-G-E2 | ↓ | 15:00 | ↓ | 5 | X | X | X | X |
| BR-G-E4 | ↓ | 15:25 | ↓ | 5 | X | X | X | X |
| BR-G-E5 | ↓ | 15:50 | ↓ | 5 | X | X | X | X |
| BR-G-E6 | ↓ | 16:15 | ↓ | 5 | X | X | X | X |
| BG-G-Dup1 | ↓ | 11:00 | ↓ | 5 | X | X | X | X |

Observations/Comments

- X Allow water samples to settle, collect aliquot from clear portion
- __ NWTPH-Dx - run acid wash silica gel cleanup
- __ Analyze for EPH if no specific product identified

VOC/BTEX/VPH (soil):
- __ non-preserved
- __ preserved w/methanol
- __ preserved w/sodium bisulfate
- __ Freeze upon receipt
- __ Dissolved metal water samples field filtered

Other * Biosolids

Special Shipment/Handling or Storage Requirements On ice

Method of Shipment LAI Delivery

| Relinquished by | Received by | Relinquished by | Received by |
|---|---|---|---|
| Signature [signature] | Signature [signature] | Signature | Signature |
| Printed Name Ken Reid | Printed Name Brandon Fisk | Printed Name | Printed Name |
| Company LAI | Company ARI | Company | Company |
| Date 10/26/17 Time 21:00 | Date 10/27/17 Time 702 | Date Time | Date Time |

WHITE COPY - Project File  YELLOW COPY - Laboratory  PINK COPY - Client Representative

12/2014

Analytical Resources, Incorporated
Analytical Chemists and Consultants

# Cooler Receipt Form

ARI Client: Landau

COC No(s): __________ NA

Assigned ARI Job No: 17J0506

Project Name: Fire Mountain - Burnt Ridge

Delivered by: Fed-Ex UPS Courier (Hand Delivered) Other: ______

Tracking No: __________ NA

**Preliminary Examination Phase:**

| | | |
|---|---|---|
| Were intact, properly signed and dated custody seals attached to the outside of to cooler? | (YES) | NO |
| Were custody papers included with the cooler? | (YES) | NO |
| Were custody papers properly filled out (ink, signed, etc.) | (YES) | NO |

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry) 4.3
Time: ______

If cooler temperature is out of compliance fill out form 00070F

Temp Gun ID#: D005206

Cooler Accepted by: BF Date: 10/27/17 Time: 702

*Complete custody forms and attach all shipping documents*

## Log-In Phase:

| | | | |
|---|---|---|---|
| Was a temperature blank included in the cooler? | | YES | (NO) |
| Was sufficient ice used (if appropriate)? | NA | (YES) | NO |
| Were all bottles sealed in individual plastic bags? | | YES | (NO) |
| Did all bottles arrive in good condition (unbroken)? | | (YES) | NO |
| Were all bottle labels complete and legible? | | (YES) | NO |
| Did the number of containers listed on COC match with the number of containers received? | | YES | (NO) |
| Did all bottle labels and tags agree with custody papers? | | YES | (NO) |
| Were all bottles used correct for the requested analyses? | | (YES) | NO |
| Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)... | NA | YES | (NO) |
| Were all VOC vials free of air bubbles? | ~~(NA)~~ | YES | (NO) BF |
| Was sufficient amount of sample sent in each bottle? | | (YES) | NO |
| Date VOC Trip Blank was made at ARI | (NA) | | |

What kind of packing material was used? ... (Bubble Wrap) (Wet Ice) Gel Packs (Baggies) (Foam Block) Paper Other: ______

Was Sample Split by ARI : (NA) YES Date/Time: ______ Equipment: ______ Split by: ______

Samples Logged by: BF Date: 10/~~27~~ 27 BF/17 Time: 744

*** Notify Project Manager of discrepancies or concerns ***

| Sample ID on Bottle | Sample ID on COC | Sample ID on Bottle | Sample ID on COC |
|---|---|---|---|
| 1-4oz. BR-G-B2 | BR-G-B3 | | |
| | | | |
| | | | |
| | | | |

*Additional Notes, Discrepancies, & Resolutions:*

TBs not on COC
TBs had 3 vials with BF hs + 1 w/a 1 bubble

one 2oz jar for BR-G-D5 had no sample volume

By: BF Date: 10/~~23~~ 27/17

| Small Air Bubbles ~2mm | Peabubbles' 2-4 mm | LARGE Air Bubbles > 4 mm | |
|---|---|---|---|
| | | | Small → "sm" (< 2 mm) |
| | | | Peabubbles → "pb" ( 2 to < 4 mm ) |
| | | | Large → "lg" ( 4 to < 6 mm ) |
| | | | Headspace → "hs" ( > 6 mm ) |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

## ANALYTICAL REPORT FOR SAMPLES

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| BR-G-A1 | 17J0506-01 | Solid (as-rec) | 26-Oct-2017 11:30 | 27-Oct-2017 07:02 |
| BR-G-A2 | 17J0506-02 | Solid (as-rec) | 26-Oct-2017 12:00 | 27-Oct-2017 07:02 |
| BR-G-B1 | 17J0506-03 | Solid (as-rec) | 26-Oct-2017 13:00 | 27-Oct-2017 07:02 |
| BR-G-B3 | 17J0506-04 | Solid (as-rec) | 26-Oct-2017 13:15 | 27-Oct-2017 07:02 |
| BR-G-C2 | 17J0506-05 | Solid (as-rec) | 26-Oct-2017 13:40 | 27-Oct-2017 07:02 |
| BR-G-D4 | 17J0506-06 | Solid (as-rec) | 26-Oct-2017 14:05 | 27-Oct-2017 07:02 |
| BR-G-D5 | 17J0506-07 | Solid (as-rec) | 26-Oct-2017 14:30 | 27-Oct-2017 07:02 |
| BR-G-E2 | 17J0506-08 | Solid (as-rec) | 26-Oct-2017 15:00 | 27-Oct-2017 07:02 |
| BR-G-E4 | 17J0506-09 | Solid (as-rec) | 26-Oct-2017 15:25 | 27-Oct-2017 07:02 |
| BR-G-E5 | 17J0506-10 | Solid (as-rec) | 26-Oct-2017 15:50 | 27-Oct-2017 07:02 |
| BR-G-E6 | 17J0506-11 | Solid (as-rec) | 26-Oct-2017 16:15 | 27-Oct-2017 07:02 |
| BR-G-Dup1 | 17J0506-12 | Solid (as-rec) | 26-Oct-2017 11:00 | 27-Oct-2017 07:02 |
| TB | 17J0506-13 | Water | 26-Oct-2017 00:00 | 27-Oct-2017 07:02 |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

# Case Narrative

**Volatiles - EPA Method SW8260C**

The sample(s) were run within the recommended holding times.

Initial and continuing calibrations were within method requirements.

Internal standard areas were within limits.

The surrogate percent recoveries were within control limits.

The method blank(s) were clean at the reporting limits.

The LCS/LCSD percent recoveries and RPD were within control limits.

The Matrix Spike/Matrix Spike duplicate recoveries and RPD were within limits with the exception of analytes flagged on the associated forms.

**Methonol - EPA Method SW8015C**

The sample(s) were extracted and analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

The surrogate percent recoveries were within control limits.

The method blank(s) were clean at the reporting limits.

The LCS percent recoveries were within control limits.

