

**BNSF** Railway Company

## 2023 Annual Long-Term Monitoring Report

Former Maintenance and Fueling Facility Skykomish, Washington

May 22, 2024

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## Contents

A	crony	ms and Abbreviations	iv
E>	ecuti	ive Summary	1
1	Int	roduction	1
	1.1	Site Description	1
	1.2	Summary of Cleanup Actions	1
	1.3	Cleanup Levels and Remediation Levels	2
	1.4	System Operations, Maintenance and Monitoring	2
2	Gro	oundwater Monitoring Activities	3
	2.1	Groundwater Elevations and Gradient	3
	2.2	Groundwater Analytical Results	4
	2.2	.1 Compliance Monitoring – Levee Zone Monitoring Wells	4
	2.2	.2 Remediation Performance Monitoring – North of Railyard	4
	2.2	.3 Remediation Performance Monitoring – Within the Railyard	5
3	Da	ta Validation and Usability	5
4	Sta	atistical Analysis	6
5	Lo	ng-Term Monitoring Program Optimization, Modification, and Termination	7
6	Co	onclusions	8
7	Re	ferences	9

## **Tables**

Table 1	2023 Groundwater Elevations and LNAPL Thicknesses
Table 2	2023 Stabilized Groundwater Field Parameter Values
Table 3	2023 Groundwater Analytical Results

## **Figures**

Figure 1	Site Plan
Figure 2	March 2023 Potentiometric Surface Map
Figure 3	September 2023 Potentiometric Surface Map
Figure 4	March 2023 Total Petroleum Hydrocarbons in Groundwater
Figure 5	September 2023 Total Petroleum Hydrocarbons in Groundwater

## **Appendices**

- Appendix A Laboratory Analytical Reports
- Appendix B Data Validation Reports
- Appendix C NWTPH-Dx Trend Plots
- Appendix D LNAPL Trend Plots
- Appendix E Statistical Analysis

## **Acronyms and Abbreviations**

95 UCL	95 <sup>th</sup> percentile Upper Confidence Limit
µg/L	microgram per liter
Arcadis	Arcadis U.S., Inc.
BNSF	BNSF Railway Company
CPOC	conditional point of compliance
CUL	cleanup level
DRO	diesel-range organics
Ecology	Washington State Department of Ecology
Farallon	Farallon Consulting, L.L.C.
HCC	hydraulic control and containment
HWF	hot water flushing
LNAPL	light non-aqueous phase liquid
LTM	long-term monitoring
RL	remediation level
Site	Former Maintenance and Fueling Facility in Skykomish, Washington
USEPA	United States Environmental Protection Agency

## **Executive Summary**

This 2023 Annual Long-Term Monitoring Report summarizes groundwater monitoring activities conducted in 2023 at the BNSF Railway Company (BNSF) Former Maintenance and Fueling Facility in Skykomish, Washington (the Site). The Site is being remediated in accordance with the Washington State Department of Ecology (Ecology) October 2007 Consent Decree No. 07-2-33672-9 SEA and Cleanup Action Plan. Site-wide groundwater monitoring was conducted in March and September 2023 in accordance with the November 9, 2020 Final Long-Term Monitoring Plan prepared for the Site by Farallon Consulting, L.L.C. (Farallon).

#### Site Groundwater Criteria

The Site-specific groundwater cleanup level (CUL) established in the 2007 Cleanup Action Plan for total petroleum hydrocarbon concentrations—defined as the sum of total petroleum hydrocarbons as diesel range organics (DRO) and heavy oil (HO) analyzed using Northwest Method NWTPH-Dx (referred to as "combined DRO/HO")—is 208 micrograms per liter ( $\mu$ g/L) and the absence of sheen. The CUL is applicable at the groundwater conditional point of compliance (CPOC), which is defined as the surface water boundary where groundwater enters the Skykomish River and Former Maloney Creek. The CUL was determined to be protective of sediments from being adversely impacted by groundwater. Compliance with the CUL currently is assessed using monitoring wells in the Levee Zone adjacent to the Skykomish River.

The Site-specific groundwater remediation level (RL) for combined DRO/HO is 477 µg/L and absence of sheen. The RL is applicable from the BNSF railyard boundary to the groundwater CPOC, except for the Skykomish School property, and is used to assess groundwater quality in areas of the Site north of the BNSF railyard boundary and outside the Levee Zone. Neither the CUL nor the RL are applicable to the Skykomish School property.

#### Groundwater Monitoring Objectives

Groundwater monitoring is intended to confirm the long-term effectiveness of Site cleanup actions by demonstrating compliance with the Site-specific combined DRO/HO groundwater CUL at the CPOC monitoring wells located within the Levee Zone, and that the Site-specific RL is being met at monitoring wells between the BNSF railyard boundary and the CPOC wells, with the exception of monitoring wells located at the Skykomish School property. Site groundwater monitoring includes the following:

- Collection of groundwater samples for analysis of NWTPH-Dx and assessment of the presence of sheen;
- Collection of Light non-aqueous phase liquid (LNAPL) data (presence and thickness) to characterize the extent of LNAPL at the Site;
- Measurement of groundwater elevations to characterize hydraulic gradients and groundwater flow directions; and
- Statistical analysis of groundwater analytical data to evaluate CUL compliance.

#### 2023 Groundwater Monitoring Results

Groundwater flow direction in 2023 was generally consistent with prior years. South (i.e., upgradient) and north (i.e. downgradient) of the hydraulic control and containment (HCC) system barrier wall, the groundwater flow direction is predominantly toward the west-northwest.

LNAPL was observed in recovery wells upgradient and adjacent to the HCC barrier system barrier wall, between the West Gate and Center Gate, which is consistent with prior years; measured LNAPL observations ranged from www.arcadis.com

a sheen to 0.02-foot thickness. Measured LNAPL thickness have exhibited an overall decreasing trend over the since the cleanup action was implemented.

Combined DRO/HO concentrations in groundwater samples collected from monitoring wells north of the BNSF railyard and outside the Levee Zone were less than the RL, except for the sample collected from HCC system monitoring well 2A-W-41 in September 2023. Combined DRO/HO was detected at 520  $\mu$ g/L, which exceeds the RL in the non-silica gel-prepared groundwater sample collected from monitoring well 2A-W-41 in September 2023. Combined DRO/HO was detected at 520  $\mu$ g/L, which exceeds the RL in the non-silica gel-prepared groundwater sample collected from monitoring well 2A-W-41 in September 2023. Combined DRO/HO was detected at an estimated concentration of 319  $\mu$ g/L, which is less than the RL in the non-silica gel-prepared groundwater sample collected in March 2023.

Combined DRO/HO was detected at an estimated concentration of 630 µg/L, which exceeds the RL, in the nonsilica gel-prepared groundwater sample collected from gate well GW-3 in March 2023. Combined DRO/HO was detected at 259 µg/L, which is less than the RL, in the non-silica gel-prepared groundwater sample collected in September 2023. The combined DRO/HO concentration at gate well GW-4 was 820 µg/L in September 2023. This location was inaccessible during the fourth quarter HCC sampling event due to surface water ponding at the location. This location is intermittently flooded and will be assessed for integrity during the March 2024 monitoring event. Combined DRO/HO concentrations in all silica gel-prepared samples were less than the RL. Biofouling observations have been noted proximate to gate well GW-3 and upgradient of monitoring well 2A-W-41 for nearly 10 years, and results of the analyses performed with and without silica gel cleanup demonstrate that the nonsilica gel-prepared samples are biased high due to biogenic or petroleum metabolite interferences and that breakthrough of groundwater containing combined DRO/HO greater than the RL is not occurring. Groundwater samples collected from gate well GW-3 and monitoring well 2A-W-41 will continue to be analyzed both with and without silica gel cleanup to gain additional perspective on biogenic or petroleum metabolite interference. Additional wells may also be added to this evaluation.

Statistical analysis of the groundwater analytical data was performed to evaluate whether cleanup actions are meeting the objectives established in the Consent Decree and whether modifications to the long-term monitoring program are warranted. The statistical evaluation consisted of calculating the combined DRO/HO concentration 95<sup>th</sup> percentile Upper Confidence Limit and the Mann-Kendall Trend Test for Plume Stability. The statistical evaluation was conducted in accordance with Section 720(9) of Chapter 173-430 of the Washington Administrative Code. Statistical analysis of the analytical results indicates that the cleanup objectives for the Site are being met.

Based on the statistical analysis presented in the 2022 Annual Long-Term Monitoring Report dated March 30, 2023 prepared by Farallon and the 2023 statistical analysis presented herein, groundwater sampling at monitoring wells 1C-W-7 and MW-4 are proposed to be discontinued in 2024 in accordance with the applicable Decision Rules presented in the Final Long-Term Monitoring Plan.

## 1 Introduction

Arcadis U.S., Inc (Arcadis) has prepared this 2023 Annual Long-Term Monitoring Report on behalf of BNSF Railway Company (BNSF) to summarize long-term groundwater monitoring activities conducted in 2023 at the Former Maintenance and Fueling Facility in Skykomish, Washington (the Site; Figure 1). Site-wide groundwater monitoring was conducted in March and September 2023 in accordance with the Final Long-Term Monitoring Plan (Farallon Consulting, L.L.C. [Farallon] 2020).

### 1.1 Site Description

The Site includes BNSF property and private properties in the town of Skykomish, Washington, and encompasses an area of approximately 40 acres (Figure 1). The Site is bounded by the Skykomish River to the north, the town of Skykomish city limits to the east, Old Cascade Highway to the south, and Former Maloney Creek to the west. Railroad Avenue separates the BNSF railyard from the main commercial district of the town of Skykomish (Figure 1). Additional Site history and background information are presented in the Supplemental Remedial Investigation, Volume 1 (The RETEC Group, Inc. 2002); 2007 Cleanup Action Plan (Washington State Department of Ecology [Ecology] 2007a); and 2017 Hot Water Flushing Remediation Performance Report (Farallon 2018).

### 1.2 Summary of Cleanup Actions

In 1991, BNSF initiated a Remedial Investigation/Feasibility Study of the Skykomish railyard in accordance with the Washington State Model Toxics Control Act Cleanup Regulations. From 1993 to 2006, three agreed orders were signed by Ecology and BNSF as summarized in the Final Long-Term Monitoring Plan (Farallon 2020). In October 2007, BNSF and Ecology signed Consent Decree No. 07-2-33672-9 SEA (Ecology 2007b), which finalized the 2007 Cleanup Action Plan (Ecology 2007a). In 2008, BNSF initiated cleanup actions pursuant to the Consent Decree. Cleanup actions consisted of the following activities:

- Excavation of contaminated soil from most of the Town of Skykomish north of the BNSF railyard and areas south and west of the railyard (including moving structures to excavate soil beneath them);
- Excavation of a minimum of 7,500 cubic yards of contaminated soil from the BNSF railyard;
- Operation of an air sparging system north of the northeastern portion of the BNSF railyard;
- Operation of a hydraulic control and containment (HCC) system that included installation of a sheet pile barrier wall with treatment gates separating the BNSF railyard from the Town of Skykomish to the north;
- Operation of recovery wells in the BNSF railyard and around the Skykomish School property to remove LNAPL; and
- Operation of a hot water flushing (HWF) system at the Skykomish School property.

From 2010 to 2020, quarterly or semiannual groundwater monitoring were performed at the Site in accordance with the 2010 Compliance Monitoring Plan (AECOM 2010) with a network of 104 monitoring wells. The Site transitioned to semiannual groundwater monitoring in 2020 with a reduced monitoring well network of 38 wells. As part of implementation of the Final Long-Term Monitoring Plan (Farallon 2020), 25 wells were decommissioned in 2021.

Detailed information about cleanup actions completed under the Consent Decree is presented in applicable asbuilt completion reports, HCC operations reports, HCC optimization reports, HWF operations reports, and groundwater monitoring reports submitted to Ecology from 2006 through 2020.

### 1.3 Cleanup Levels and Remediation Levels

The Site-specific groundwater cleanup level (CUL) established in the 2007 Cleanup Action Plan (Ecology 2007a) for total petroleum hydrocarbon concentrations—defined as the sum of total petroleum hydrocarbons as diesel range organics (DRO) and heavy oil (HO) analyzed using Ecology Method NWTPH-Dx and referred to was "combined DRO/HO" —is 208 micrograms per liter ( $\mu$ g/L) and the absence of sheen. The CUL is applicable at the groundwater conditional point of compliance (CPOC), defined as the surface water boundary where groundwater enters the Skykomish River and Former Maloney Creek. The basis for the CUL is protection of sediments from being adversely impacted by groundwater. Compliance with the CUL currently is assessed using monitoring wells in the Levee Zone adjacent to the Skykomish River (Figure 1). Based on historical groundwater elevation and hydraulic gradient data, groundwater does not flow toward or discharge to Former Maloney Creek (Farallon 2020).

The Site-specific groundwater remediation level (RL) for combined DRO/HO is 477 µg/L and absence of sheen. The RL is applicable from the BNSF railyard boundary to the groundwater CPOC, except for the Skykomish School property, and is used to assess groundwater quality in areas of the Site north of the BNSF railyard boundary and outside the Levee Zone (Figure 1).

Per the Consent Decree (Ecology 2007b), there may be isolated areas outside of the BNSF railyard boundary where the RL cannot be achieved: "Ecology will not require the remediation level be met beneath and down-gradient of such isolated areas" (e.g., the Skykomish School property); however, the CUL must still be met at the CPOC in the Levee Zone (Figure 1). Contingency treatment methods will be employed at the groundwater CPOC if a sheen or combined DRO/HO concentrations exceeding 208  $\mu$ g/L are reported in groundwater samples at the CPOC.

### 1.4 System Operations, Maintenance and Monitoring

The HCC system and monitoring locations used to assess the operation and performance of the HCC system are described in the 2011 Operation and Maintenance Manual for the Hydraulic Control and Containment System (AECOM 2011) and the 2014 Addendum to the Operation and Maintenance Manual for the Hydraulic Control and Containment System (Farallon 2014). The 2023 Addendum to the Operation and Maintenance Manual for the Hydraulic Control and Containment System (Arcadis 2023) is currently in Ecology review. HCC system monitoring locations include 11 HCC system monitoring wells (gate wells GW-1 through GW-4; end wells EW-1 and EW-2A; and monitoring wells 5-W-43, 2A-W-40, 2A-W-41, 1B-W-23, and 2A-W-42), 20 sentry wells, 14 piezometers, and several HCC system gate vaults. HCC system monitoring locations have been monitored in accordance with the 2011 Operation and Maintenance Manual and the 2014 Addendum (AECOM 2011; Farallon 2014) pending 2023 Addendum approval. HCC system monitoring wells, sentry wells, and piezometers were sampled quarterly in March, June, September, and December 2023. On July 18, 2023, the pump-and-treat component of the HCC system was turned off and the system was transitioned into passive mode in accordance with the fourth amendment of the Consent Decree (Ecology 2023). Results of HCC system groundwater monitoring and details on the HCC system transition are provided in the 2023 Annual HCC System Operations Report (Arcadis 2024).