The Matrix Spike/Matrix Spike duplicate recoveries and RPD were within limits.

**Wet Chemistry**

The sample(s) were prepared and analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

The method blank(s) were clean at the reporting limits.

The LCS percent recoveries were within control limits.





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# Analytical Report

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-A1**

**17J0506-01 (Solid (as-rec))**

## Volatile Organic Compounds

Method: EPA 8260C — Sampled: 10/26/2017 11:30

Instrument: NT5 — Analyzed: 01-Nov-2017 19:30

Sample Preparation: Preparation Method: No Prep - Volatiles
Preparation Batch: BFK0027 — Sample Size: 5.18 g (wet)
Prepared: 01-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Acetone | 67-64-1 | 1 | 4.83 | **422** | ug/kg | |
| Benzene | 71-43-2 | 1 | 0.97 | **1.01** | ug/kg | |
| Toluene | 108-88-3 | 1 | 0.97 | **8.93** | ug/kg | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | *80-149 %* | *119* | *%* | |
| *Surrogate: Toluene-d8* | | | *77-120 %* | *97.3* | *%* | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-A1**

**17J0506-01 (Solid (as-rec))**

**Glycols**

Method: EPA 8015C — Sampled: 10/26/2017 11:30

Instrument: FID7 — Analyzed: 03-Nov-2017 15:01

Sample Preparation: Preparation Method: No Prep-Organics
Preparation Batch: BFK0086 — Sample Size: 5.23 g (wet)
Prepared: 03-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Methanol | 67-56-1 | 1 | 9.6 | ND | mg/kg | U |
| *Surrogate: o-Cresol* | | | *30-160 %* | *65.7* | *%* | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-A1**

**17J0506-01 (Solid (as-rec))**

## Wet Chemistry

Method: EPA 9045D — Sampled: 10/26/2017 11:30

Instrument: Accumet AR60 — Analyzed: 31-Oct-2017 18:31

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0891 — Sample Size: 20 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 20 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| pH | | 1 | 0.01 | **7.26** | pH Units | |

Analytical Resources, Incorporated
Analytical Chemists and Consultants

# Analytical Report

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-A1**

**17J0506-01 (Solid (as-rec))**

## Wet Chemistry

Method: SM 2540 G-97 | Sampled: 10/26/2017 11:30

Instrument: BAL2 | Analyzed: 31-Oct-2017 12:36

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0880 | Sample Size: 10 g (wet)
Prepared: 31-Oct-2017 | Final Volume: 10 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Total Solids | | 1 | 0.04 | **16.76** | % | |

**Analytical Resources, Incorporated**
Analytical Chemists and Consultants

# Analytical Report

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-A2**

**17J0506-02 (Solid (as-rec))**

## Volatile Organic Compounds

Method: EPA 8260C — Sampled: 10/26/2017 12:00

Instrument: NT5 — Analyzed: 01-Nov-2017 19:52

Sample Preparation: Preparation Method: No Prep - Volatiles
Preparation Batch: BFK0027 — Sample Size: 5.77 g (wet)
Prepared: 01-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Acetone | 67-64-1 | 1 | 4.33 | **284** | ug/kg | |
| Benzene | 71-43-2 | 1 | 0.87 | ND | ug/kg | U |
| Toluene | 108-88-3 | 1 | 0.87 | **7.05** | ug/kg | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | *80-149 %* | *120* | *%* | |
| *Surrogate: Toluene-d8* | | | *77-120 %* | *96.0* | *%* | |





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| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-A2**

**17J0506-02 (Solid (as-rec))**

## Glycols

Method: EPA 8015C — Sampled: 10/26/2017 12:00

Instrument: FID7 — Analyzed: 03-Nov-2017 15:34

Sample Preparation: Preparation Method: No Prep-Organics
Preparation Batch: BFK0086 — Sample Size: 5.28 g (wet)
Prepared: 03-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Methanol | 67-56-1 | 1 | 9.5 | ND | mg/kg | U |
| *Surrogate: o-Cresol* | | | *30-160 %* | *63.0* | *%* | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-A2**

**17J0506-02 (Solid (as-rec))**

**Wet Chemistry**

Method: EPA 9045D — Sampled: 10/26/2017 12:00

Instrument: Accumet AR60 — Analyzed: 31-Oct-2017 18:31

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0891 — Sample Size: 20 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 20 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| pH | | 1 | 0.01 | **7.28** | pH Units | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-A2**

**17J0506-02 (Solid (as-rec))**

**Wet Chemistry**

Method: SM 2540 G-97 — Sampled: 10/26/2017 12:00

Instrument: BAL2 — Analyzed: 31-Oct-2017 12:36

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0880 — Sample Size: 10 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 10 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Total Solids | | 1 | 0.04 | **14.19** | % | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-B1**

**17J0506-03 (Solid (as-rec))**

**Volatile Organic Compounds**

Method: EPA 8260C — Sampled: 10/26/2017 13:00

Instrument: NT5 — Analyzed: 01-Nov-2017 20:14

Sample Preparation: Preparation Method: No Prep - Volatiles
Preparation Batch: BFK0027 — Sample Size: 5.15 g (wet)
Prepared: 01-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Acetone | 67-64-1 | 1 | 4.85 | **278** | ug/kg | |
| Benzene | 71-43-2 | 1 | 0.97 | ND | ug/kg | U |
| Toluene | 108-88-3 | 1 | 0.97 | **5.99** | ug/kg | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | *80-149 %* | *114* | *%* | |
| *Surrogate: Toluene-d8* | | | *77-120 %* | *91.8* | *%* | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-B1**

**17J0506-03 (Solid (as-rec))**

## Glycols

Method: EPA 8015C — Sampled: 10/26/2017 13:00

Instrument: FID7 — Analyzed: 03-Nov-2017 16:07

Sample Preparation: Preparation Method: No Prep-Organics
Preparation Batch: BFK0086 — Sample Size: 5.02 g (wet)
Prepared: 03-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Methanol | 67-56-1 | 1 | 10.0 | ND | mg/kg | U |
| *Surrogate: o-Cresol* | | | *30-160 %* | *71.4* | *%* | |

Analytical Resources, Incorporated
Analytical Chemists and Consultants

# Analytical Report

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-B1**

**17J0506-03 (Solid (as-rec))**

## Wet Chemistry

Method: EPA 9045D — Sampled: 10/26/2017 13:00

Instrument: Accumet AR60 — Analyzed: 31-Oct-2017 18:31

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0891 — Sample Size: 20 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 20 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| pH | | 1 | 0.01 | **7.16** | pH Units | |

Analytical Resources, Inc.

*The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.*

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| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-B1**

**17J0506-03 (Solid (as-rec))**

## Wet Chemistry

Method: SM 2540 G-97 — Sampled: 10/26/2017 13:00

Instrument: BAL2 — Analyzed: 31-Oct-2017 12:36

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0880 — Sample Size: 10 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 10 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Total Solids | | 1 | 0.04 | **12.77** | % | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-B3**

**17J0506-04 (Solid (as-rec))**

## Volatile Organic Compounds

Method: EPA 8260C — Sampled: 10/26/2017 13:15

Instrument: NT5 — Analyzed: 01-Nov-2017 20:35

Sample Preparation: Preparation Method: No Prep - Volatiles
Preparation Batch: BFK0027 — Sample Size: 5.57 g (wet)
Prepared: 01-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Acetone | 67-64-1 | 1 | 4.49 | **116** | ug/kg | |
| Benzene | 71-43-2 | 1 | 0.90 | ND | ug/kg | U |
| Toluene | 108-88-3 | 1 | 0.90 | **8.47** | ug/kg | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | *80-149 %* | *112* | *%* | |
| *Surrogate: Toluene-d8* | | | *77-120 %* | *94.6* | *%* | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-B3**

**17J0506-04 (Solid (as-rec))**

## Glycols

Method: EPA 8015C — Sampled: 10/26/2017 13:15

Instrument: FID7 — Analyzed: 03-Nov-2017 16:39

Sample Preparation: Preparation Method: No Prep-Organics
Preparation Batch: BFK0086 — Sample Size: 5.03 g (wet)
Prepared: 03-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Methanol | 67-56-1 | 1 | 9.9 | ND | mg/kg | U |
| *Surrogate: o-Cresol* | | | *30-160 %* | *70.2* | *%* | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-B3**

**17J0506-04 (Solid (as-rec))**

**Wet Chemistry**

Method: EPA 9045D — Sampled: 10/26/2017 13:15

Instrument: Accumet AR60 — Analyzed: 31-Oct-2017 18:31

Sample Preparation:
Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0891 — Sample Size: 20 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 20 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| pH | | 1 | 0.01 | **6.89** | pH Units | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-B3**

**17J0506-04 (Solid (as-rec))**

**Wet Chemistry**

Method: SM 2540 G-97 — Sampled: 10/26/2017 13:15

Instrument: BAL2 — Analyzed: 31-Oct-2017 12:36

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0880 — Sample Size: 10 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 10 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Total Solids | | 1 | 0.04 | **8.34** | % | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-C2**

**17J0506-05 (Solid (as-rec))**

**Volatile Organic Compounds**

Method: EPA 8260C — Sampled: 10/26/2017 13:40

Instrument: NT5 — Analyzed: 01-Nov-2017 20:57

Sample Preparation: Preparation Method: No Prep - Volatiles
Preparation Batch: BFK0027 — Sample Size: 5.83 g (wet)
Prepared: 01-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Acetone | 67-64-1 | 1 | 4.29 | **288** | ug/kg | |
| Benzene | 71-43-2 | 1 | 0.86 | ND | ug/kg | U |
| Toluene | 108-88-3 | 1 | 0.86 | **10.1** | ug/kg | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | *80-149 %* | *121* | *%* | |
| *Surrogate: Toluene-d8* | | | *77-120 %* | *91.0* | *%* | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-C2**

**17J0506-05 (Solid (as-rec))**

## Glycols

Method: EPA 8015C — Sampled: 10/26/2017 13:40

Instrument: FID7 — Analyzed: 03-Nov-2017 17:12

| | | |
|---|---|---|
| Sample Preparation: | Preparation Method: No Prep-Organics | |
| | Preparation Batch: BFK0086 | Sample Size: 5.05 g (wet) |
| | Prepared: 03-Nov-2017 | Final Volume: 5 g |

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Methanol | 67-56-1 | 1 | 9.9 | ND | mg/kg | U |
| *Surrogate: o-Cresol* | | | *30-160 %* | *56.3* | *%* | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

## BR-G-C2

### 17J0506-05 (Solid (as-rec))

**Wet Chemistry**

Method: EPA 9045D — Sampled: 10/26/2017 13:40

Instrument: Accumet AR60 — Analyzed: 31-Oct-2017 18:31

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0891 — Sample Size: 20 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 20 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| pH | | 1 | 0.01 | **7.26** | pH Units | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-C2**

**17J0506-05 (Solid (as-rec))**

## Wet Chemistry

Method: SM 2540 G-97 — Sampled: 10/26/2017 13:40

Instrument: BAL2 — Analyzed: 31-Oct-2017 12:36

Sample Preparation:
Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0880 — Sample Size: 10 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 10 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Total Solids | | 1 | 0.04 | **15.34** | % | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-D4**

**17J0506-06 (Solid (as-rec))**

## Volatile Organic Compounds

Method: EPA 8260C — Sampled: 10/26/2017 14:05

Instrument: NT5 — Analyzed: 01-Nov-2017 21:19

Sample Preparation: Preparation Method: No Prep - Volatiles
Preparation Batch: BFK0027 — Sample Size: 5.23 g (wet)
Prepared: 01-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Acetone | 67-64-1 | 1 | 4.78 | **380** | ug/kg | |
| Benzene | 71-43-2 | 1 | 0.96 | ND | ug/kg | U |
| Toluene | 108-88-3 | 1 | 0.96 | **10.3** | ug/kg | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | *80-149 %* | *115* | *%* | |
| *Surrogate: Toluene-d8* | | | *77-120 %* | *94.5* | *%* | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-D4**

**17J0506-06 (Solid (as-rec))**

**Glycols**

Method: EPA 8015C — Sampled: 10/26/2017 14:05

Instrument: FID7 — Analyzed: 03-Nov-2017 17:45

Sample Preparation:
Preparation Method: No Prep-Organics
Preparation Batch: BFK0086 — Sample Size: 5.52 g (wet)
Prepared: 03-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Methanol | 67-56-1 | 1 | 9.1 | ND | mg/kg | U |
| *Surrogate: o-Cresol* | | | *30-160 %* | *56.3* | *%* | |

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# Analytical Report

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-D4**

**17J0506-06 (Solid (as-rec))**

**Wet Chemistry**

Method: EPA 9045D — Sampled: 10/26/2017 14:05

Instrument: Accumet AR60 — Analyzed: 31-Oct-2017 18:31

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0891 — Sample Size: 20 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 20 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| pH | | 1 | 0.01 | **7.22** | pH Units | |

# Analytical Report

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-D4**

**17J0506-06 (Solid (as-rec))**

**Wet Chemistry**

Method: SM 2540 G-97 — Sampled: 10/26/2017 14:05

Instrument: BAL2 — Analyzed: 31-Oct-2017 12:36

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0880 — Sample Size: 10 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 10 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Total Solids | | 1 | 0.04 | **17.28** | % | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-D5**

**17J0506-07 (Solid (as-rec))**

**Volatile Organic Compounds**

Method: EPA 8260C — Sampled: 10/26/2017 14:30

Instrument: NT5 — Analyzed: 01-Nov-2017 21:41

Sample Preparation: Preparation Method: No Prep - Volatiles
Preparation Batch: BFK0027 — Sample Size: 5.13 g (wet)
Prepared: 01-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Acetone | 67-64-1 | 1 | 4.87 | **201** | ug/kg | |
| Benzene | 71-43-2 | 1 | 0.97 | ND | ug/kg | U |
| Toluene | 108-88-3 | 1 | 0.97 | **5.75** | ug/kg | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | *80-149 %* | *110* | *%* | |
| *Surrogate: Toluene-d8* | | | *77-120 %* | *97.4* | *%* | |

# Analytical Report

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-D5**

**17J0506-07 (Solid (as-rec))**

**Glycols**

Method: EPA 8015C — Sampled: 10/26/2017 14:30

Instrument: FID7 — Analyzed: 03-Nov-2017 19:55

Sample Preparation: Preparation Method: No Prep-Organics
Preparation Batch: BFK0086 — Sample Size: 5.33 g (wet)
Prepared: 03-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Methanol | 67-56-1 | 1 | 9.4 | ND | mg/kg | U |
| *Surrogate: o-Cresol* | | | *30-160 %* | *62.6* | *%* | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-D5**