### 2 Groundwater Monitoring Activities

The objective of groundwater monitoring and sampling under the Final Long-Term Monitoring Plan (Farallon 2020) is to confirm the long-term effectiveness of the cleanup actions by demonstrating compliance with the Site-specific combined DRO/HO groundwater CUL at the CPOC monitoring wells located within the Levee Zone, and that the Site-specific RL is being met at monitoring wells between the BNSF railyard boundary and the CPOC wells, with the exception of monitoring wells located at the Skykomish School property (Ecology 2007a).

To meet this objective, the long-term monitoring (LTM) program consists of the following activities:

- Collection of groundwater samples for analysis of NWTPH-Dx and assessment of the presence of sheen to confirm that Site groundwater quality complies with the CUL and the RL at the respective points of compliance (i.e., Levee Zone and areas north of the BNSF railyard boundary, respectively);
- Collection of LNAPL data (presence and thickness) to characterize the extent of LNAPL at the Site;
- Measurement of groundwater elevations to characterize hydraulic gradients and groundwater flow directions at the Site; and
- Statistical analysis of groundwater analytical data to evaluate compliance that the CUL is being met at the CPOC.

Groundwater elevations and LNAPL thicknesses, as well as groundwater quality parameters measured during the 2023 groundwater monitoring events, are summarized in Tables 1 and 2, respectively. Table 3 includes the DRO, HO and combined DRO/HO groundwater analytical results. Groundwater elevation contour maps for the monitoring events are presented on Figures 2 and 3. NWTPH-Dx results and LNAPL thickness (where observed) are presented on Figures 4 and 5.

#### 2.1 Groundwater Elevations and Gradient

Groundwater and LNAPL gauging were conducted at the Site during the March and September events in 2023 in accordance with the Final Long-Term Monitoring Plan (Farallon 2020). During the March and September 2023 events, 38 monitoring locations, including the surface water elevation of the Skykomish River, were gauged. Depth to water measurements were subtracted from the surveyed well top-of-casing elevations (where available) to obtain the groundwater elevation at each monitoring location during the gauging events. When LNAPL was present, a site-specific LNAPL density of 0.974 grams per cubic centimeter was applied to the LNAPL-water interface elevation to correct for the depression of the water table. Depth to groundwater, groundwater elevations, and LNAPL thicknesses are included in Table 1. Groundwater contours and approximate flow direction for the annual monitoring event are presented on Figures 2 and 3. Seasonal groundwater-level fluctuations of 1.34 to 4.45 feet occurred in wells on the southern (i.e., upgradient) side of the HCC system barrier wall. Seasonal groundwater level fluctuations in wells and piezometers on the northern (i.e., downgradient) side of the HCC system barrier wall restricts groundwater flow, generally causing groundwater mounding on the southern side of the barrier wall and accentuating a westerly component to groundwater flow near the wall.

Interpreted hydraulic gradients in 2023 were generally consistent with prior years. South of the HCC system barrier wall, the gradient direction was predominantly toward the northwest. North of the HCC system barrier wall, the gradient direction was predominantly toward the west-northwest, and roughly parallel to the Skykomish River flow direction. Gradient magnitudes on the southern side of the HCC system barrier wall were approximately

0.005 foot per foot. Gradient magnitudes on the northern side of the HCC system barrier wall were approximately 0.006 to 0.008 foot per foot.

#### 2.2 Groundwater Analytical Results

Groundwater sampling was conducted at the Site in March and September 2023 in accordance with the Final Long-Term Monitoring Plan (Farallon 2020) and the groundwater analytical results are summarized in the subsections below. Table 3 includes groundwater analytical results the DRO, HO and combined DRO/HO concentrations. Figures 4 and 5 present the combined DRO/HO results for each groundwater monitoring event. Laboratory analytical reports and data validation reports are included as Appendices A and B, respectively. NWTPH-Dx trend plots are included as Appendix C.

#### 2.2.1 Compliance Monitoring – Levee Zone Monitoring Wells

Levee zone monitoring wells (5-W-14 and 5-W-16 through 5-W-19) were gauged, assessed for the absence of sheen, and sampled for NWTPH-Dx in March and September 2023 to verify compliance with the CUL at the CPOC. DRO and HO were non-detect at all Levee Zone monitoring wells during the March and September 2023 monitoring events. LNAPL or sheen was not observed in any of the Levee Zone monitoring wells.

#### 2.2.2 Remediation Performance Monitoring – North of Railyard

Wells north of the railyard including GW-1 through GW-4, 1B-W-23, 1C-W-4, 1C-W-7, 1C-W-8, 2A-W-40 through 2A-W-42, and 5-W-43 and were gauged, assessed for the absence of sheen, and sampled for NWTPH-Dx in March and September 2023 to demonstrate that the RL is being met north of the BNSF railyard boundary and outside the Levee Zone, and to assess the effectiveness of the HCC system.

Combined DRO/HO concentrations were 630  $\mu$ g/L in GW-3 (estimated concentration; March 2023), 820  $\mu$ g/L in GW-4 (September 2023), and 520  $\mu$ g/L in 2A-W-41 (September 2023), which exceeded the RL of 477  $\mu$ g/L. The March 2023 sample from GW-3 was also analyzed following a silica gel cleanup preparation process, with a reported estimated concentration of 168  $\mu$ g/L. The results at well GW-4 may have been influenced by surface water intrusion as the area is intermittently flooded and the well combined DRO/HO has not historically exceeded the RL in this location. The integrity of this well will be reassessed in March 2024 and any observed deficiencies will be addressed. The March and September 2023 samples from 2A-W-41 were analyzed using silica gel cleanup, with combined DRO/HO estimated concentrations of 119  $\mu$ g/L and 249  $\mu$ g/L, respectively.

Combined DRO/HO was detected at concentrations less than the RL of 477  $\mu$ g/L or was not detected in groundwater samples collected from the remaining nine monitoring wells during the March and September 2023 monitoring events (see Table 3 and Figures 4 and 5).

Monitoring well 2A-W-41 is downgradient of gate well GW-3, which is immediately north and downgradient of the Center Gate, where substantial biofouling by iron bacteria has been observed. DRO and HO concentrations in groundwater at this location has been variable since biofouling was first observed in 2014. Groundwater samples from gate well GW-3 and monitoring well 2A-W-41 were analyzed with and without silica gel cleanup to further assess sample interference. Combined DRO/HO concentrations in all silica gel–prepared samples were less than the RL, and notably less than the combined DRO/HO concentrations in non-silica gel–prepared samples (see Appendix C). The lower combined DRO/HO concentrations reported in the silica gel–prepared samples from gate

well GW-3 and monitoring well 2A-W-41 indicate that reported concentrations in the non-silica gel–prepared samples are biased high due to biogenic interference and that the DRO and HO concentrations reported at gate well GW-3 and monitoring well 2A-W-41 do not indicate that breakthrough of groundwater containing combined DRO/HO greater than the RL is occurring.

Skykomish School monitoring wells 5-W-51, 5-W-55, 5-W-56, and RW-10 were gauged, assessed for the absence of sheen, and sampled (except RW-10) for NWTPH-Dx to assess the effectiveness of the HWF remediation system. Combined DRO/HO was detected at a concentration of 390  $\mu$ g/L (estimated) and 750  $\mu$ g/L (parent sample) / 880  $\mu$ g/L (duplicate sample) in well 5-W-51 during the March and September 2023 monitoring events, respectively. DRO and HO were non-detect in the March and September 2023 samples collected from 5-W-55. Combined DRO/HO concentrations of 4,600  $\mu$ g/L and 2,110  $\mu$ g/L (both estimated values) were recorded in well 5-W-56 during the March and September 2023 monitoring events, respectively.

The combined DRO/HO concentrations detected in 5-W-51 and 5-W-55 are consistent with combined DRO/HO concentrations reported in those wells following completion of HWF activities in 2018. The combined DRO/HO concentrations detected in 5-W-56 have increased compared to combined DRO/HO concentrations reported for the well following completion of HWF activities in 2018. As noted in Section 1.3, the Skykomish School monitoring wells are not required to meet the RL per the Consent Decree.

LNAPL or sheen was not observed in any wells downgradient of the HCC wall, including the Levee Zone or Skykomish School property, in 2023.

#### 2.2.3 Remediation Performance Monitoring – Within the Railyard

Monitoring wells MW-4 and 2A-W-9 were gauged, assessed for sheen, and sampled for DRO and HO to evaluate upgradient groundwater conditions. Combined DRO/HO was detected at an estimated concentration of 570  $\mu$ g/L during the March 2023 monitoring event in the groundwater sample collected from monitoring well 2A-W-9 and concentrations of 300  $\mu$ g/L (estimated) and 390  $\mu$ g/L during the March and September 2023 events in the groundwater samples collected from MW-4. LNAPL or sheen was not observed in monitoring wells MW-4 and 2A-W-9.

The following occurrences of measurable LNAPL were observed in 2023 (Table 1):

- <u>Recovery well RW-07</u>: LNAPL sheen was observed in March 2023. Measurable LNAPL was recorded in September 2023 (0.02 foot). LNAPL thicknesses decreased from March 2022 (0.81 foot); however in October 2022 only a sheen was recorded at RW-07.
- <u>Recovery well RW-08</u>: LNAPL sheen was observed in March 2023. Measurable LNAPL was recorded in September 2023 (0.01 foot). LNAPL thickness decreased from the March 2022 (7.10 feet) and October 2022 (2.12 feet) thicknesses.

LNAPL thickness trend plots for recovery wells that historically contained measurable LNAPL are included as Appendix D.

## 3 Data Validation and Usability

Quality assurance and quality control samples were collected and analyzed for both field and laboratory operations to monitor overall precision and accuracy throughout the groundwater monitoring period in accordance with the Final Long-Term Monitoring Plan (Farallon 2020). Field quality assurance and quality control samples

included field duplicate and field blank samples. Field duplicate samples were collected at a frequency of one duplicate sample per 10 samples, or one duplicate sample per batch of samples if less than 10 samples were collected. Duplicate samples were treated as separate samples from the originals (assigned unique sample numbers) and not identified to the laboratory as duplicate samples. Field duplicate samples were documented on the field sampling form. At least one field blank sample was collected at a frequency of one per 20 samples collected, or one per batch if less than 20 samples were collected. Data validation was conducted in accordance with the following guidance documents:

- United States Environmental Protection Agency (USEPA) Contract Laboratory Program National Functional Guidelines for Organic Superfund Methods Data Review (2020a), with reference to the historical Contract Laboratory Program National Functional Guidelines for Organic Data Review (USEPA 1999), as appropriate.
- USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Methods Data Review (2020b), with reference to the historical Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA 2002), as appropriate.

Quality assurance and quality control sample results are discussed in the data validation reports included as Appendix B. The laboratory quality control criteria were met, unless otherwise noted, and all data were deemed usable. The qualified validated laboratory analytical reports are included as Appendix B.

## 4 Statistical Analysis

The groundwater monitoring data were evaluated against the decision rules provided in Section 7 of the Final Long-Term Monitoring Plan to determine whether the cleanup actions are meeting the objectives established in the Consent Decree, and whether any modifications to the LTM program are warranted (Farallon 2020). The decision rules specify the criteria for continuing, modifying, or terminating the LTM program.

The dataset used for the statistical evaluation included the last 3 years of sampling data for each monitoring location, or the most recent 10 data points for locations with fewer than 10 data points within the last 3 years. To verify compliance with the appropriate target, the data were evaluated to determine whether they met the required three-part statistical test in accordance with Section 720[9] of Chapter 173-340 of the Washington Administrative Code:

- The 95<sup>th</sup> percentile Upper Confidence Limit (95 UCL) on the true mean of the combined DRO/HO concentration from the monitoring point must be less than the groundwater CUL or RL (whichever is applicable at the specific monitoring location);
- Fewer than 10 percent of the samples may exceed the applicable groundwater CUL or RL; and
- No single sample may be greater than two times the applicable groundwater CUL or RL.

U.S. Environmental Protection Agency ProUCL statistical software was used to calculate the combined DRO/HO concentration 95 UCL using the appropriate statistical method (based on the data distribution) for comparison with the monitoring location target (i.e., CUL or RL).

Mann-Kendall Trend Tests for Plume Stability were completed using available historical groundwater monitoring data as summarized in previous long-term monitoring reports. Groundwater monitoring data collected from 2018 through 2023 from monitoring wells that are currently sampled as part of the groundwater monitoring program

were screened for analysis of primary constituent of concern (i.e., NWTPH-Dx) concentration trends. Trends were not evaluated at monitoring locations where any of the following criteria applied:

- Constituent concentrations did not exceed the CUL or RL in the 10 previous data points.
- Greater than 50 percent of the results were below reporting limits.

The Mann-Kendall trend test is a non-parametric test that determines trends based on ranked data; the test is useful where large variations in the magnitude of concentrations may be present and otherwise influence a timeseries trend analysis. The basic Mann-Kendall trend test involves listing the concentrations in temporal order and computing all differences that may be formed between a given measurement and earlier measurements (Gilbert 1987). The test statistic (sum of trend) is the difference between the number of strictly positive differences and the number of strictly negative differences. If there is an underlying upward trend, these differences are typically positive, indicated by a sufficiently large positive value of the test statistic. The p-value of the correlation provides a measure of the level of significance of the statistical test. Correlations were accepted as significant for p-values less than or equal to 0.05 (i.e., 95 UCL). The statistical analysis results are summarized in Table E-1 and E-2 of Appendix E; supporting ProUCL and Mann-Kendall analyses data are also included in Appendix E.

The statistical evaluation confirms that the cleanup objectives for the Levee Zone wells (CUL of 208  $\mu$ g/L) and monitoring wells north of the BNSF railyard and outside of the Levee Zone and Skykomish School property (RL of 477  $\mu$ g/L) are being met, with the exception of monitoring well 2A-W-41 and gate well GW-3, where the results are biased high due to biofouling (Farallon 2023). However, combined DRO/HO concentrations indicate stable (non-statistically significant) trends at wells 2A-W-41 and GW-3. NWTPH-Dx concentrations in all silica gel–prepared samples were less than the RL.