**17J0506-07 (Solid (as-rec))**

## Wet Chemistry

Method: EPA 9045D — Sampled: 10/26/2017 14:30

Instrument: Accumet AR60 — Analyzed: 31-Oct-2017 18:31

| | | |
|---|---|---|
| Sample Preparation: | Preparation Method: No Prep Wet Chem | |
| | Preparation Batch: BFJ0891 | Sample Size: 20 g (wet) |
| | Prepared: 31-Oct-2017 | Final Volume: 20 g |

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| pH | | 1 | 0.01 | **7.26** | pH Units | |

**Analytical Resources, Incorporated**
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# Analytical Report

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

## BR-G-D5

### 17J0506-07 (Solid (as-rec))

**Wet Chemistry**

Method: SM 2540 G-97 — Sampled: 10/26/2017 14:30

Instrument: BAL2 — Analyzed: 31-Oct-2017 12:36

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0880 — Sample Size: 10 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 10 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Total Solids | | 1 | 0.04 | **17.53** | % | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-E2**

**17J0506-08 (Solid (as-rec))**

**Volatile Organic Compounds**

Method: EPA 8260C — Sampled: 10/26/2017 15:00

Instrument: NT5 — Analyzed: 01-Nov-2017 22:03

Sample Preparation: Preparation Method: No Prep - Volatiles
Preparation Batch: BFK0027 — Sample Size: 5.38 g (wet)
Prepared: 01-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Acetone | 67-64-1 | 1 | 4.65 | **232** | ug/kg | |
| Benzene | 71-43-2 | 1 | 0.93 | ND | ug/kg | U |
| Toluene | 108-88-3 | 1 | 0.93 | **7.30** | ug/kg | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | *80-149 %* | *119* | *%* | |
| *Surrogate: Toluene-d8* | | | *77-120 %* | *90.5* | *%* | |





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| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

## BR-G-E2

**17J0506-08 (Solid (as-rec))**

### Glycols

Method: EPA 8015C — Sampled: 10/26/2017 15:00

Instrument: FID7 — Analyzed: 03-Nov-2017 20:28

Sample Preparation:
Preparation Method: No Prep-Organics
Preparation Batch: BFK0086 — Sample Size: 5.3 g (wet)
Prepared: 03-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Methanol | 67-56-1 | 1 | 9.4 | ND | mg/kg | U |
| *Surrogate: o-Cresol* | | | *30-160 %* | *66.0* | *%* | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-E2**

**17J0506-08 (Solid (as-rec))**

## Wet Chemistry

Method: EPA 9045D — Sampled: 10/26/2017 15:00

Instrument: Accumet AR60 — Analyzed: 31-Oct-2017 18:31

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0891 — Sample Size: 20 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 20 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| pH | | 1 | 0.01 | **7.12** | pH Units | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-E2**

**17J0506-08 (Solid (as-rec))**

## Wet Chemistry

Method: SM 2540 G-97 — Sampled: 10/26/2017 15:00

Instrument: BAL2 — Analyzed: 31-Oct-2017 12:36

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0880 — Sample Size: 10 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 10 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Total Solids | | 1 | 0.04 | **11.44** | % | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-E4**

**17J0506-09 (Solid (as-rec))**

**Volatile Organic Compounds**

Method: EPA 8260C — Sampled: 10/26/2017 15:25

Instrument: NT5 — Analyzed: 01-Nov-2017 22:25

Sample Preparation: Preparation Method: No Prep - Volatiles
Preparation Batch: BFK0027 — Sample Size: 5.22 g (wet)
Prepared: 01-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Acetone | 67-64-1 | 1 | 4.79 | **341** | ug/kg | |
| Benzene | 71-43-2 | 1 | 0.96 | ND | ug/kg | U |
| Toluene | 108-88-3 | 1 | 0.96 | **10.1** | ug/kg | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | *80-149 %* | *118* | *%* | |
| *Surrogate: Toluene-d8* | | | *77-120 %* | *92.3* | *%* | |





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# Analytical Report

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-E4**

**17J0506-09 (Solid (as-rec))**

## Glycols

Method: EPA 8015C — Sampled: 10/26/2017 15:25

Instrument: FID7 — Analyzed: 03-Nov-2017 21:00

Sample Preparation: Preparation Method: No Prep-Organics
Preparation Batch: BFK0086 — Sample Size: 5.21 g (wet)
Prepared: 03-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Methanol | 67-56-1 | 1 | 9.6 | ND | mg/kg | U |
| *Surrogate: o-Cresol* | | | *30-160 %* | *57.7* | *%* | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-E4**

**17J0506-09 (Solid (as-rec))**

## Wet Chemistry

Method: EPA 9045D — Sampled: 10/26/2017 15:25

Instrument: Accumet AR60 — Analyzed: 31-Oct-2017 18:31

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0891 — Sample Size: 20 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 20 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| pH | | 1 | 0.01 | **7.22** | pH Units | |

# Analytical Report

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-E4**

**17J0506-09 (Solid (as-rec))**

## Wet Chemistry

Method: SM 2540 G-97 — Sampled: 10/26/2017 15:25

Instrument: BAL2 — Analyzed: 31-Oct-2017 12:36

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0880 — Sample Size: 10 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 10 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Total Solids | | 1 | 0.04 | **15.56** | % | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-E5**

**17J0506-10 (Solid (as-rec))**

## Volatile Organic Compounds

Method: EPA 8260C — Sampled: 10/26/2017 15:50

Instrument: NT5 — Analyzed: 01-Nov-2017 22:47

Sample Preparation: Preparation Method: No Prep - Volatiles
Preparation Batch: BFK0027 — Sample Size: 5.1 g (wet)
Prepared: 01-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Acetone | 67-64-1 | 1 | 4.90 | **251** | ug/kg | |
| Benzene | 71-43-2 | 1 | 0.98 | ND | ug/kg | U |
| Toluene | 108-88-3 | 1 | 0.98 | **13.2** | ug/kg | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | *80-149 %* | *117* | *%* | |
| *Surrogate: Toluene-d8* | | | *77-120 %* | *88.8* | *%* | |

# Analytical Report

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-E5**

**17J0506-10 (Solid (as-rec))**

## Glycols

Method: EPA 8015C — Sampled: 10/26/2017 15:50

Instrument: FID7 — Analyzed: 03-Nov-2017 21:33

Sample Preparation: Preparation Method: No Prep-Organics
Preparation Batch: BFK0086 — Sample Size: 5.25 g (wet)
Prepared: 03-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Methanol | 67-56-1 | 1 | 9.5 | ND | mg/kg | U |
| *Surrogate: o-Cresol* | | | *30-160 %* | *59.3* | *%* | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-E5**

**17J0506-10 (Solid (as-rec))**

## Wet Chemistry

Method: EPA 9045D — Sampled: 10/26/2017 15:50

Instrument: Accumet AR60 — Analyzed: 31-Oct-2017 18:31

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0891 — Sample Size: 20 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 20 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| pH | | 1 | 0.01 | **7.28** | pH Units | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
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**BR-G-E5**

**17J0506-10 (Solid (as-rec))**

## Wet Chemistry

Method: SM 2540 G-97 — Sampled: 10/26/2017 15:50

Instrument: BAL2 — Analyzed: 31-Oct-2017 12:36

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0880 — Sample Size: 10 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 10 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Total Solids | | 1 | 0.04 | **19.98** | % | |