Skykomish School monitoring wells 5-W-51 and 5-W-56, which are not required to meet the RL (see Section 1.3), contain concentrations of DRO and HO that exceed the RL; the concentrations are exhibiting a stable trend at monitoring well 5-W-56 and a statistically significant downward trend at monitoring well 5-W-51 (Appendix E).

## 5 Long-Term Monitoring Program Optimization, Modification, and Termination

The LTM program is intended to be adaptive to changing conditions at the Site. Data are evaluated against the decision rules provided in Section 7.1 of the Final Long-Term Monitoring Plan to determine whether the cleanup actions are meeting the objectives established in the Consent Decree, and whether any modifications to the LTM program are warranted. The decision rules specify the criteria for continuing, modifying, or terminating the LTM program. The decision rules also identify Site conditions that may warrant contingency measures.

Statistical analysis data are used to optimize the LTM program while ensuring that sufficient data are collected to verify that DRO/HO concentrations in groundwater are not endangering potential receptors (e.g., the Skykomish River). The following LTM program optimization recommendations, which are based on the statistical evaluation of data presented in Section 4.0 are presented below:

 Per Section 3.1.2 and Decision Rule 2 in Section 7.1 of the Final Long-Term Monitoring Plan (Farallon 2020), Former Air Sparge Area monitoring well 1C-W-7 remains eligible for removal from the LTM program, as the statistical analysis of NTWPH-Dx results indicates the 95 UCL for combined DRO/HO is less than the RL, spatial coverage of the area around 1C-W-7 is achieved by monitoring well 1C-W-8, and further monitoring of 1C-W-7 would provide redundant information. However, due to the recent Combined DRO/HO detection at GW-4, 1C-W-7 will continue to be monitored in 2024.

Per Section 3.1.2 and Decision Rule 1 in Section 7.1 of the Final Long-Term Monitoring Plan (Farallon 2020), monitoring well MW-4 remains eligible for removal from the LTM program, as the statistical analysis of NWTPH-Dx results indicates that the 95 UCL for combined DRO/HO is less than the RL, and monitoring well MW-4 is not under the influence of an engineering control. Furthermore, the groundwater flow direction at MW-4 is consistently to the northwest toward the BNSF railyard. Therefore, groundwater monitoring at monitoring well MW-4 does not provide data useful for the evaluation of whether cleanup actions are meeting the objectives, and NWTPH-Dx sampling at monitoring well MW-4 should be discontinued and the well decommissioned.

### 6 Conclusions

Groundwater monitoring data indicate that LNAPL thicknesses in decreased in 2023 and concentrations of DRO/HO in groundwater remained generally stable in 2023. DRO and HO were not detected in any of the Levee Zone monitoring wells during the March and September 2023 monitoring events and no LNAPL was observed north (downgradient) of the HCC barrier wall.

LNAPL was observed in monitoring wells and piezometers up-gradient of and adjacent to the HCC system barrier wall, between the West Gate and Center Gate, which is consistent with prior years. LNAPL observations ranged from a sheen to 0.02 foot thick. LNAPL thicknesses have exhibited an overall decreasing trend, with minor variability since LNAPL gauging began in 2012 (Appendix D).

Combined DRO/HO concentrations were below the CUL or RL in all but three locations in 2023 (2A-W-41, GW-3, and GW-4). In wells 2A-W-41 and GW-3, both of which are downgradient of an area of known biofouling and subject to biogenic interferences, the combined DRO/HO concentrations of the silica gel–prepared samples were less than the RL. The detections at well GW-4 may be attributable to surface water intrusion and the integrity of this well will be thoroughly assessed, and remedied as needed, in March 2024. Samples collected from GW-4 will also be analyzed with and without silica gel cleanup in 2024 to further assess the potential for biogenic interference in the sample results.

Statistical analysis of the analytical results indicates that the cleanup objectives for the Site are being met. Additionally, based on the statistical analysis, groundwater sampling at monitoring wells 1C-W-7 and MW-4 may be discontinued in accordance with the applicable Decision Rules presented in the Final Long-Term Monitoring Plan (Farallon 2020). While 1C-W-7 is eligible to be removed from the sampling network based on the Decision Rules presented in the Final Long-Term Monitoring Plan, this monitoring well will continue to be monitored until GW-4 is confirmed to provide continued delineation downgradient of the east gate. It is recommended for LTM program optimization that groundwater sampling at monitoring well MW-4 be discontinued moving forward. As discussed in the 2022 Annual Long-Term Monitoring Report (Farallon 2023), monitoring well MW-4 should be decommissioned.

### 7 References

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## **Tables**

# Table 12023 Groundwater Elevations and LNAPL Thicknesses2023 Annual Long-Term Monitoring ReportBNSF Railway CompanyFormer Maintenance and Fueling Facility, Skykomish, WA

5-W-19

924.35

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Measuring Point Measuring Point LNAPL Groundwater Depth to Elevation Q3 **Elevation Q1 Depth to LNAPL** Elevation Date Groundwater Thickness Zone Location and Q2 and Q4 (ft btoc) (ft btoc) (ft) (ft NAVD88)<sup>2</sup> (ft NAVD88) (ft NAVD88) 3/27/2023 10.85 ---917.39 --GW-1 928.24 --10/17/2023 11.18 917.06 ------3/27/2023 12.85 -----917.44 Gate Wells GW-2 930.29 930.14 9/26/2023 10.57 919.57 ------3/27/2023 14.10 921.72 ------GW-3 935.82 ---920.52 9/25/2023 15.30 -----3/27/2023 10.82 923.86 ------GW-4 934.68 934.58 922.08 9/25/2023 12.50 ------3/27/2023 9.15 923.69 ------RW-01 932.84 936.20 925.32 9/25/2023 10.88 ----3/27/2023 10.25 923.59 ------RW-02 933.84 936.85 922.37 9/25/2023 14.48 ------3/27/2023 10.18 923.62 ---Sheen RW-03 933.80 936.81 924.30 9/26/2023 12.51 Sheen ---3/31/2023 ---923.02 8.84 --RW-04 931.86 934.91 **Recovery Wells** 9/28/2023 ---Sheen Sheen ---3/27/2023 16.78 ------911.75 RW-05 928.53 931.85 9/26/2023 14.14 917.71 -----3/27/2023 16.17 912.36 -----928.53 RW-06 931.55 9/25/2023 13.79 917.76 -----3/31/2023 7.33 925.73 ---Sheen RW-07 933.06 ---9/26/2023 11.45 11.43 0.02 921.63 3/28/2023 7.49 Sheen 924.36 ---RW-08 931.85 --9/26/2023 10.44 10.43 0.01 921.42 3/27/2023  $NM^4$  $NM^4$ ------**RW-09** 933.96 937.01 9/25/2023 10.97 Sheen 926.04 ---3/27/2023 916.65 9.94 ----5-W-14 926.59 ---9/25/2023 10.90 915.69 ----3/27/2023 8.67 916.53 ------Levee Zone Wells 5-W-16 925.20 ---9/25/2023 9.64 ------915.56 916.53 3/27/2023 8.07 ------5-W-17 924.60 --9/25/2023 915.55 9.05 ------3/27/2023 8.09 916.55 -----5-W-18 924.64 ---9/25/2023 9.05 915.59 -----3/27/2023 7.93 ---916.42 ---

				9/25/2023	8.85	 	915.50
<u>s</u>	5-\\/-51	025.08		3/27/2023	7.96	 	917.12
We	5-11-51	920.00		9/25/2023	9.15	 	915.93
erty	5-\\/-55	023.02		3/27/2023	7.52	 	916.40
rop	5-11-55	923.92		9/25/2023	8.10	 	915.82
2 2	5-W-56 024 76	024 76		3/27/2023	6.91	 	917.85
olya	5-11-50	5-10-56 924.76		9/25/2023	8.63	 	916.13
choe	RW-10	RW-10 925.11		3/27/2023	7.52	 	917.59
Ň				9/28/2023	8.86	 	916.25

# Table 12023 Groundwater Elevations and LNAPL Thicknesses2023 Annual Long-Term Monitoring ReportBNSF Railway CompanyFormer Maintenance and Fueling Facility, Skykomish, WA



Zone	Location	Measuring Point Elevation Q1 and Q2 (ft NAVD88) <sup>1</sup>	Measuring Point Elevation Q3 and Q4 (ft NAVD88)	Date	Depth to Groundwater (ft btoc)	Depth to LNAPL (ft btoc)	LNAPL Thickness (ft)	Groundwater Elevation (ft NAVD88) <sup>2</sup>
				3/27/2023	9.47			919.60
	1A-W-4	929.07		9/25/2023	11.00			918.07
				3/31/2023	9.79			924.64
	2A-W-3	934.43		9/26/2023	13.81			920.62
		000 50		3/27/2023	9.00			927.58
	2A-W-9	936.58		9/26/2023	NM <sup>4</sup>			NM <sup>4</sup>
	24.141.40	022.24	022.02	3/27/2023	12.50			920.84
	2A-VV-40	933.34	933.03	9/27/2023	13.41			919.62
	20 10/ 41	025.22	024.00	3/27/2023	17.61			917.61
	27-00-41	955.22	934.90	9/26/2023	18.49			916.41
	24-\\/-42	035 37	935.04	3/27/2023	13.33			922.04
	27-11-42	955.57		9/28/2023	14.22			920.82
	1B-W/-2	035.81		3/27/2023	14.01			921.80
	10-00-2	333.01		9/26/2023	14.70			921.11
	1B-W/-23	936 25	930.39	3/27/2023	15.58			920.67
/ells	10 10 23	330.23	550.55	9/26/2023	16.57			913.82
de V	1C-W-4	932 74		3/27/2023	10.76			921.98
Wig		002.14		9/26/2023	11.95			920.79
Site	1C-W-7	935.04	934 70	3/27/2023	12.70			922.34
			504.70	9/25/2023	14.10			920.60
	1C-W-8	935.70		3/27/2023	13.46			922.24
				9/26/2023	14.80			920.90
	5-W-43	926.18		3/27/2023	8.29			917.89
				9/26/2023	9.60			916.58
	MW-4	936.95		3/27/2023	9.35			927.60
				9/26/2023	13.46			923.49
	MW-11	939.20		3/28/2023	12.98		Sheen	926.22
				9/26/2023	15.99			923.21
	MW-14	936.80		3/27/2023	11.91			924.89
				9/26/2023	Dry			Dry
	MW-47	932.61		3/27/2023	8.48			924.13
				9/25/2023	12.93			919.68
	BRIDGE	943.09		3/27/2023	25.30			917.79
		575.03		9/26/2023	25.68			917.41

Footnotes:

#### 1 000100000

<sup>1</sup> 2015 survey measuring point elevations used for groundwater elevation calculations prior to third quarter of 2023 or if well not resurveyed in 2023.

<sup>2</sup> Survey was performed on October 6, 2023 by Otak, Inc.

<sup>3</sup> Groundwater elevation corrected where LNAPL present. LNAPL density estimated at 0.974 grams per cubic centimeter.

<sup>4</sup> Well inavertandly missed during gauging event.

#### Acronyms and Abbreviations:

-- = not applicable

btoc = below top of casing

DRO = diesel range organics

ft = feet

HO = heavy oil

LNAPL = light non-aqueous phase liquid NAVD 88 = North American Vertical Datum of 1988

NM = not measured

Q1, Q2, Q3, Q4 = first quarter, second quarter, third quarter, fourth quarter

# Table 22023 Stabilized Groundwater Field Parameter Values2023 Annual Long-Term Monitoring ReportBNSF Railway CompanyFormer Maintenance and Fueling Facility, Skykomish, WA



Monitoring Well	Sample Date	Dissolved Oxygen (milligrams per liter)	Oxidation- Reduction Potential (millivolts)	pH (Standard Units)	Specific Conductivity (milliSiemens per centimeter)	Temperature (degrees Celsius)
1 D W 22	3/29/2023	10.71	230.9	6.27	0.106	8.62
10-00-23	9/27/2023	6.08	211.2	6.09	0.090	18.40
1C-W-4	3/28/2023	7.71	94.7	5.87	0.066	6.86
10 W 7	3/29/2023	4.59	232.5	5.77	0.074	8.16
10-00-7	9/27/2023	3.36	179.1	6.08	0.099	12.14
10 W/ 9	3/28/2023	7.60	103.2	6.01	0.066	6.44
10-00-0	9/27/2023	5.13	48.8	6.12	0.235	9.81
20.10/ 40	3/29/2023	9.58	12.8	6.56	0.052	7.69
2A-W-40	9/28/2023	6.96	183.6	6.44	0.057	9.07
20.10/ 41	3/29/2023	4.20	4.2	6.47	0.144	8.41
2A-VV-41	9/28/2023	3.67	26.1	6.35	0.171	10.93
24.14/42	3/30/2023	3.20	45.1	6.07	0.132	7.31
2A-VV-42	9/28/2023	3.40	209.8	5.90	0.116	10.60
2A-W-9	3/29/2023	0.56	95.3	6.29	0.052	8.26
E 10/ 4 4	3/28/2023	5.65	203.0	6.71	0.078	9.21
5-00-14	9/26/2023	6.19	160.2	6.44	0.074	10.44
E.W. 40	3/28/2023	7.59	197.8	6.74	0.073	7.75
5-00-16	9/26/2023	8.06	137.8	6.71	0.061	12.75
E W 47	3/28/2023	5.77	207.0	6.46	0.072	8.55
5-00-17	9/29/2023	6.19	128.8	6.28	0.726	9.22
E W/ 19	3/28/2023	6.31	208.4	6.64	0.066	8.71
5-00-10	9/29/2023	5.89	144.6	6.47	0.094	10.05
E W 10	3/28/2023	7.50	203.6	6.72	0.059	9.12
5-00-19	9/29/2023	6.34	126.0	6.68	0.072	11.21
5 W 43	3/29/2023	5.03	104.7	6.11	0.086	8.04
5-77-43	9/29/2023	0.98	207.7	6.13	0.073	10.63
E W E1	3/29/2023	0.24	219.0	5.81	0.106	8.14
5-00-51	9/29/2023	0.15	48.8	6.22	0.095	11.59
5 W 55	3/28/2023	5.81	29.0	6.40	0.110	8.75
5-11-55	9/28/2023	0.94	140.5	6.28	0.102	14.46
E W EG	3/28/2023	0.19	-163.5	6.27	0.590	10.33
5-00-00	9/28/2023	0.27	-199.3	6.37	0.776	16.56
	3/29/2023	3.22	99.2	6.04	0.087	7.96
	9/28/2023	0.53	196.3	6.01	0.058	8.84
	3/29/2023	6.49	246.4	6.10	0.046	8.10
	9/27/2023	5.20	192.0	5.94	0.062	9.79