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# Analytical Report

| | | |
|---|---|---|
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| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-E6**

**17J0506-11 (Solid (as-rec))**

## Volatile Organic Compounds

Method: EPA 8260C — Sampled: 10/26/2017 16:15

Instrument: NT5 — Analyzed: 01-Nov-2017 23:09

Sample Preparation: Preparation Method: No Prep - Volatiles
Preparation Batch: BFK0027 — Sample Size: 5.06 g (wet)
Prepared: 01-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Acetone | 67-64-1 | 1 | 4.94 | **279** | ug/kg | |
| Benzene | 71-43-2 | 1 | 0.99 | ND | ug/kg | U |
| Toluene | 108-88-3 | 1 | 0.99 | **6.42** | ug/kg | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | *80-149 %* | *110* | *%* | |
| *Surrogate: Toluene-d8* | | | *77-120 %* | *88.7* | *%* | |



*The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.*

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| | | |
|---|---|---|
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| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

## BR-G-E6

**17J0506-11 (Solid (as-rec))**

### Glycols

Method: EPA 8015C — Sampled: 10/26/2017 16:15

Instrument: FID7 — Analyzed: 03-Nov-2017 22:05

Sample Preparation:
Preparation Method: No Prep-Organics
Preparation Batch: BFK0086 — Sample Size: 5.68 g (wet)
Prepared: 03-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Methanol | 67-56-1 | 1 | 8.8 | ND | mg/kg | U |
| *Surrogate: o-Cresol* | | | *30-160 %* | *68.5* | *%* | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
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**BR-G-E6**

**17J0506-11 (Solid (as-rec))**

## Wet Chemistry

Method: EPA 9045D — Sampled: 10/26/2017 16:15

Instrument: Accumet AR60 — Analyzed: 31-Oct-2017 18:31

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0891 — Sample Size: 20 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 20 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| pH | | 1 | 0.01 | **7.23** | pH Units | |

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# Analytical Report

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|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
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| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

## BR-G-E6

**17J0506-11 (Solid (as-rec))**

### Wet Chemistry

Method: SM 2540 G-97 — Sampled: 10/26/2017 16:15

Instrument: BAL2 — Analyzed: 31-Oct-2017 12:36

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0880 — Sample Size: 10 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 10 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Total Solids | | 1 | 0.04 | **10.58** | % | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-Dup1**

**17J0506-12 (Solid (as-rec))**

**Volatile Organic Compounds**

Method: EPA 8260C — Sampled: 10/26/2017 11:00

Instrument: NT5 — Analyzed: 01-Nov-2017 23:30

Sample Preparation: Preparation Method: No Prep - Volatiles
Preparation Batch: BFK0027 — Sample Size: 5.12 g (wet)
Prepared: 01-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Acetone | 67-64-1 | 1 | 4.88 | **166** | ug/kg | |
| Benzene | 71-43-2 | 1 | 0.98 | ND | ug/kg | U |
| Toluene | 108-88-3 | 1 | 0.98 | **9.11** | ug/kg | |
| *Surrogate: 1,2-Dichloroethane-d4* | | | *80-149 %* | *115* | *%* | |
| *Surrogate: Toluene-d8* | | | *77-120 %* | *91.0* | *%* | |

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# Analytical Report

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-Dup1**

**17J0506-12 (Solid (as-rec))**

## Glycols

Method: EPA 8015C — Sampled: 10/26/2017 11:00

Instrument: FID7 — Analyzed: 03-Nov-2017 22:37

Sample Preparation: Preparation Method: No Prep-Organics
Preparation Batch: BFK0086 — Sample Size: 5.29 g (wet)
Prepared: 03-Nov-2017 — Final Volume: 5 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Methanol | 67-56-1 | 1 | 9.5 | ND | mg/kg | U |
| *Surrogate: o-Cresol* | | | *30-160 %* | *62.6* | *%* | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

## BR-G-Dup1

### 17J0506-12 (Solid (as-rec))

**Wet Chemistry**

Method: EPA 9045D — Sampled: 10/26/2017 11:00

Instrument: Accumet AR60 — Analyzed: 31-Oct-2017 18:31

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0891 — Sample Size: 20 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 20 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| pH | | 1 | 0.01 | **7.17** | pH Units | |

# Analytical Report

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**BR-G-Dup1**

**17J0506-12 (Solid (as-rec))**

## Wet Chemistry

Method: SM 2540 G-97 — Sampled: 10/26/2017 11:00

Instrument: BAL2 — Analyzed: 31-Oct-2017 12:36

Sample Preparation: Preparation Method: No Prep Wet Chem
Preparation Batch: BFJ0880 — Sample Size: 10 g (wet)
Prepared: 31-Oct-2017 — Final Volume: 10 g

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Total Solids | | 1 | 0.04 | **14.20** | % | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

**TB**

**17J0506-13 (Water)**

**Volatile Organic Compounds**

Method: EPA 8260C — Sampled: 10/26/2017 00:00

Instrument: NT3 — Analyzed: 02-Nov-2017 13:39

Sample Preparation: Preparation Method: EPA 5030 (Purge and Trap)
Preparation Batch: BFK0044 — Sample Size: 10 mL
Prepared: 02-Nov-2017 — Final Volume: 10 mL

| Analyte | CAS Number | Dilution | Reporting Limit | Result | Units | Notes |
|---|---|---|---|---|---|---|
| Acetone | 67-64-1 | 1 | 5.00 | ND | ug/L | U |
| Benzene | 71-43-2 | 1 | 0.20 | ND | ug/L | U |
| Toluene | 108-88-3 | 1 | 0.20 | ND | ug/L | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | | *80-129 %* | *98.1* | *%* | |
| *Surrogate: Toluene-d8* | | | *80-120 %* | *96.4* | *%* | |

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|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