# Table 22023 Stabilized Groundwater Field Parameter Values2023 Annual Long-Term Monitoring ReportBNSF Railway CompanyFormer Maintenance and Fueling Facility, Skykomish, WA



Monitoring Well	Sample Date	Dissolved Oxygen (milligrams per liter)	Oxidation- Reduction Potential (millivolts)	рН (Standard Units)	Specific Conductivity (milliSiemens per centimeter)	Temperature (degrees Celsius)
GW-1	3/29/2023	2.50	59.2	6.34	0.117	7.58
300-1	10/17/2023	0.84	-68.8	6.16	0.121	11.48
CW 2	3/29/2023	117.71	-35.9	6.24	0.118	7.61
Gvv-2	9/28/2023	1.02	18.7	6.27	0.119	11.49
CW/ 3	3/29/2023	1.58	-59.7	6.23	0.102	8.67
Gw-3	9/27/2023	2.92	56.4	6.05	0.088	10.85
	3/30/2023	1.84	-47.7	6.61	0.089	7.45
Gvv-4	9/27/2023	3.00	112.4	6.35	0.087	10.09
	3/29/2023	2.28	230.8	5.51	0.070	5.93
10100-4	9/29/2023	0.07	175.8	5.34	0.090	10.64



# Table 32023 Groundwater Analytical Results2023 Annual Long-Term Monitoring ReportBNSF Railway CompanyFormer Maintenance and Fueling Facility, Skykomish, WA

Well	Date	Sample Identification	Sample Type	Diesel Range Organics (µg/L)	Heavy Oil (µg/L)	Combined DRO/HO (µg/L)
		Site-Specific Gro	oundwater (	Cleanup Level		208
	3/28/2023	5-W-14	N	<100 UJ	<100 UJ	16.5 UJ
5-W-14	3/28/2023	DUP-1	FD	<100 UJ	<100 UJ	16.5 UJ
	9/26/2023	5-W-14_092623	N	<100 U	<100 U	16.5 U
E W/ 10	3/28/2023	5-W-16	N	<100 UJ	<100 UJ	16 UJ
01-00-6	9/26/2023	5-W-16_092623	N	<100 U	<100 U	16.5 U
E \\\ 17	3/28/2023	5-W-17	N	<100 UJ	<100 UJ	15.5 UJ
5-00-17	9/29/2023	5-W-17_092923	N	<100 U	<100 U	16.5 U
E W/ 19	3/28/2023	5-W-18	N	<100 UJ	<100 UJ	16.5 UJ
01-00-C	9/29/2023	5-W-18_092923	N	<100 U	<100 U	16.5 U
E W/ 10	3/28/2023	5-W-19	N	<100 UJ	<100 UJ	16.5 UJ
5-00-19	9/29/2023	5-W-19_092923	N	<100 U	<100 U	16.5 U
		Site-Specific Grou	ndwater Re	mediation Level		477
4D W/ 00	3/29/2023	1B-W-23	N	<100 UJ	<100 UJ	16.5 UJ
1B-W-23	9/27/2023	1B-W-23_092723	N	<100 U	<100 U	16.5 U
1C-W-4	3/28/2023	1C-W-4	N	100 J	<100 UJ	109 J
	3/29/2023	1C-W-7	N	100 J	<100 UJ	109 J
10-00-7	9/27/2023	1C-W-7_092723	N	120	<100 U	129
10 10 0	3/28/2023	1C-W-8	N	<100 UJ	<100 UJ	15.5 UJ
10-00-8	9/27/2023	1C-W-8_092723	N	<100 U	<100 U	17.5 U
	3/29/2023	2-A-W-40	N	<100 UJ	280 J	288 J
2A-W-40	3/29/2023	DUP-2	FD	<100 UJ	330 J	338 J
	9/28/2023	2A-W-40_092823	N	<100 U	<100 U	16.5 U
20 10/ 41	3/29/2023	2A-W-41	N	310 J [110 J]	<100 UJ [<100 UJ]	319 J [119 J]
2A-W-41	9/28/2023	2A-W-41_092823	N	400 [240 J]	<b>120</b> [<100 U]	520 [249 J]
20 10/ 42	3/30/2023	2A-W-42	N	<100 UJ	<100 UJ	16.5 UJ
2A-W-42	9/28/2023	2A-W-42_092823	N	120	<100 U	129
	3/29/2023	5-W-43	N	<100 UJ	<100 UJ	15.5 UJ
5-W-43	9/29/2023	5-W-43_092923	N	<100 U	<100 U	17.5 U
	9/29/2023	FD-4_092923	FD	<100 U	<100 U	16.5 U
	3/29/2023	GW-1	N	<100 UJ	<100 UJ	15.5 UJ
GW-1	10/17/2023	GW-1_101723	N	150	110	260
	10/17/2023	DUP-1_101723	FD	140	130	270
G\M_2	3/29/2023	GW-2	N	<100 UJ	<100 UJ	15.5 UJ
<u> </u>	9/28/2023	GW-2_092823	N	<100 U	<100 U	16.5 U
C\M_2	3/29/2023	GW-3	N	490 J [160 J]	<b>140 J</b> [<100 UJ]	630 J [168 J]
000-0	9/27/2023	GW-3_092723	N	250 [110]	<100 U [<100 U]	259 [119]
GW 4	3/30/2023	GW-4	N	<100 UJ	<100 UJ	16 UJ
Gvv-4	9/27/2023	GW-4_092723	N	130	690	820

# Table 32023 Groundwater Analytical Results2023 Annual Long-Term Monitoring ReportBNSF Railway CompanyFormer Maintenance and Fueling Facility, Skykomish, WA



Well	Date	Sample Identification	Sample Type	Diesel Range Organics (μg/L)	Heavy Oil (µg/L)	Combined DRO/HO (µg/L)						
No Target Remediation or Cleanup Level												
2A-W-9	3/29/2023	2A-W-9	N	350 J	220 J	570 J						
	3/29/2023	5-W-51	Ν	270 J	120 J	390 J						
5-W-51	9/29/2023	5-W-51_092923	N	530	220	750						
	9/29/2023	FD-3_092923	FD	590	290	880						
E \\/ EE	3/28/2023	5-W-55	Ν	<100 UJ	<100 UJ	16.5 UJ						
5-00-55	9/28/2023	5-W-55_092823	Ν	<100 U	<100 U	16.5 U						
E \\\ 66	3/28/2023	5-W-56	N	2,800 J	1,800 J	4,600 J						
5-00-50	9/28/2023	5-W-56_092823	N	1,400	710	2,110						
M\\\/_4	3/29/2023	MW-4	N	140 J	160 J	300 J						
10100-4	9/29/2023	MW-4_092923	N	290	100	390						

#### Notes:

1. Results in **bold** font indicate the compound was detected at a concentration greater than the laboratory reporting limit.

2. Results in **bold** font and shaded gray indicate the compound was detected at a concentration greater than the Site-specific remediation level. The remediation level is not applicable to vaults in the barrier wall treatment gates.

3. Analyzed by Northwest Method NWTPH-Dx without silica gel cleanup, unless otherwise noted.

4. Calculated NWTPH-Dx is the sum of diesel range organics and heavy oil, using half the method detection limit for non-detect results.

#### Acronyms and Abbreviations:

-- = not applicable

< = Denotes analyte not reported as detected at or exceeding the listed laboratory reporting limit.

[] = Sample analyzed by Northwest Method NWTPH-Dx with silica gel cleanup.

 $\mu g/L = microgram per liter$ 

FD = field duplicate

N = parent sample

#### **Data Qualifiers:**

J = compound was positively identified and the associated numerical value is an estimate

U = compound was analyzed for but not detected and the associated value is the compound quantitation limit

UJ = compound was not detected above the reported sample quantitation limit and the reported limit is approximate





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Laboratory Analytical Reports



April 12, 2023

Mr. Kyle Haslam Arcadis U.S., Inc. 1100 Olive Way, Suite 800 Seattle, WA 98101

Dear Mr. Haslam,

On March 31st, 49 samples were received by our laboratory and assigned our laboratory project number EV23040003. The project was identified as your BNSF Skykomish. The sample identification and requested analyses are outlined on the attached chain of custody record.

No abnormalities or nonconformances were observed during the analyses of the project samples.

Please do not hesitate to call me if you have any questions or if I can be of further assistance.

Sincerely,

**ALS Laboratory Group** 

Rob Greer Laboratory Director

Page 1
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#### CERTIFICATE OF ANALYSIS

CLIENT: Arcadis U.S., Inc. 1100 Olive Way, Suite 800 Seattle, WA 98101			DATE: 4/12/2023 ALS JOB#: EV23040003 ALS SAMPLE#: EV23040003-01					
CLIENT CONTACT: Kyle Haslam CLIENT PROJECT: BNSF Skykomish			DATE RECEIVED: 03/31/2023 COLLECTION DATE: 3/28/2023 9:45:00 AM				M	
CLIENT SAMPLE ID	1C-W-8		WDOE AC	CCREDITATION:	C601			
		SAMPLE	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS / DATE	ANALYSI: BY	5
TPH-Diesel Range	NWTPH-DX	U	100	1	UG/L	04/07/2023	DHM	
TPH-Oil Range	NWTPH-DX	U	100	1	UG/L	04/07/2023	DHM	
								S
SURROGATE	METHOD	%REC				DATE	DI	
C25	NWTPH-DX	103				04/07/2023	DHM	

U - Analyte analyzed for but not detected at level above reporting limit.

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		CERTIFIC	ATE OF ANALYSIS						
CLIENT: Arcadis U.S., Inc. 1100 Olive Way, Suite 800 Seattle, WA 98101				DATE: 4/12/2023 ALS JOB#: EV23040003 ALS SAMPLE#: EV23040003-02					
CLIENT CONTACT: CLIENT PROJECT:	D/ COLI	DATE RECEIVED: 03/31/2023 COLLECTION DATE: 3/28/2023 9:50:00 AM							
CLIENT SAMPLE ID	5-W-17		WDOE AC	CREDITATION:	C601				
		SAMPLE	DATA RESULTS						
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range	NWTPH-DX	U	100	1	UG/L	04/07/2023	DHM		
TPH-Oil Range	NWTPH-DX	U	100	1	UG/L	04/07/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25	NWTPH-DX	116				04/07/2023	DHM		

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		CERTIFIC	ATE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:			4/12/2023 EV23040003 EV23040003-03		
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish		D/ COLI	DATE RECEIVED: COLLECTION DATE:		03/31/2023 3/28/2023 11:15:00 AM			
CLIENT SAMPLE ID	5-W-16 WDOE ACCREDITAT			CREDITATION:	C601				
		SAMPLE	DATA RESULTS						
		RESULTS	REPORTING LIMITS		UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Dieser Range TPH-Oil Range	NWTPH-DX NWTPH-DX	U	100	1	UG/L	04/07/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25	NWTPH-DX	100				04/07/2023	DHM		

U - Analyte analyzed for but not detected at level above reporting limit.

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		CERTIFIC	ATE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:			4/12/2023 EV23040003 EV23040003-04		
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish 5-W-55		D/ COLI WDOE AC	DATE RECEIVED: COLLECTION DATE: WDOF ACCREDITATION			03/31/2023 3/28/2023 4:10:00 PM C601		
		SAMPLE	DATA RESULTS						
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range	NWTPH-DX	U	100	1	UG/L	04/07/2023	DHM		
TPH-Oil Range	NWTPH-DX	U	100	1	UG/L	04/07/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25	NWTPH-DX	108				04/07/2023	DHM		

U - Analyte analyzed for but not detected at level above reporting limit..

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800	DATE: 4/12/2023 ALS JOB#: EV2304000 ALS SAMPLE#: EV2304000			4/12/2023 EV23040003 EV23040003-05	
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish 1C-W-4		DA COLL WDOE AC	ATE RECEIVED: LECTION DATE: CREDITATION:	03/31/20 3/28/202 C601	)23 23 11:00:00	AM
		SAMPLE	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	100	100	1	UG/L	04/07/2023	DHM
TPH-Oil Range	NWTPH-DX	U	100	1	UG/L	04/07/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	104				04/07/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit. Chromatogram indicates that it is likely that sample contains an unidentified diesel range product.

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 9810	Guite 800		DATE: ALS JOB#: ALS SAMPLF#:				
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish 5-W-56		D/ COLI WDOE AC	ATE RECEIVED: LECTION DATE: CCREDITATION:	03/31/20 3/28/202 C601	03/31/2023 3/28/2023 4:05:00 PM C601		
		SAMPLE	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	2800	500	5	UG/L	04/09/2023	DHM	
TPH-Oil Range	NWTPH-DX	1800	500	5	UG/L	04/09/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 5X Dilution	NWTPH-DX	87.6				04/09/2023	DHM	

Chromatogram indicates that it is likely that sample contains an unidentified diesel range product and an unidentified oil range product.

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/20 ALS JOB#: EV230 ALS SAMPLE#: EV230			
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish		D/ COLI	ATE RECEIVED: LECTION DATE:	03/31/20 3/28/202	EV23040003-07 03/31/2023 3/28/2023 12:40:00 PM C601 ANALYSIS ANAL	
CLIENT SAMPLE ID	5-W-14		WDOE AC	CREDITATION:	C601		
		SAMPLE	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	99.6				04/08/2023	DHM

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		CERTIFIC	ATE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2 ALS JOB#: EV23 ALS SAMPLE#: EV23			'12/2023 V23040003 V23040003-08		
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish 5-W-19		D/ COLI WDOF AC	ATE RECEIVED: LECTION DATE:	03/31/20 3/28/202 C601	03/31/2023 3/28/2023 2:08:00 PM C601			
	0 11 10	SAMPLE	DATA RESULTS		0001				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM		
TPH-Oil Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25	NWTPH-DX	109				04/08/2023	DHM		

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/20 ALS JOB#: EV2304 ALS SAMPLE#: EV2304			
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/28/202	03/31/2023 3/28/2023 3:10:00 PM C601	
CLIENT SAMPLE ID	5-VV-18	SAMPLE	WDOE AC	CREDITATION:	C601		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	106				04/08/2023	DHM

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4 ALS JOB#: E ALS SAMPLE#: E			
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/28/202	03/31/2023 3/28/2023 2601	
CLIENT SAMPLE ID	DUP-1	SAMPLE	E DATA RESULTS	CREDITATION:	C601		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	107				04/08/2023	DHM

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/20 ALS JOB#: EV2304 ALS SAMPLE#: EV2304			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish EW-2A		D/ COLI WDOE AC	ATE RECEIVED: ECTION DATE: CREDITATION:	03/31/20 3/29/202 C601	)23 23 5:02:00 I	ЪМ
		SAMPLE	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range		U	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC	100		UCIL	ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	150 SUR01				04/08/2023	DHM

SUR01 -One or more surrogate recoveries were above the upper control limits. The sample results may be biased high. U - Analyte analyzed for but not detected at level above reporting limit.