## Volatile Organic Compounds - Quality Control

### Batch BFK0027 - No Prep - Volatiles

Instrument: NT5 Analyst: PB

| QC Sample/Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BFK0027-BLK1)** | | | | Prepared: 01-Nov-2017 Analyzed: 01-Nov-2017 14:51 | | | | | | |
| Acetone | ND | 5.00 | ug/kg | | | | | | | U |
| Benzene | ND | 1.00 | ug/kg | | | | | | | U |
| Toluene | ND | 1.00 | ug/kg | | | | | | | U |
| *Surrogate: 1,2-Dichloroethane-d4* | | 57.6 | ug/kg | *50.0* | | *115* | *80-149* | | | |
| *Surrogate: Toluene-d8* | | 51.5 | ug/kg | *50.0* | | *103* | *77-120* | | | |
| **LCS (BFK0027-BS1)** | | | | Prepared: 01-Nov-2017 Analyzed: 01-Nov-2017 14:29 | | | | | | |
| Acetone | 246 | | ug/kg | 250 | | 98.5 | 48-137 | | | |
| Benzene | 49.6 | | ug/kg | 50.0 | | 99.2 | 80-120 | | | |
| Toluene | 47.3 | | ug/kg | 50.0 | | 94.6 | 75-120 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | | 57.9 | ug/kg | *50.0* | | *116* | *80-149* | | | |
| *Surrogate: Toluene-d8* | | 50.8 | ug/kg | *50.0* | | *102* | *77-120* | | | |
| **LCS Dup (BFK0027-BSD1)** | | | | Prepared: 01-Nov-2017 Analyzed: 01-Nov-2017 15:29 | | | | | | |
| Acetone | 268 | | ug/kg | 250 | | 107 | 48-137 | 8.35 | 30 | |
| Benzene | 50.2 | | ug/kg | 50.0 | | 100 | 80-120 | 1.24 | 30 | |
| Toluene | 49.3 | | ug/kg | 50.0 | | 98.7 | 75-120 | 4.24 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | | 59.1 | ug/kg | *50.0* | | *118* | *80-149* | | | |
| *Surrogate: Toluene-d8* | | 51.3 | ug/kg | *50.0* | | *103* | *77-120* | | | |
| **Matrix Spike (BFK0027-MS1)** | **Source: 17J0506-06** | | | Prepared: 01-Nov-2017 Analyzed: 01-Nov-2017 23:52 | | | | | | |
| Acetone | 508 | | ug/kg | 250 | 380 | 37.7 | 48-137 | | | * |
| Benzene | 43.0 | | ug/kg | 50.0 | ND | 84.8 | 80-120 | | | |
| Toluene | 42.8 | | ug/kg | 50.0 | 10.3 | 63.3 | 75-120 | | | * |
| *Surrogate: 1,2-Dichloroethane-d4* | | 57.4 | ug/kg | *50.0* | *57.5* | *115* | *80-149* | | | |
| *Surrogate: Toluene-d8* | | 44.4 | ug/kg | *50.0* | *47.3* | *88.7* | *77-120* | | | |
| Recovery limits for target analytes in MS/MSD QC samples are advisory only. | | | | | | | | | | |
| **Matrix Spike Dup (BFK0027-MSD1)** | **Source: 17J0506-06** | | | Prepared: 01-Nov-2017 Analyzed: 02-Nov-2017 00:14 | | | | | | |
| Acetone | 660 | | ug/kg | 250 | 380 | 105 | 48-137 | 26.00 | 30 | |
| Benzene | 39.3 | | ug/kg | 50.0 | ND | 77.4 | 80-120 | 9.10 | 30 | * |
| Toluene | 37.7 | | ug/kg | 50.0 | 10.3 | 54.0 | 75-120 | 12.80 | 30 | * |
| *Surrogate: 1,2-Dichloroethane-d4* | | 60.3 | ug/kg | *50.0* | *57.5* | *121* | *80-149* | | | |
| *Surrogate: Toluene-d8* | | 45.2 | ug/kg | *50.0* | *47.3* | *90.5* | *77-120* | | | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

## Volatile Organic Compounds - Quality Control

### Batch BFK0027 - No Prep - Volatiles

Instrument: NT5 Analyst: PB

| QC Sample/Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Matrix Spike Dup (BFK0027-MSD1)** | **Source: 17J0506-06** | Prepared: 01-Nov-2017 Analyzed: 02-Nov-2017 00:14 | | | | | | | | |

Recovery limits for target analytes in MS/MSD QC samples are advisory only.

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

## Volatile Organic Compounds - Quality Control

### Batch BFK0044 - EPA 5030 (Purge and Trap)

Instrument: NT3 Analyst: PC

| QC Sample/Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BFK0044-BLK1)** | | | | Prepared: 02-Nov-2017 | Analyzed: 02-Nov-2017 12:49 | | | | | |
| Acetone | ND | 5.00 | ug/L | | | | | | | U |
| Benzene | ND | 0.20 | ug/L | | | | | | | U |
| Toluene | ND | 0.20 | ug/L | | | | | | | U |
| *Surrogate: 1,2-Dichloroethane-d4* | 5.01 | | ug/L | *5.00* | | *100* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4.88 | | ug/L | *5.00* | | *97.5* | *80-120* | | | |
| **LCS (BFK0044-BS1)** | | | | Prepared: 02-Nov-2017 | Analyzed: 02-Nov-2017 09:51 | | | | | |
| Acetone | 46.7 | 5.00 | ug/L | 50.0 | | 93.3 | 58-142 | | | |
| Benzene | 9.23 | 0.20 | ug/L | 10.0 | | 92.3 | 80-120 | | | |
| Toluene | 9.16 | 0.20 | ug/L | 10.0 | | 91.6 | 80-120 | | | |
| *Surrogate: 1,2-Dichloroethane-d4* | 4.72 | | ug/L | *5.00* | | *94.4* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4.99 | | ug/L | *5.00* | | *99.8* | *80-120* | | | |
| **LCS Dup (BFK0044-BSD1)** | | | | Prepared: 02-Nov-2017 | Analyzed: 02-Nov-2017 10:17 | | | | | |
| Acetone | 50.4 | 5.00 | ug/L | 50.0 | | 101 | 58-142 | 7.74 | 30 | |
| Benzene | 9.84 | 0.20 | ug/L | 10.0 | | 98.4 | 80-120 | 6.36 | 30 | |
| Toluene | 9.85 | 0.20 | ug/L | 10.0 | | 98.5 | 80-120 | 7.22 | 30 | |
| *Surrogate: 1,2-Dichloroethane-d4* | 4.80 | | ug/L | *5.00* | | *95.9* | *80-129* | | | |
| *Surrogate: Toluene-d8* | 4.98 | | ug/L | *5.00* | | *99.5* | *80-120* | | | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

## Glycols - Quality Control

### Batch BFK0086 - No Prep-Organics

Instrument: FID7 Analyst: ML

| QC Sample/Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BFK0086-BLK1)** | | | | Prepared: 03-Nov-2017 Analyzed: 03-Nov-2017 13:55 | | | | | | |
| Methanol | ND | 10.0 | mg/kg | | | | | | | U |
| *Surrogate: o-Cresol* | 24.9 | | mg/kg | *25.0* | | *99.7* | *30-160* | | | |
| **LCS (BFK0086-BS1)** | | | | Prepared: 03-Nov-2017 Analyzed: 03-Nov-2017 14:28 | | | | | | |
| Methanol | 235 | 10.0 | mg/kg | 250 | | 94.2 | 30-160 | | | |
| *Surrogate: o-Cresol* | 23.8 | | mg/kg | *25.0* | | *95.0* | *30-160* | | | |
| **Matrix Spike (BFK0086-MS1)** | **Source: 17J0506-06** | | | Prepared: 03-Nov-2017 Analyzed: 03-Nov-2017 18:18 | | | | | | |
| Methanol | 123 | 9.4 | mg/kg | 125 | ND | 98.5 | 30-160 | | | |
| *Surrogate: o-Cresol* | 6.78 | | mg/kg | *12.5* | *6.67* | *54.4* | *30-160* | | | |

Recovery limits for target analytes in MS/MSD QC samples are advisory only.

| QC Sample/Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Matrix Spike Dup (BFK0086-MSD1)** | **Source: 17J0506-06** | | | Prepared: 03-Nov-2017 Analyzed: 03-Nov-2017 18:51 | | | | | | |
| Methanol | 126 | 8.8 | mg/kg | 113 | ND | 112 | 30-160 | 2.85 | 30 | |
| *Surrogate: o-Cresol* | 7.18 | | mg/kg | *11.3* | *6.67* | *63.4* | *30-160* | | | |

Recovery limits for target analytes in MS/MSD QC samples are advisory only.