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 9810	uite 800		DATE: 4/12/2023 ALS JOB#: EV23040003 ALS SAMPLE#: EV23040003 DATE RECEIVED: 02/21/2023			
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish MW-4			ATE RECEIVED: LECTION DATE:	03/31/20 3/29/202	)23 23 10:15:00	AM
CLIENT SAMPLE ID	10100-4	SAMPLE	E DATA RESULTS	CREDITATION.	001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	140 160	100 100	1 1	UG/L UG/L	04/08/2023 04/08/2023	DHM DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	105				04/08/2023	DHM

Chromatogram indicates that it is likely that sample contains an unidentified diesel range product and light oil. Diesel range product results biased high due to oil range product overlap.

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12 ALS JOB#: EV2 ALS SAMPLE#: EV2				
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20	03/31/2023 3/29/2023 12:20:00 PM C601		
CLIENT SAMPLE ID	EVV-1	SAMPLE	E DATA RESULTS	CREDITATION:	C601			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM	
TPH-Oil Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	110				04/08/2023	DHM	

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/20 ALS JOB#: EV2304 ALS SAMPLE#: EV2304			
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish		D/ COLI	ATE RECEIVED: LECTION DATE:	03/31/20 3/29/202	EV23040003-14 03/31/2023 3/29/2023 12:50:00 PM C601 ANALYSIS ANA	
CLIENT SAMPLE ID	5-W-43		WDOE AC	CREDITATION:	C601		
		SAMPLE	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	111				04/08/2023	DHM

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		CERTIFIC	ATE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/ ALS JOB#: EV23 ALS SAMPLE#: EV23			I/12/2023 EV23040003 EV23040003-15		
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish 2-A-W-40		D/ COLI WDOE AC	ATE RECEIVED: LECTION DATE: CCREDITATION:	03/31/20 3/29/202 C601	03/31/2023 3/29/2023 2:45:00 PM C601			
		SAMPLE	DATA RESULTS						
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	U 280	100 100	1	UG/L UG/L	04/08/2023 04/08/2023	DHM DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25	NWTPH-DX	106				04/08/2023	DHM		

U - Analyte analyzed for but not detected at level above reporting limit. Chromatogram indicates that it is likely that sample contains weathered lube oil.

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2 ALS JOB#: EV230 ALS SAMPLE#: EV230			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish GW-1			TE RECEIVED: ECTION DATE:	03/31/20 3/29/202 C601	)23 23 12:10:00	PM
	6001	SAMPLE	DATA RESULTS	OREDITATION.	0001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	U U	100 100	1 1	UG/L UG/L	04/08/2023 04/08/2023	DHM DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	161 SUR01				04/08/2023	DHM

SUR01 -One or more surrogate recoveries were above the upper control limits. The sample results may be biased high.

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, Su Seattle, WA 98101	ite 800		DATE: ALS JOB#: ALS SAMPLE#:	4/12/202 EV2304 EV2304	/12/2023 V23040003 V23040003-17 3/31/2023 /29/2023 5:00:00 PM 601 ANALYSIS ANAL UNITS DATE B UG/L 04/09/2023 DH UG/L 04/08/2023 DH UG/L 04/08/2023 DH		
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			TE RECEIVED: ECTION DATE:	03/31/20 3/29/202	023 23 5:00:00 I	PM	
CLIENT SAMPLE ID	GVV-3	SAMDLE		CREDITATION:	C601			
		RESULTS	REPORTING LIMITS		UNITS	ANALYSIS DATE		
TPH-Oil Range	NWTPH-DX w/ SGA	U	100	1	UG/L	04/09/2023	DHM	
TPH-Diesel Range	NWTPH-DX	490	100	1	UG/L	04/08/2023	DHM	
TPH-Oil Range	NWTPH-DX	140	100	1	UG/L	04/08/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX w/ SGA	105				04/09/2023	DHM	
C25	NWTPH-DX	106				04/08/2023	DHM	

U - Analyte analyzed for but not detected at level above reporting limit. Chromatogram indicates that it is likely that sample contains highly weathered diesel and an unidentified oil range product.

Oil range product results biased high due to diesel range product overlap.

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		4/12/2023 EV23040003 EV23040003-18			
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish		D/ COLI	ATE RECEIVED: LECTION DATE:	03/31/20 3/29/202	)23 23 1:45:00 F	РΜ
CLIENT SAMPLE ID	GW-2			CREDITATION:	C601		
		SAMPLE	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range		U	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC	100	1	UG/L	04/08/2023 ANALYSIS DATE	

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:	4/12/202 EV2304 EV2304	23 0003 0003-19		
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/29/202	03/31/2023 3/29/2023 1:00:00 PM C601		
CLIENT SAMPLE ID	500-51	SAMPLE		CREDITATION.	001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	270 120	100 100	1	UG/L UG/L	04/08/2023 04/08/2023	DHM DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	95.7				04/08/2023	DHM	

Chromatogram indicates that it is likely that sample contains highly weathered an unidentified diesel range product and an unidentified oil range product.

Oil range product results biased high due to diesel range product overlap.

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	CERTIFIC	ATE OF ANALYSIS					
Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800	DATE: 4/12/2 ALS JOB#: EV230 ALS SAMPLE#: EV230			2/2023 23040003 23040003-20		
Kyle Haslam BNSF Skykomish 1B-W-23		D/ COLI WDOE AC	ATE RECEIVED: LECTION DATE:	03/31/20 3/29/202 C601	03/31/2023 3/29/2023 3:35:00 PM C601		
10 10 20	SAMPLE	DATA RESULTS	OREDITATION.	0001			
METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
	U	100	1	UG/L	04/08/2023	DHM	
METHOD NWTPH-DX	%REC 95.1	100	I	0G/L	04/08/2023 ANALYSIS DATE 04/08/2023		
	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101 Kyle Haslam BNSF Skykomish 1B-W-23 METHOD NWTPH-DX NWTPH-DX NWTPH-DX	CERTIFIC         Arcadis U.S., Inc.         1100 Olive Way, Suite 800         Seattle, WA 98101         Kyle Haslam         BNSF Skykomish         1B-W-23         SAMPLE         METHOD       RESULTS         NWTPH-DX       U         NWTPH-DX       U         METHOD       %REC         NWTPH-DX       95.1	CERTIFICATE OF ANALYSISArcadis U.S., Inc.1100 Olive Way, Suite 800Seattle, WA 98101Kyle HaslamBNSF SkykomishCOLL1B-W-23WDOE ACSAMPLE DATA RESULTSREPORTING LIMITSMETHODNWTPH-DXU100NWTPH-DXVMETHOD%RECNWTPH-DX95.1	CERTIFICATE OF ANALYSISArcadis U.S., Inc.DATE:1100 Olive Way, Suite 800ALS JOB#:Seattle, WA 98101ALS SAMPLE#:Kyle HaslamDATE RECEIVED:BNSF SkykomishCOLLECTION DATE:1B-W-23WDOE ACCREDITATION:SAMPLE DATA RESULTSMETHOD RESULTSMETHOD%RECNWTPH-DXU1001METHOD%RECNWTPH-DX95.1	CERTIFICATE OF ANALYSIS         Arcadis U.S., Inc.       DATE:       4/12/202         1100 Olive Way, Suite 800       ALS JOB#:       EV2304         Seattle, WA 98101       ALS SAMPLE#:       EV2304         Seattle, WA 98101       ALS SAMPLE#:       EV2304         Kyle Haslam       DATE RECEIVED:       03/31/20         BNSF Skykomish       COLLECTION DATE:       3/29/202         1B-W-23       WDOE ACCREDITATION:       C601         REPORTING DILUTION PACE         NWTPH-DX       U       100       1       UG/L         NWTPH-DX       U       100       1       UG/L         NWTPH-DX       U       100       1       UG/L         METHOD       %REC       NWTPH-DX       U       100       1       UG/L         NWTPH-DX       95.1       95.1       1       1       1       1	CERTIFICATE OF ANALYSIS         Arcadis U.S., Inc.       DATE:       4/12/2023         1100 Olive Way, Suite 800       ALS JOB#:       EV2304003         Seattle, WA 98101       ALS SAMPLE#:       EV23040003-20         Kyle Haslam       DATE RECEIVED:       03/31/2023         BNSF Skykomish       COLLECTION DATE:       3/29/2023         1B-W-23       WDOE ACCREDITATION:       C601         THOD         RESULTS         METHOD       RESULTS         NWTPH-DX       U       100       1       UG/L       04/08/2023         NWTPH-DX       95.1       04/08/2023       04/08/2023	

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:	4/12/202 EV2304 EV2304	23 0003 0003-21	
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish 2A-W-9			ATE RECEIVED: LECTION DATE:	03/31/20 3/29/202	)23 23 11:55:00	AM
CLIENT SAMPLE ID	2R-W-9	SAMPLE		CREDITATION.	001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	350 220	100 100	1 1	UG/L UG/L	04/08/2023 04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	91.9				04/08/2023	DHM

Chromatogram indicates that it is likely that sample contains highly weathered diesel and lube oil.

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:	4/12/202 EV2304 EV2304	23 0003 0003-22	
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish 1C-W-7		DA COLI WDOE AC	ATE RECEIVED: LECTION DATE: CCREDITATION:	03/31/20 3/29/202 C601	PM	
		SAMPLE	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	<b>100</b> U	100 100	1	UG/L UG/L	04/08/2023 04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	89.9				04/08/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit. Chromatogram indicates that it is likely that sample contains an unidentified diesel range product.

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, Su Seattle, WA 98101	ite 800		DATE: ALS JOB#: ALS SAMPLE#:	4/12/202 EV2304 EV2304	4/12/2023 EV23040003 EV23040003-23 03/31/2023 3/29/2023 4:00:00 PM C601 UNITS UG/L 04/09/2023 DF UG/L 04/09/2023 DF UG/L 04/09/2023 DF		
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish 2A-W-41			ATE RECEIVED: LECTION DATE:	03/31/20 3/29/202 C601	)23 23 4:00:00 F	РМ	
	2/1-11-41	SAMPLE		CREDITATION.	0001			
ANALYTE TPH-Diesel Range	<b>METHOD</b> NWTPH-DX w/ SGA	RESULTS	REPORTING LIMITS 100	DILUTION FACTOR	UNITS UG/L	ANALYSIS DATE 04/09/2023	ANALYSIS BY DHM	
TPH-Oil Range	NWTPH-DX w/ SGA	U	100	1	UG/L	04/09/2023	DHM	
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	310 U	100	1	UG/L UG/L	04/08/2023 04/08/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 C25	NWTPH-DX w/ SGA NWTPH-DX	91.1 92.9				04/09/2023 04/08/2023	DHM DHM	

U - Analyte analyzed for but not detected at level above reporting limit. Chromatogram indicates that it is likely that sample contains highly weathered diesel.

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12 ALS JOB#: EV2 ALS SAMPLE#: EV2				
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish GW-4		D/ COLI W/DOE AC	ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202 C601	03/31/2023 3/30/2023 5:50:00 PN C601		
	011-4	SAMPLE	DATA RESULTS	DOREDITATION.	0001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	UU	100 100	1	UG/L UG/L	04/08/2023 04/08/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	92.1				04/08/2023	DHM	

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/20 ALS JOB#: EV2304 ALS SAMPLE#: EV2304				
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish S3-CD		D/ COLI WIDOE AC	ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	03/31/2023 3/30/2023 2:49:00 PM C601		
	00-00	SAMPLE	DATA RESULTS	DOREDITATION.	0001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	U U	100 100	1 1	UG/L UG/L	04/08/2023 04/08/2023	DHM DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	88.6				04/08/2023	DHM	

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800	DATE: 4/12/2 ALS JOB#: EV23 ALS SAMPLE#: EV23			2/2023 23040003 23040003-26	
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish		D/ COLI	ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	)23 23 4:55:00	PM
CLIENT SAMPLE ID	S4-CD	SAMPLE	WDOE AC	CREDITATION:	C601		
ANALYTE	METHOD	RESULTS	REPORTING	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	90.9				04/08/2023	DHM

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		CERTIFIC	ATE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	Guite 800		DATE: 4, ALS JOB#: E ALS SAMPL F# <sup>:</sup> F			4/12/2023 EV23040003 EV23040003-27		
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	PM			
CLIENT SAMPLE ID	54-AD	SAMPLE		CREDITATION.	001				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	U U	100 100	1 1	UG/L UG/L	04/08/2023 04/08/2023	DHM DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25	NWTPH-DX	94.2				04/08/2023	DHM		

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800	DATE: 4/12/20 ALS JOB#: EV230 ALS SAMPLE#: EV230			′2023 3040003 3040003-28		
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish		D/ COLI	ATE RECEIVED: LECTION DATE:	03/31/20 3/29/202	03/31/2023 3/29/2023 4:24:00 PM C601		
CLIENT SAMPLE ID	S4-BD		WDOE AC	CREDITATION:	C601			
		SAMPLE	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM	
TPH-Oil Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	95.2				04/08/2023	DHM	

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/20 ALS JOB#: EV230 ALS SAMPLE#: EV230			
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			TE RECEIVED: LECTION DATE:	03/31/20 3/30/202	03/31/2023 3/30/2023 1:16:00 PM 2601	
CLIENT SAMPLE ID	53-AD	SAMPLE		CREDITATION.	001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	91.4				04/08/2023	DHM

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2 ALS JOB#: EV23( ALS SAMPLE#: EV23)			
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20	)23 23 12:05:00	PM
CLIENT SAMPLE ID	S1-BU	SAMPLE	E DATA RESULTS	CREDITATION:	C601		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	94.0				04/08/2023	DHM

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		CERTIFIC	ATE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4, ALS JOB#: E ALS SAMPLE#: E			4/12/2023 EV23040003 EV23040003-31		
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish		D/ COLI	ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	03/31/2023 3/30/2023 3:50:00 PM 0601			
CLIENT SAMPLE ID	S4-AU		WDOE AC	CREDITATION:	C601				
		SAMPLE	DATA RESULTS						
		RESULTS	REPORTING LIMITS		UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Dieser Range TPH-Oil Range	NWTPH-DX NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25	NWTPH-DX	80.4				04/08/2023	DHM		

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	Guite 800		DATE: 4/12 ALS JOB#: EV2 ALS SAMPLE#: EV2				
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	03/31/2023 3/30/2023 12:35:00 PM C601		
CLIENT SAMPLE ID	31-AU	SAMPLE		CREDITATION.	001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	U U	100 100	1 1	UG/L UG/L	04/08/2023 04/08/2023	DHM DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	92.7				04/08/2023	DHM	

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/20 ALS JOB#: EV230 ALS SAMPLE#: EV230			
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish		D/ COLI	ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	23040003-33 )3/31/2023 3/30/2023 1:55:00 PM 2601 ANALYSIS ANAL	
CLIENT SAMPLE ID	S3-BD	SAMPLE	WDOE AC	CREDITATION:	C601		
ANALYTE	METHOD	RESULTS	REPORTING	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	95.3				04/08/2023	DHM

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2023 ALS JOB#: EV23040003 ALS SAMPLE#: EV23040003-			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish S4-CU		DA COLL WDOE AC	ATE RECEIVED: LECTION DATE: CREDITATION:	03/31/20 3/30/202 C601	)23 23 5:00:00 F	РМ
		SAMPLE	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS		ANALYSIS BY
TPH-Diesei Range TPH-Oil Range	NWTPH-DX NWTPH-DX	1 <b>30</b> U	100	1	UG/L UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	93.0				04/08/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit. Chromatogram indicates that it is likely that sample contains an unidentified diesel range product.

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/ ALS JOB#: EV23 ALS SAMPLE#: EV23				
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish S3-CU		D/ COLI WDOF AC	ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202 C601	03/31/2023 3/30/2023 2:48:00 PM C601		
	0000	SAMPLE	DATA RESULTS		0001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	U U	100 100	1 1	UG/L UG/L	04/08/2023 04/08/2023	DHM DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	90.7				04/08/2023	DHM	

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		CERTIFIC	ATE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12 ALS JOB#: EV2 ALS SAMPLE#: EV2			4/12/2023 EV23040003 EV23040003-36		
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20	03/31/2023 3/30/2023 4:30:00 PM C601			
CLIENT SAMPLE ID	54-BU	SAMPLE	DATA RESULTS	CREDITATION:	C601				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	U U	100 100	1 1	UG/L UG/L	04/08/2023 04/08/2023	DHM DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25	NWTPH-DX	93.1				04/08/2023	DHM		

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, Suite 800 AL Seattle, WA 98101 ALS SA Kula Haslam DATE PE			DATE: ALS JOB#: ALS SAMPLE#:	4/12/2023 EV23040003 EV23040003-37			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish DUP-2		D/ COLI WDOE AC	ATE RECEIVED: LECTION DATE: CCREDITATION:	03/31/20 3/29/202 C601	03/31/2023 3/29/2023 C601 ANALYSIS AN		
	-	SAMPLE	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	U 330	100 100	1 1	UG/L UG/L	04/08/2023 04/08/2023	DHM DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	101				04/08/2023	DHM	

U - Analyte analyzed for but not detected at level above reporting limit. Chromatogram indicates that it is likely that sample contains weathered lube oil.

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2 ALS JOB#: EV23 ALS SAMPLE#: EV23			
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/29/202	EV23040003-38 )3/31/2023 3/29/2023 2601 ANALYSIS AN UNITO DATE	
CLIENT SAMPLE ID	DUP-3	SAMPLE	E DATA RESULTS	CREDITATION:	C601		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	96.9				04/08/2023	DHM

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	Guite 800		DATE: 4/12 ALS JOB#: EV2 ALS SAMPLE#: EV2				
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20	03/31/2023 3/30/2023 11:20:00 AM C601		
CLIENT SAMPLE ID	51-BD	SAMPLE	DATA RESULTS	CREDITATION:	C601			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	U	100	1	UG/L	04/08/2023	DHM	
SURROGATE	METHOD	0 %REC	100	1	UG/L	04/08/2023 ANALYSIS DATE		
020		101				04/08/2023		

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/ ALS JOB#: E` ALS SAMPLE#: E`			
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish S2-BU			ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	4/12/2023 EV23040003 EV23040003-40 03/31/2023 3/30/2023 9:55:00 AM C601 ANALYSIS ANAL UNITS DATE B UG/L 04/08/2023 DH	
CLIENT SAMPLE ID	32-80	SAMPLE		CREDITATION.	001		
		RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS		
TPH-Oil Range	NWTPH-DX NWTPH-DX	110	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	91.4				04/08/2023	DHM

Chromatogram indicates that it is likely that sample contains highly weathered diesel and an unidentified oil range product. Oil range product results biased high due to diesel range product overlap.

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4 ALS JOB#: E ALS SAMPLE#: E		4/12/2023 EV23040003 EV23040003-41		
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20	03/31/2023 3/30/2023 9:07:00 AM C601		
CLIENT SAMPLE ID	52-BD	SAMPLE		CREDITATION:	C601			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	U U	100 100	1 1	UG/L UG/L	04/08/2023 04/08/2023	DHM DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	94.5				04/08/2023	DHM	

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:		4/12/2023 EV23040003 EV23040003-42		
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish S3-AU		DA COLL WDOE AC	ATE RECEIVED: LECTION DATE: CREDITATION:	03/31/20 3/30/202 C601	03/31/2023 3/30/2023 1:56:00 PM C601		
		SAMPLE	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	<b>160</b> U	100 100	1	UG/L UG/L	04/08/2023 04/08/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	98.7				04/08/2023	DHM	

U - Analyte analyzed for but not detected at level above reporting limit. Chromatogram indicates that it is likely that sample contains an unidentified diesel range product.

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:		4/12/2023 EV23040003 EV23040003-43		
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: ECTION DATE:	03/31/20 3/30/202	03/31/2023 3/30/2023 11:26:00 AM C601		
CLIENT SAMPLE ID	S1-AD	SAMPLE	E DATA RESULTS	CREDITATION:	C601			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	U	100	1	UG/L	04/09/2023	DHM	
TPH-Oil Range	NWTPH-DX	U	100	1	UG/L	04/09/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	100				04/09/2023	DHM	

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4 ALS JOB#: E ALS SAMPLE#: E		4/12/2023 EV23040003 EV23040003-44		
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish		D/ COLI	ATE RECEIVED: ECTION DATE:	03/31/20 3/30/202	03/31/2023 3/30/2023 1:21:00 PM C601		
CLIENT SAMPLE ID	S3-BU		WDOE ACCREDITATION: C6			: C601		
		SAMPLE	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	U	100	1	UG/L	04/09/2023	DHM	
TPH-Oil Range	NWTPH-DX	U	100	1	UG/L	04/09/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	93.0				04/09/2023	DHM	

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	Guite 800		DATE: ALS JOB#: ALS SAMPLE#:		4/12/2023 EV23040003 EV23040003-45		
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	03/31/2023 3/30/2023 9:05:00 AM C601		
CLIENT SAMPLE ID	52-AD	SAMPLE	E DATA RESULTS	CREDITATION.	001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	U U	100 100	1 1	UG/L UG/L	04/09/2023 04/09/2023	DHM DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	93.8				04/09/2023	DHM	

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:		4/12/2023 EV23040003 EV23040003-46		
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish 24-W-42		D/ COLI W/DOE AC	ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	03/31/2023 3/30/2023 6:18:00 PM C601		
	28-10-42	SAMPLE	DATA RESULTS	CREDITATION.	001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	UU	100 100	1	UG/L UG/L	04/09/2023 04/09/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	96.9				04/09/2023	DHM	

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	Guite 800		DATE: ALS JOB#: ALS SAMPLE#:		4/12/2023 EV23040003 EV23040003-47		
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20	03/31/2023 3/30/2023 9:45:00 AM C601		
CLIENT SAMPLE ID	52-AU	SAMPLE	E DATA RESULTS	CREDITATION.	001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	U U	100 100	1 1	UG/L UG/L	04/09/2023 04/09/2023	DHM DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	96.1				04/09/2023	DHM	

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish DUP-4		DA COLL WDOE AC	DATE RECEIVED: 03/31/2023 COLLECTION DATE: 3/30/2023 WDOE ACCREDITATION: C601			
	-	SAMPLE	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	<b>170</b> U	100 100	1 1	UG/L UG/L	04/09/2023 04/09/2023	DHM DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	96.7				04/09/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit. Chromatogram indicates that it is likely that sample contains an unidentified diesel range product.

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2023 ALS JOB#: EV23040003 ALS SAMPLE#: EV23040003-4			
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish		D/ COLI	ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	03/31/2023 3/30/2023 1:00:00 PM C601	
CLIENT SAMPLE ID	EQUIPMENT BLA	NK	WDOE ACCREDITATION: C601			C601	
		SAMPLE	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	U	100	1	UG/L	04/09/2023	DHM
TPH-Oil Range	NWTPH-DX	U	100	1	UG/L	04/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	92.9				04/09/2023	DHM

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4/12/2023

C601

EV23040003

CLIENT:	Arcadis U.S., Inc.	DATE:
	1100 Olive Way, Suite 800	ALS SDG#:
	Seattle, WA 98101	WDOE ACCREDITATION:
CLIENT CONTACT:	Kyle Haslam	
CLIENT PROJECT:	BNSF Skykomish	

## LABORATORY BLANK RESULTS

# MB-040423W - Batch 192046 - Water by NWTPH-DX

				REPORTING	ANALYSIS	ANALYSIS
ANALYTE	METHOD	RESULTS	UNITS	LIMITS	DATE	BY
TPH-Diesel Range	NWTPH-DX	U	UG/L	100	04/07/2023	DHM
TPH-Oil Range	NWTPH-DX	U	UG/L	100	04/07/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit.

#### MB-040523W - Batch 192064 - Water by NWTPH-DX

				REPORTING	ANALYSIS	ANALYSIS
ANALYTE	METHOD	RESULTS	UNITS	LIMITS	DATE	BY
TPH-Diesel Range	NWTPH-DX	U	UG/L	100	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	U	UG/L	100	04/08/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit.

### MB2-040523W - Batch 192065 - Water by NWTPH-DX

				REPORTING	ANALYSIS	ANALYSIS
ANALYTE	METHOD	RESULTS	UNITS	LIMITS	DATE	BY
TPH-Diesel Range	NWTPH-DX	U	UG/L	100	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	U	UG/L	100	04/08/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit.

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4/12/2023 EV23040003

DHM

04/08/2023

C601

CLIENT:	Arcadis U.S., Inc.	DATE:
	1100 Olive Way, Suite 800	ALS SDG#:
	Seattle, WA 98101	WDOE ACCREDITATION:
CLIENT CONTACT:	Kyle Haslam	
CLIENT PROJECT:	BNSF Skykomish	

## LABORATORY CONTROL SAMPLE RESULTS

# ALS Test Batch ID: 192046 - Water by NWTPH-DX

					LIN	IITS	ANALYSIS	ANALYSIS BY
SPIKED COMPOUND	METHOD	%REC	RPD	QUAL	MIN	MAX	DATE	
TPH-Diesel Range - BS	NWTPH-DX	85.9			67	125	04/07/2023	DHM
TPH-Diesel Range - BSD	NWTPH-DX	95.0	10		67	125	04/07/2023	DHM
ALS Test Batch ID: 1920	064 - Water by NW1	ГРН-DХ			LIN	IITS	ANALYSIS	ANALYSIS BY
SPIKED COMPOUND	METHOD	%REC	RPD	QUAL	MIN	MAX	DATE	
TPH-Diesel Range - BS	NWTPH-DX	119			67	125	04/08/2023	DHM

67

125

## ALS Test Batch ID: 192065 - Water by NWTPH-DX

NWTPH-DX

117

2

TPH-Diesel Range - BSD

	-				LIMI	TS	ANALYSIS	ANALYSIS BY
SPIKED COMPOUND	METHOD	%REC	RPD	QUAL	MIN	MAX	DATE	
TPH-Diesel Range - BS	NWTPH-DX	101			67	125	04/08/2023	DHM
TPH-Diesel Range - BSD	NWTPH-DX	110	8		67	125	04/05/2023	DHM

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CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, Suite 800 Seattle, WA 98101	DATE: ALS SDG#: WDOE ACCREDITATION:	4/12/2023 EV23040003 C601
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish		

#### MATRIX SPIKE RESULTS

ALS Test Batch ID: 192064 - Water Parent Sample: S4-AU

SPIKED COMPOUND	METHOD	%REC	RPD	QUAL	SPIKE Added	PARENT SAMPLE RESULT	RESULT	MIN	LIMITS MAX	RPD	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range - MS	NWTPH-DX	102			500	29.0	510	67	125		04/08/2023	DHM
TPH-Diesel Range - MSD	NWTPH-DX	101	0		500	29.0	500	67	125	15.2	04/08/2023	DHM