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

## Wet Chemistry - Quality Control

### Batch BFJ0880 - No Prep Wet Chem

Instrument: BAL2 Analyst: KLE

| QC Sample/Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Blank (BFJ0880-BLK1)** | | | Prepared: 31-Oct-2017 Analyzed: 31-Oct-2017 12:36 | | | | | | | |
| Total Solids | ND | 0.04 | % | | | | | | | U |
| **Duplicate (BFJ0880-DUP1)** | **Source: 17J0506-06** | | Prepared: 31-Oct-2017 Analyzed: 31-Oct-2017 12:36 | | | | | | | |
| Total Solids | 17.54 | 0.04 | % | | 17.28 | | | 1.52 | 20 | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

## Wet Chemistry - Quality Control

### Batch BFJ0891 - No Prep Wet Chem

Instrument: Accumet AR60 Analyst: A

| QC Sample/Analyte | Result | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **LCS (BFJ0891-BS1)** | | | | Prepared: 31-Oct-2017 Analyzed: 31-Oct-2017 18:31 | | | | | | |
| pH | 6.99 | 0.01 | pH Units | 7.00 | | 99.9 | 0-200 | | | |
| **Duplicate (BFJ0891-DUP1)** | **Source: 17J0506-06** | | | Prepared: 31-Oct-2017 Analyzed: 31-Oct-2017 18:31 | | | | | | |
| pH | 7.27 | 0.01 | pH Units | | 7.22 | | | 0.69 | 20 | |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

## Certified Analyses included in this Report

| Analyte | Certifications |
|---|---|
| ***EPA 8260C in Water*** | |
| Chloromethane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Vinyl Chloride | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Bromomethane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Chloroethane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Trichlorofluoromethane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Acrolein | DoD-ELAP,NELAP,CALAP,WADOE |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Acetone | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| 1,1-Dichloroethene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Bromoethane | DoD-ELAP,NELAP,CALAP,WADOE |
| Iodomethane | DoD-ELAP,NELAP,CALAP,WADOE |
| Methylene Chloride | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Acrylonitrile | DoD-ELAP,NELAP,CALAP,WADOE |
| Carbon Disulfide | DoD-ELAP,NELAP,CALAP,WADOE |
| trans-1,2-Dichloroethene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Vinyl Acetate | DoD-ELAP,NELAP,CALAP,WADOE |
| 1,1-Dichloroethane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| 2-Butanone | DoD-ELAP,NELAP,CALAP,WADOE |
| 2,2-Dichloropropane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| cis-1,2-Dichloroethene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Chloroform | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Bromochloromethane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| 1,1,1-Trichloroethane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| 1,1-Dichloropropene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Carbon tetrachloride | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| 1,2-Dichloroethane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Benzene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Trichloroethene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| 1,2-Dichloropropane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Bromodichloromethane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Dibromomethane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| 2-Chloroethyl vinyl ether | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| 4-Methyl-2-Pentanone | DoD-ELAP,NELAP,CALAP,WADOE |
| cis-1,3-Dichloropropene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Toluene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |

| | |
|---|---|
| trans-1,3-Dichloropropene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| 2-Hexanone | DoD-ELAP,NELAP,CALAP,WADOE |
| 1,1,2-Trichloroethane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| 1,3-Dichloropropane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Tetrachloroethene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Dibromochloromethane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| 1,2-Dibromoethane | DoD-ELAP,NELAP,CALAP,WADOE |
| Chlorobenzene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Ethylbenzene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| 1,1,1,2-Tetrachloroethane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| m,p-Xylene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| o-Xylene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Styrene | DoD-ELAP,NELAP,CALAP,WADOE |
| Bromoform | DoD-ELAP,NELAP,CALAP,WADOE |
| 1,1,2,2-Tetrachloroethane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| 1,2,3-Trichloropropane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| trans-1,4-Dichloro 2-Butene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| n-Propylbenzene | DoD-ELAP,NELAP,CALAP,WADOE |
| Bromobenzene | DoD-ELAP,NELAP,CALAP,WADOE |
| Isopropyl Benzene | DoD-ELAP,NELAP,CALAP,WADOE |
| 2-Chlorotoluene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| 4-Chlorotoluene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| t-Butylbenzene | DoD-ELAP,NELAP,CALAP,WADOE |
| 1,3,5-Trimethylbenzene | DoD-ELAP,NELAP,CALAP,WADOE |
| 1,2,4-Trimethylbenzene | DoD-ELAP,NELAP,CALAP,WADOE |
| s-Butylbenzene | DoD-ELAP,NELAP,CALAP,WADOE |
| 4-Isopropyl Toluene | DoD-ELAP,NELAP,CALAP,WADOE |
| 1,3-Dichlorobenzene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| 1,4-Dichlorobenzene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| n-Butylbenzene | DoD-ELAP,NELAP,CALAP,WADOE |
| 1,2-Dichlorobenzene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| 1,2-Dibromo-3-chloropropane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| 1,2,4-Trichlorobenzene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Hexachloro-1,3-Butadiene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Naphthalene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| 1,2,3-Trichlorobenzene | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Dichlorodifluoromethane | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| Methyl tert-butyl Ether | DoD-ELAP,ADEC,NELAP,CALAP,WADOE |
| n-Hexane | WADOE |
| 2-Pentanone | WADOE |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

***EPA 9045D in Solid***

pH WADOE,CALAP,DoD-ELAP,NELAP

| Code | Description | Number | Expires |
|---|---|---|---|
| ADEC | Alaska Dept of Environmental Conservation | UST-033 | 09/01/2017 |
| CALAP | California Department of Public Health CAELAP | 2748 | 02/28/2018 |
| DoD-ELAP | DoD-Environmental Laboratory Accreditation Program | 66169 | 02/07/2019 |
| NELAP | ORELAP - Oregon Laboratory Accreditation Program | WA100006 | 05/11/2018 |
| WADOE | WA Dept of Ecology | C558 | 06/30/2018 |
| WA-DW | Ecology - Drinking Water | C558 | 06/30/2018 |

| | | |
|---|---|---|
| Landau Associates, Inc. | Project: Fire Mountain Farms- Burnt Ridge | |
| 130 2nd Avenue S. | Project Number: 066045 | **Reported:** |
| Edmonds WA, 98020 | Project Manager: Ken Reid | 08-Nov-2017 11:33 |

## Notes and Definitions

| | |
|---|---|
| U | This analyte is not detected above the applicable reporting or detection limit. |
| Q | Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20% RSD, <20% drift or minimum RRF) |
| J | Estimated concentration value detected below the reporting limit. |
| E | The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL) |
| D | The reported value is from a dilution |
| * | Flagged value is not within established control limits. |
| DET | Analyte DETECTED |
| ND | Analyte NOT DETECTED at or above the reporting limit |
| NR | Not Reported |
| dry | Sample results reported on a dry weight basis |
| RPD | Relative Percent Difference |
| [2C] | Indicates this result was quantified on the second column on a dual column analysis. |

# Technical Memorandum

**TO:** Kristy Hendrickson, Project Manager

**FROM:** Kristi Schultz and Danille Jorgensen

**DATE:** November 17, 2017

**RE:** **Fire Mountain Farms Burnt Ridge Storage Unit**
**Waste Characterization Sampling**
**Laboratory Data Verification and Validation**

This technical memorandum provides the results of a focused data verification and validation associated with 12 mixed material samples and 1 trip blank collected at the Fire Mountain Farms Burnt Ridge Storage Unit. Samples were analyzed by Analytical Resources, Inc (ARI) located in Tukwila, Washington. This data quality evaluation covers ARI data package 17J0506. Samples submitted to ARI were analyzed for volatile organic compounds ([VOCs]; US Environmental Protection Agency [EPA] Method SW8260C), methanol (EPA Method SW8015), pH (EPA Method 9045D), and total solids (Method SM2540 G-97).