APPROVED BY

G

Rob Greer Laboratory Director

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											EVa	230	40	2003
Company Namerau	*****	Billing Infor	mation:					An	alvsis /	Containe	er / Preservative	Para 2000		Chain of Custody Page <u>1</u> of
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		630 Plaza	Dr., Ste. 600		Chk	X			:			1.11		Para
1100 Olive Way		Highland	s Ranch, CO 80	129		š/IU					1209.00			PEOPLE ADVANCING SCIENCE
Suite 800						lor	· . [				Alexand a			
Report to:	-	Email To:	KYLE. HAS	LAMOI	FRIA	る王	CON							MT JULIET, TN
James O'Connell/Sydney Clark K	YLE HASLA	M <del>Sydney.Cla</del>	rk@arcadis.com;A	manda.Bowr	ing@a	Aec		÷		1				12065 Lebanon Rd Mount Juliet, TN 37122 Submitting a sample via this chain of custody
Project Description: 200410 BUSF SKY	Colle	State ected: SKXK0	MISH, WA	Please Cir PT MT C	cle: T ET	Wh/dm	a l	ml/Si	consect.		and and a second			constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard- terms.pdf
Phone: <del>206-325-5254-</del> 206 726 4753	Client Project # 3 30053829.25.2 BNSF SK	0144053 F LYKOMES4	Lab Project # CHEVARCWA	200410	-	40mlA	CIL-NoP	1eOH10	NoPres					sdg # EJ2040003
Collected by (print): FIIZABENH SCHELLER	Site/Facility ID # 15510 AURORA	AVEN	P.O. #			260Ľ	a <del>80</del> 2	W/qu	əzClr					Acctnum: CITEVARCWA
Collected by (signature)	Rush? (Lab M	IUST Be Notified)	Quote #			DC 8	silic	imlAi	10'8'					Template:1220745-
Immedia <u>tely</u> Packed on Ice NY	Same Day Next Day Two Day Three Day	Five Day 5 Day (Rad Only) 10 Day (Rad Only)	Date Results	Needed	No. of	M,EDB,E	HDX no	HGX 40	Lead 60					Pret <del>ogin, 19<b>67072</b></del> PM <del>: 110 - Brian Ford -</del> PB:
Sample ID	Comp/Grab Ma	atrix * Depth	Date	Time	Cntrs	BTEXI	ITWN	ITWI	<b>fotal</b>					Shipped Via: Remarks Sample # (lab only)
1C -W-8	G1 GW	<del>~ 22</del>	3-28-23	0945	1		*							
5-W-17	1 GW	ss.		0950	1		$\mathbf{x}$						2	
5- W- 16		-55-		1115	1		×						3	
5-W-55		-55-4		1610	1.		X						ý	
1C-W-4		<u>ss</u>		1100	1		X						5	
5-W-56		-55-		1605	] ]		×						6	
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5- W- 19		-55-		1408	ł		X						8	
5-W-18		<del>-ss</del>		<b>\$</b> 1510			×						9	
DUP-1	* *	-55	*		1		$\left  \right\rangle$	i suite and					10	
* Matrix: SS - Soil AIR - Air F - Filter GW - Groundwater B - Bioassay	marks: STD -	TAT							pН		Temp	COC Se COC Si Bottle	Sampl al Pre gned/A s arri	e Receipt Checklist sent/Intact: NP Y N. sccurate: Y N ve intact: Y N
WW - WasteWater DW - Drinking Water OT - Other	mples returned via:		Trackir	g#					Flow		Other	Correc Suffic	t bott ient v	les used: Y N olume sent: Y N If Applicable
Relinquished by-(Signature)	UPS FedEx	Courier Time	: Receiv	by: (Signa)	ure)			UU. T	rip Blan	k Receiv	ed: Yes/No	VOA Ze Preser RAD Sc	ro Hea vation reen <	dspace:YN Correct/Checked:YN 0.5 mR/nr:YN
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Relinquished by : (Signature)	Date:	Time	: Receive	ed for lab by:	(Signat	ure)		D	)ate:		Time:	Hold:	28	Condition: NCF / OK

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lames O'Connell/Sydney Clark		Email 10: Sydney. Clark@	Jarcadis.com;An	nanda.Bowning	icoi e		, L					12065 Leb	IVI JULIE1, IN anon &d Mount Juliet, TN 37122	~~~~
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Immediately Packed on ice NY		uay / (Rad Only) ay (Rad Only)	Date Results I	Needed	וינספינ נייבס נייב	on XQH	07 X 9H	14(0)				Prelogi PM: 11 PB:	n: <b>P967072</b> 0-Brian Ford	
Sample ID	Comp/Grab Matrix *	Depth	Date	Time	<sup>5</sup> ₩X∃T8	91WN	9TWN	_/ /// \ / ////	0001			Shippe	d Via: marks { Sample # (la	ab only}
EW- 2A	(S) 556W		3-2-1-23	1302	-	X			8 200					
MW-4	\$\$			1015		X						2		
EW-I				[220]		X						6		
5-W-43	2			1250	1	X								
2-A-W-40	<b>.</b>			1445	1	X						5		1
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1B-W-23	* * *		≻	225		X					(0	ç		
* Matrix: 55 - Soil AIR - Air F - Filter 5W - Groundwater B - Bioassay WW - WasteWater	arks: STY	E					-	Hq	Tem Othe		COC Seal COC Seal COC Sign Cortles	ample Rece Present/. ed/Accurat arrive int	ipt Checklist Intact:NPY e: act: act:	2227
DW - Drinking Water Sam DT - Other	ples returned via: PSFedExCourier		Tracking	#		44					Sufficie VOA Zero	nt volume <u>If An</u> Headsbace	sent: <u>olicable</u> v	(Z) 2
Relinquesthed M : (Signature)	Date:	S Itime:	Received	l by: (Signature	» 3-31-2°	(5:2)	Trip	Blank Rec	eived: Y	es / No HCL / MeaH TBR	Preserva RAD Scre	tion Corre en <0.5 m	ect/Checked:Y V/hr:Y	
Reinquished by : (Signature)	Date:	Time:	Received	l by: (Signature	(5		Ten	d.	°C <sup>Bott</sup>	les Received:	If preserva	ation require	d by Login: Date/Tin	e
Relinquished by : (Signature)	Date:	Time:	Received	l for lab by. (Si	gnature)		Date		Tim	ä	Hold:		Conditio	έð
											-			1

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ELIZOUN

Ena	Chain of Custody Page 3 of	Ç	PEOPLE ADVANCING SCIENCE		MT JULIET, TN	12065 Lebanon Rd Mount Juliet, TN 37122 Submitting a sample via this chain of custody	constitutes admowledgment and acceptance of the Pace Terms and Conditions found at: https://finb.pacelabs.com/hu0is/pas-standard-	entable.		Table#	Acctnum: CHEVARCWA	Template <b>T220745</b>	Prelogin: P30 AU/ 2 PM: 110 - Brian Ford	PB:	Shipped Via: Remarks Sample # (lab only)		12	23	3		16		)%  )%	49 P	0%	amble Receipt Checklist 1. Present/Intact: <u>NP Y N</u> ed/Accurate: <u>Y N</u>	arrive intact: <u>1 N</u> bottles used: <u>Y N</u> ent volume sent: <u>Y N</u>	<u>If Applicable</u> D Headspace: <u>Y</u> M	stlon Correct/Checked: <u>Y_N</u> een <0.5 mR/hr:	ation required by Login. Date/Time	Condition: NCE / OK
23040															1					<u></u>	<u>ہ</u>	0	<u> </u>	0		COC Seal	Boutles Correct Sufficie	VOA Zero	Preserve RAD SCre	. If preserv	:ploH
EV.	- / Preservative														-14											Temp	Other		I. Yes/No. HCL/MeoH TBR	Bottles Received	Time:
	lvsis / Container					7	୰ଽ	Pres	M	:Clr-	508 ×	<u>م</u> ٥٢٥	)9 be HG	7U 591	Ictal VU			Х								Hq	Flow		o Blank Received	np: C	ij
	- Ana					λι	son son	oth <del>Jon</del>	-19 O91	√/q zoş	eol MA	lin c	in XC	)Hc IHc	ITWN ITWN		. X	x	x	X	X	<u>ネ</u>	X	X	×				15-2J		Dat
		Pres Chk Yf	\$/JW	OT	но	ng@a	<b>v/qw</b>	(Alm	04	209	28	EDC	f <b>DB</b> ,	۹, M	BTEXI			7	-		1			1	-				re) • 3-31-23	re)	Signature)
		υ.	0129			Amanda.Bowri	Please Circ PT MT CT						ts Needed		Time	IISS	1410	1600	OSF1	9449	lbss	1549	1624	1316	1205			ing#	ved by: Signatu	ved by: (Signatu	ved for lab by. (
	nation:	ounts Payabl Dr Ste. 600	Ranch, CO 8			k@arcadis.com;		Lab Project # CHEVARCW		P.O.#	# 0+0-0	duote #	Date Resul		Date	3-29-23		⅔	3-30-25	·					¥			Tracki	2 D Recei	2 Receiv	Recei
	Billing Inforr	Attn: Acco 630 Plaza	Highlands		Email To:	Sydney.clar			IN ANY	N		e Notified) e Dav	ay (Rad Only) Day (Rad Only)		Depth											k		L	C IIme:	Time:	Time:
							City/State Collected:	roject # 879-75-71	NN L	cility ID # • • • • • • • • • • • • • • • • • • •		s <b>nr</b> (Lab MUST B ame Dav Fiv	Vext Day 5 D	Three Day	'Grab Matrīx *	л (bw <sup>355</sup>		-35-		*	শ্ব	8	*	32	× ×55	STO TA	urned via:	FedExCourie	Date:	Date:	Date:
		۸A				<del>rk</del>		Client P 30063	Ð	Site/Fac		X X			Comp/	9										Remarks:	Samples ret	UPS			
	Company Name/Address:	Arcadis - Chevron - V	1100 Olive Way Suite 800	Seattle. WA 98101	Report to:	James O Connell/Sydney Cla	Project Description: 2004.10	Phone: 206-325-5254		Collected by (print):	Collected hy (signature)-		Immediately	Packed on Ice N Y	Sample ID	24- W- 9	1C-W-7	2A- W- 41	GNU-LI	S3-CD	S4 - CD	05-HS	54 - 13D	53- AD	S1 - BU	* Matrix: SS - Soil AIR - Air F - Filter GW - Groundwater B - Bioassay	<b>WW</b> - WasteWater <b>DW</b> - Drinking Water	0T - Other	Relinquished by : (Signature)	Relinquished by Signature)	Relinquished by : (Signature)

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3040003	Chain of Custody Page 4 of 6	Ç	PEOPLE ADVANCING SCIENCE		MT JULIET, TN	2,2005 teoanon ka Mount Lutet, IN 37122 Submitting a sample via this chain of custody	constitutes advacwledgment and acceptance of the Pace Yerms and Conditions found at: https://info.pacelabs.com/hubity/pas-standard-		SDG#	Table #	Arctiniter-CHEVABCIWA	Template: T220745	Prelogin: P967072	PM: 110 - Brian Ford PB:	Shipped Via: Remarks Sample # (lab only)	31 MS/MSD	*	¢.	<del>34</del> 33	<del>35</del> 33	35 J	<del>37</del> 35	<u>36</u>	37 37	40 23	Sample Receipt Checklist COC Seal Present/Intact: NP I N COC Signed/Accurate: Y N Sottles annie intact: Y N Correct bottles weed: Y N	Sufficient volume sent: <u>Y N</u> <u>If Applicable</u> v N	Preservation Correct/Checked: <u> </u>	If preservation required by Login: Date/Time	Hold: Condition: NCF / OK
EVI	ntainer / Preservative																									TempOther		eceived: Yes/No HCL/MeoH	°C Bottles Received:	Time:
	Analvsis / Cor					١٨	s/jw	LGS 0TH	109 106	1-1 1-1 1W1	)zc /qu	1AIn 98.0	10: 401	) pea	(9TW) Dial L	L N										PH Flow		Trip Blank Re	Temp:	Date:
		.At	s/Ju	iot	HO	•Me	res 1/dm	IAIN 901	104 1-1 :	)20 00	9- <del>8</del> -0 9-8-0	8 Do	: 01 ]3'	903" • X0F	IWTPI	X V A	<b>永</b>	k	X	*	×	Х	X	X	×			731 8618		ture)
		Pres	29		conda Rourinado		Please Circle: PT MT CT ET		2012002					Veeded No.	Time Cntrs	1550 <b>3</b>	1-10-551	10551	1235 1	1355	- 00ti	1449 1	1630 1	- 			#	by: (Signature)	by: (Signature)	for lab by: (Signat
	nation:	unts Payable Dr., Ste. 600	Ranch, CO 803		a Armadie com.As	· ·· ·································		Lab Project #	CHEVAKCMA-	P.O.#		Quote #		Date Results	Date	3-3023							≯	3-29-23	22925		Tracking	Received	Received	Received
	Billing Inform	Attn: Acco 630 Plaza	Highlands		Email To: Sudney Clarl		8 <del>1</del> 1	ſ	THANK		₹ ₹	Be Notified)	ive Day	. Day (Kad Only) .0 Day (Rad Only)	* Depth											Jer (	ier		Time:	Time:
		(					City/Stat Collecte	lient Project #	PAIL 5 22.22.21	ite/Facility ID #	5510 AURORA A	Rush? (Lab MUST	Same DayF		Comp/Grab Matrix	(Shubb	<del>≈   + - + )</del>		<u></u>		22		2	\$8 	× **	rks: SR	es returned via: SFedExCour	Date:	Bate:	Date:
	Company Name/Address:	Arcadis - Chevron - WA	1100 Olive Way Suite 800	Seattle. WA 98101	Report to: James <b>O'Connell /Svdnov-Clart</b>		Project Description: 200410	Phone: <b>206-325-5254</b>	<u>n</u> ,	Collected by (print): Si	H	Collected by (signature):		Immediately Packed on Ice N Y	Sample ID (	SH-AU		- ASH	SI- AU	53- BD	SH-CU	53-20	SH - BU	DUP - 2	DUP-3	* Matrix: Rema SS - Soil AIR - Air F - Filter GW - Groundwater B - Bioassay WW - WasteWater	DW - Drinking Water Samp OT - Other UP	Relinguished by : (Signature)	Relipquished by (Signature)	Relinquished by : (Signature)

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040003	Chain of Custody Page S of G	2	Pace	PEOPLE ADVANCING SCIENCE		MI JULEI, IN 12065 Lebenne Ed Mount Hiller TN 22733	Submitting a sample via this chain of custody	constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard-	terms.pdf	SDG#		Table #		CFUC201	Prelogin: <b>F30/0/2</b> PM: 110 - Brian Ford PB:	Shipped Via: Remarks Sample # (lab only)	- 41- NKT Red - 20		43 (LO	<u>44</u> [4]	「り」ンカ	₹ 5	23	المعر الأر	<del>41</del> 46	रक्ष प्र भ	Samule Receipt Checklist Seal Present/Intact: NF Y Signed(Accumate: Y N Lies antive intact: Y N Lies antive intact: Y N	ficient volume sent: <u>Y</u> N If Applicable Voluminante volume	screen <0.5 mR/hr: Screen <0.5 mR/hr:	eservation required by Login: Date/Time	E. Condition: NGF f OX
E733	ainer / Precenvative																										Temp Coc	Suf	eived: Yes / No Pre- HCL/ MeoH	°C Bottles Received: If pr	Time: Hold
	Analveis / Cont						://L	s/Im 	5ə 101 20	ъ н (	oN کوار	1 <del>802</del> N/dr ZClr-	soll nAl 28	01( W0 IS D	9 peə 9 x9H u x0H	uwan uwrp otal L	L	( <b>X</b>	×	×	X	$\frac{1}{\lambda}$	×	X	X	×	pH Flow		Trip Blank Rec	Temp	Date:
		/able Pres		m0	12)-	com:Amanda Rowring@a		Please Circle:	######################################	CWA-200410 6	<b>. 70</b>		.8 _	E Dy	R Results Needed No.	Time	23-475-4	1120 1	1 2550	1 4040	1356 1	1 921	1321	0705 1	1818 1	< 0945 1		racking #	eceived by: (Signature)	eceived by: (Signature)	eceived for lab by: (Signature)
	Billing Information:	Attn: Accounts Pay	Highlands Ranch, C	1		Email 10: Svdnev.Clark@arcadis.		ate ed:	Lab Project	CHEVAR	NEWNON	AVE N	T Be Notified) Quote #	Five Day	5 Day (Rad Only) Date F 10 Day (Rad Only)	ix * Depth Date	330		1.							~*	TAT	Trier	Time: R	Time:	Time:
		WA						City/Sta Collecte	Client Project #	30063829.25.21	BNSF SU	Site/Facility ID # 15510 AUKORA /	Rush? (Lah MUS	Same Day	Next Day Two Day Three Day	Comp/Grab Matri				 			 		8		Remarks: STO	Samples returned via: UPSFedExCou	Pate:	Date:	Date:
	Company Name/Address:	Arcadis <del>- Chevron - N</del>	1100 Olive Way	Suite 800	Seattle. WA 98101	lames O'Connell/Svdnev Ca		Project Description: 200410	34000. 206. 226.525			Collected by (print):	Collected by (signature):		immediately Packed on Ice NY	Sample ID	51-80-	SI - 13D	52-BU	52- BD	53 - AU	SI-B	52- BU	SZ - AD	24-M-42	SZ -AU	* Matrix: 5S - Soil AIR - Air F - Filter 5W - Groundwater B - Bioassay VW - WasteWater	JW - Drinking Water JT - Other	Relinquished by : (Signature)	Relinqui <del>shed b</del> y : (Signature)	Relinquished by : (Signature)