The verification and validation check was conducted with guidance from applicable portions of EPA's *National Functional Guidelines for Organic Data Review* (EPA 2016b) and *National Functional Guidelines for Inorganic Data Review* (EPA 2016a). Landau Associates performed an EPA-equivalent Level IIA verification and validation check on each laboratory data package, which included the following:

- Verification that the laboratory data package contained all necessary documentation (including chain-of-custody records; identification of samples received by the laboratory; date and time of receipt of the samples at the laboratory; sample conditions upon receipt at the laboratory; date and time of sample analysis; explanation of any significant corrective actions taken by the laboratory during the analytical process; and, if applicable, date of extraction, definition of laboratory data qualifiers, all sample-related quality control data, and quality control acceptance criteria).
- Verification that all requested analyses, special cleanups, and special handling methods were performed.
- Verification that quality control samples were analyzed as specified in the project QAPP (LAI 2017a) and the Waste Characterization Plan (LAI 2017b).
- Evaluation of sample holding times.
- Evaluation of quality control data compared to acceptance criteria, including method blanks, surrogate recoveries, matrix spike results, laboratory duplicate and/or replicate results, and laboratory control sample results.
- Evaluation of reporting limits compared to target reporting limits specified in the project QAPP (LAI 2017a) and the Waste Characterization Plan (LAI 2017b).
- Evaluation of overall data quality and completeness of analytical data.

Data validation qualifiers are added to the sample results, as appropriate, based on the verification and validation check. The absence of a data qualifier indicates that the reported result is acceptable without qualification. The data quality evaluation is summarized below. Data qualifiers are summarized in Table 1.

## Chain-of-Custody Records

A signed chain-of-custody (COC) record was attached to the data packages. The laboratory received all samples in good condition. All analyses were performed as requested. No special cleanups or handling methods were requested.

Upon receipt by ARI, the sample container information was compared to the associated chain-of-custody and the cooler temperature was recorded. The cooler was received with a temperature (4.3°C) within the EPA-recommended limit of ≤6°C. No qualification of the data was necessary.

## Holding Times

For all analyses and all samples, the time between sample collection, extraction (if applicable), and analysis was determined to be within EPA- and project-specified holding times. No qualification of the data was necessary.

## Blank Results

### Laboratory Method Blanks

At least one method blank was analyzed with each batch of samples for VOCs and methanol analyses. Target analytes were not detected at concentrations greater than the reporting limits in the associated method blanks. No qualification of the data was necessary.

### Field Trip Blanks

One trip blank was submitted to the laboratory for VOC analysis with the sample batches. Target analytes were not detected at concentrations greater than the reporting limits in the associated trip blank. No qualification of the data was necessary.

## Surrogate Recoveries

Appropriate compounds were used as surrogate spikes for the VOCs and methanol analyses. Recovery values for the surrogate spikes were within the current laboratory-specified control limits. No qualification of the data was necessary.

## Matrix Spike/Matrix Spike Duplicate (MS/MSD) and Laboratory Duplicate Results

At least one matrix spike and/or matrix spike duplicate (MS/MSD) or laboratory duplicate was analyzed with each batch of samples. Recoveries and RPDs for the MS/MSDs and laboratory duplicates were within the current laboratory-specified control limits with the following exceptions:

- The MS or MSD recoveries for acetone and benzene associated with the VOC analysis of sample BR-G-D4 were below the laboratory-specified control limits. The corresponding MS or MSD recoveries were within the laboratory-specified control limits. No qualification of the data was necessary.
- The MS/MSD recoveries for toluene associated with the VOC analysis of sample BR-G-D4 were below the laboratory-specified control limit. The associated sample result was qualified as estimated (J), as indicated in Table 1.

## Laboratory Control Sample and Laboratory Control Sample Duplicate (LCS/LCSD) Results

At least one laboratory control sample and/or laboratory control sample duplicate (LCS/LCSD) was analyzed with each batch of samples. Recoveries and RPDs for the laboratory control samples and associated duplicates were within the current laboratory-specified control limits. No qualification of the data was determined necessary.

## Blind Field Duplicate Results

As specified in the QAPP, blind field duplicate samples were collected at a rate of one blind field duplicate sample per 20 samples per chemical analysis and per facility (not including QC samples), but not less than one blind field duplicate per sampling event. One pair of blind field duplicate mixed material samples (BR-G-Dup1/BR-G-A2) was submitted for analysis with data package 17J0506.

A project-specified control limit of 50 percent was used to evaluate the RPDs between the duplicate samples. RPDs for the duplicate sample pair submitted for analysis were within the project-specified control limits, with the following exception:

- The RPD for acetone associated with the VOC analysis of the field duplicate samples exceeded the project-specified control limit. The associated sample results were qualified as estimated (J), as indicated in Table 1.

## Quantitation Limits

Project-specified quantitation limits were met for all samples.

## Audit/Corrective Action Records

No audits were performed or required. No corrective action records were generated for this sample batch. Based on the laboratory's case narratives, continuing calibration verification (CCV) recovery results were within laboratory-specified control limits. No qualification of the data was necessary.

## Completeness and Overall Data Quality

The completeness for this data set is 100 percent, which meets the project-specified goal of 90 percent minimum.

Data precision was evaluated through field duplicates, laboratory control sample duplicates, matrix spike duplicates, and laboratory duplicates. Data accuracy was evaluated through laboratory control samples, matrix spikes, and surrogate spikes. No data were rejected.

LANDAU ASSOCIATES, INC.

Kristi Schultz
Data Specialist

Danille Jorgensen
Environmental Data Manager

DRJ/kes
[P:\066\045\T\DATA\DV MEMOS\BURNT RIDGE\BURNT RIDGE WASTE CHAR SAMPLING DV MEMO.DOCX]

## References


EPA. 2016a. National Functional Guidelines for Inorganic Superfund Methods Data Review. edited by Office of Superfund Remediation and Technology Innovation (OSRTI). Washington, DC: US Environmental Protection Agency.

EPA. 2016b. National Functional Guidelines for Organic Superfund Methods Data Review. edited by Office of Superfund Remediation and Technology Innovation (OSRTI). Washington, DC: US Environmental Protection Agency.

LAI. 2017a. Quality Assurance Project Plan, Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units, Lewis County, Washington. Edmonds, Washington: Landau Associates, Inc.

LAI. 2017b. Waste Characterization Plan, Fire Mountain Farms Mixed Material Storage Units, Lewis County, Washington. Edmonds, Washington: Landau Associates, Inc.

# Table 1
## Summary of Data Qualifiers
## Fire Mountain Farms Burnt Ridge Storage Unit

| Data Package | Analyte | Result | Qualifier | Sample Number | Reason |
|---|---|---|---|---|---|
| 17J0506 | Acetone | 284 | J | BR-G-A2 | High field duplicate RPD |
| 17J0506 | Acetone | 166 | J | BR-G-Dup1 | High field duplicate RPD |
| 17J0506 | Toluene | 10.3 | J | BR-G-D4 | Low matrix spike/matrix spike duplicate recovery |

J = Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.