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# ALS ENVIRONMENTAL

Sample Receiving Checklist

Client: ARCADE,	ALS Job #:	EV230	1000	3
Project: BNSF SKyKOMESH				
Received Date: 33123 Received Time: 15:2	.0	Ву:	ßF	
Type of shipping container: Cooler <u> </u> Box <u> </u>	Other			/
Shipped via: FedEx Ground UPS Mail FedEx Express	Courier	H	and Deliv C	vered <u>1</u>
Were custody seals on outside of shipping container?         If yes, how many?       Where?         Custody seal date:       Seal name:	<b></b>	Yes	No	<u>N/A</u>
Was Chain of Custody properly filled out (ink, signed, dated, o	etc.)?	$\checkmark$		
Did all bottles have labels?				
Did all bottle labels and tags agree with Chain of Custody?			<u> </u>	
Were samples received within hold time?		<u> </u>		
Did all bottles arrive in good condition (unbroken, etc.)?				
Was sufficient amount of sample sent for the tests indicated?				
Was correct preservation added to samples?				
If no, Sample Control added preservative to the following:          Sample Number       Reagent       Analyte				
Were VOA vials checked for absence of air bubbles? Bubbles present in sample #:			<u></u>	$\overline{}$
Temperature of cooler upon receipt: $6.4^{\circ}$	Cold Cool	Ambie	ent N/.	A
Explain any discrepancies:				
Was client contacted?    Who was called?      Outcome of call:	By whom?	)	Date	::



October 16, 2023

Ms. Michelle Nguyen Arcadis U.S., Inc. 1420 - 5th Ave , Unit 2400 Seattle, WA 98101

Dear Ms. Nguyen,

On October 2nd, 46 samples were received by our laboratory and assigned our laboratory project number EV23100004. The project was identified as your BNSF Skykomish PN 30159457.01. The sample identification and requested analyses are outlined on the attached chain of custody record.

No abnormalities or nonconformances were observed during the analyses of the project samples.

Please do not hesitate to call me if you have any questions or if I can be of further assistance.

Sincerely,

**ALS Laboratory Group** 

Rob Greer Laboratory Director

Page 1
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CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/202 ALS JOB#: EV231000 ALS SAMPLE#: EV231000				
CLIENT CONTACT:	Michelle Nguyen		D	ATE RECEIVED:	10/02/2023			
CLIENT PROJECT:	BNSF Skykomish	NSF Skykomish PN 30159457.01		COLLECTION DATE:		9/28/2023 2:05:00 PM		
CLIENT SAMPLE ID	GW-2_092823		WDOE AC	CCREDITATION:	C601			
		SAMPLE D	ATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	93.8				10/09/2023	DHM	

U - Analyte analyzed for but not detected at level above reporting limit.

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		CERTIFICAT	E OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , Uni Seattle, WA 98101	t 2400		DATE: ALS JOB#: ALS SAMPLE#:		10/16/2023 EV23100004 EV23100004-02		
CLIENT CONTACT:	Michelle Nguyen		D	ATE RECEIVED:	10/02/2023			
CLIENT PROJECT:	BNSF Skykomish P	N 30159457.01	COL	LECTION DATE:	9/27/202	23 5:55:00	PM	
CLIENT SAMPLE ID	GW-3_092723		WDOE AG	CCREDITATION:	C601			
		SAMPLE D	ATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	250	100	1	UG/L	10/09/2023	DHM	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX w/ SGA	110	100	1	UG/L	10/16/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX w/ SGA	U	100	1	UG/L	10/16/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	90.4				10/09/2023	DHM	
C25 CAS: 629-99-2	NWTPH-DX w/ SGA	101				10/16/2023	DHM	

U - Analyte analyzed for but not detected at level above reporting limit. Chromatogram indicates that it is likely that sample contains highly weathered diesel.

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		CERTIFICAT	<b>FE OF ANALYSIS</b>					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	Arcadis U.S., Inc. 1420 - 5th Ave , Unit 2400 Seattle, WA 98101		DATE: ALS JOB#: ALS SAMPLE#:		10/16/2023 EV23100004 EV23100004-03		
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01	D/ COLI	DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/27/2023 12:30:00 PM		
CLIENT SAMPLE ID	GW-4_092723		WDOE ACCREDITATION:			ON: C601		
		SAMPLE D	ATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	130	100	1	UG/L	10/09/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	690	100	1	UG/L	10/09/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	93.8				10/09/2023	DHM	

Chromatogram indicates that it is likely that sample contains an unidentified diesel range product and an unidentified oil range product.

Page 4
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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2 ALS JOB#: EV2310 ALS SAMPLE#: EV2310				
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	Michelle Nguyen BNSF Skykomish PN 30159457.01 EW-1_092823		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/28/2023 4:42:00 PM		
CLIEINT SAMPLE ID	EVV-1_092823	SAMPLE D	DATA RESULTS	CREDITATION.	001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	95.0				10/09/2023	DHM	

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		CERTIFICAT	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2023 ALS JOB#: EV23100004 ALS SAMPLE#: EV23100004-05			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish EW-2A 092723	/lichelle Nguyen BNSF Skykomish PN 30159457.01 EW-2A_092723		DATE RECEIVED: COLLECTION DATE: WDOE ACCREDITATION		10/02/2023 9/27/2023 1:50:00 PM C601	
		SAMPLE D	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	250	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	115				10/09/2023	DHM

Chromatogram indicates that it is likely that sample contains an unidentified oil range product.

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	Arcadis U.S., Inc. 1420 - 5th Ave , Unit 2400 Seattle, WA 98101		DATE: ALS JOB#: ALS SAMPLE#:		10/16/2023 EV23100004 EV23100004-06		
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	Michelle Nguyen BNSF Skykomish PN 30159457.01 S1-AD 092823		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/28/2023 5:25:00 PM		
CLIENT SAMPLE ID	51-AD_092623	SAMPLE D	DATA RESULTS	CREDITATION.	001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	93.0				10/09/2023	DHM	

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/20 ALS JOB#: EV23100 ALS SAMPLE#: EV23100				
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	Michelle Nguyen BNSF Skykomish PN 30159457.01 S1-AU_092823		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/28/2023 5:25:00 PM		
	31-A0_092023	SAMPLE D	DATA RESULTS	CREDITATION.	001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	82.6				10/09/2023	DHM	

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		CERTIFICAT	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 9810	rcadis U.S., Inc. 420 - 5th Ave , Unit 2400 eattle, WA 98101		DATE: ALS JOB#: ALS SAMPLE#:		10/16/2023 EV23100004 EV23100004-08		
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01	D/ COLI	DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/28/2023 5:50:00 PM		
CLIENT SAMPLE ID	S1-BD_092823	_092823 WDOE ACCREDITATION: C60			C601			
		SAMPLE D	ATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	93.3				10/09/2023	DHM	

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2 ALS JOB#: EV231( ALS SAMPLE#: EV231(			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish S1-BU 092823	/lichelle Nguyen BNSF Skykomish PN 30159457.01 S1-BU_092823		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/28/2023 5:55:00 PM	
	01 00_002020	SAMPLE D	DATA RESULTS	DOREDITATION.	0001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	86.3				10/09/2023	DHM

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 9810	Arcadis U.S., Inc. 1420 - 5th Ave , Unit 2400 Seattle, WA 98101		DATE: ALS JOB#: ALS SAMPLE#:		10/16/2023 EV23100004 EV23100004-10		
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	/lichelle Nguyen NSF Skykomish PN 30159457.01		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/29/2023 3:42:00 PM		
CLIENT SAMPLE ID	S2-AD_092923	92923 WDOE ACCREDITATION: C6			C601			
		SAMPLE D	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	96.9				10/09/2023	DHM	

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2023 ALS JOB#: EV2310000 ALS SAMPLE#: EV2310000			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	Michelle Nguyen BNSF Skykomish PN 30159457.01 S2-AU_092923		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/29/2023 3:18:00 PM	
	32-A0_092923	SAMPLE F	DATA RESULTS	CREDITATION.	001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	94.5				10/09/2023	DHM

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		CERTIFICAT	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , Unit 2400 Seattle, WA 98101			DATE: ALS JOB#: ALS SAMPLE#:		10/16/2023 EV23100004 EV23100004-12		
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish PN 30159457.01		D/ COLI	DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/29/2023 12:42:00 PM		
CLIENT SAMPLE ID	S2-BD_092923	S2-BD_092923 WDOE ACCREDITATION:						
		SAMPLE L	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	140	100	1	UG/L	10/09/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	93.7				10/09/2023	DHM	

Chromatogram indicates that it is likely that sample contains an unidentified oil range product.

Page 13 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , Unit 2400 Seattle, WA 98101			DATE: ALS JOB#: ALS SAMPLE#:			10/16/2023 EV23100004 EV23100004-13		
CLIENT CONTACT:	Michelle Nguyen		D	DATE RECEIVED:		10/02/2023			
CLIENT PROJECT: CLIENT SAMPLE ID	BNSF Skykomish PN 30159457.01 S2-BU 092923 MS/MSD		WDOE AC	COLLECTION DATE: WDOE ACCREDITATION:		9/29/2023 12:03:00 PM C601			
		SAMPLE [	DATA RESULTS						
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	1000	100	1	UG/L	10/09/2023	DHM		
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	200	100	1	UG/L	10/09/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25 CAS: 629-99-2	NWTPH-DX	97.6				10/09/2023	DHM		

Chromatogram indicates that it is likely that sample contains weathered diesel and an unidentified oil range product. Oil range product results biased high due to diesel range product overlap.

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , Unit 2400 Seattle, WA 98101			DATE: ALS JOB#: ALS SAMPLE#:		10/16/2023 EV23100004 EV23100004-14		
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish PN 30159457.01			DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/27/2023 4:51:00 PM		
CLIENT SAMPLE ID	S3-AD_092723	SAMPLED		CREDITATION:	C601			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	92.8				10/09/2023	DHM	

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , Unit 2400 Seattle, WA 98101			DATE: ALS JOB#: ALS SAMPLE#:		10/16/2023 EV23100004 EV23100004-15		
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish PN 30159457.01			DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/27/2023 4:26:00 PM		
	33-AU_092723	SAMPLE D	DATA RESULTS	CREDITATION.	001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	95.0				10/09/2023	DHM	

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		CERTIFICA	TE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , Unit 2400 Seattle, WA 98101			DATE: ALS JOB#: ALS SAMPLE#:		10/16/2023 EV23100004 EV23100004-16			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish PN 30159457.01		D/ COLI	DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/28/2023 9:30:00 AM			
CLIENT SAMPLE ID	S3-BD_092823		WDOE AC	WDOE ACCREDITATION:			C601		
		SAMPLE D	DATA RESULTS						
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM		
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25 CAS: 629-99-2	NWTPH-DX	91.7				10/09/2023	DHM		

Page 17 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/20 ALS JOB#: EV2310 ALS SAMPLE#: EV2310			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01		ATE RECEIVED: LECTION DATE:	10/02/20 9/28/202	)23 23 10:45:00	) AM
CLIENT SAMPLE ID	S3-BU_092823			CCREDITATION:	C601		
		SAMPLE L	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	97.7				10/09/2023	DHM

Page 18 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICAT	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 9810	nit 2400		DATE: 10/16/2 ALS JOB#: EV231 ALS SAMPLE#: EV231			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01	D/ COLI	DATE RECEIVED: COLLECTION DATE: WDOE ACCREDITATION:			PM
CLIENT SAMPLE ID	S3-CD_092723		WDOE AC	CREDITATION:	C601		
		SAMPLE D	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	100				10/09/2023	DHM

Page 19 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2023 ALS JOB#: EV23100004 ALS SAMPLE#: EV23100004-19				
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01	DA COLI	ATE RECEIVED: LECTION DATE:	10/02/20 9/27/202	023 23 4:25:00	PM	
CLIENT SAMPLE ID	S3-CU_092723 N	IS/MD	WDOE AC	CREDITATION:	C601			
		SAMPLE [	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	95.1				10/09/2023	DHM	

Page 20 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICAT	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2 ALS JOB#: EV2310 ALS SAMPLE#: EV2310				
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01	D/ COLI	ATE RECEIVED: LECTION DATE:	10/02/20 9/27/202	10/02/2023 9/27/2023 9:28:00 AM		
CLIENT SAMPLE ID	S4-AD_092723		WDOE AC	CREDITATION:	C601			
		SAMPLE D	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	100				10/09/2023	DHM	

Page 21 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2 ALS JOB#: EV2310 ALS SAMPLE#: EV2310			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01		DATE RECEIVED: 10/02/2023 COLLECTION DATE: 9/27/2023 10:2 WDOE ACCREDITATION: C601			) AM
	34-AU_092723	SAMPLE [	DATA RESULTS	CREDITATION.	001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	95.9				10/09/2023	DHM

Page 22 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400	DATE: 10/16/2023 ALS JOB#: EV23100004 ALS SAMPLE#: EV23100004-2;				
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01	D/ COLI	ATE RECEIVED: LECTION DATE:	10/02/20 9/27/202	)23 23 11:37:00	AM
CLIENT SAMPLE ID	S4-BD_092723		WDOE AC	CREDITATION:	C601		
		SAMPLE D	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	101				10/09/2023	DHM

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 9810	nit 2400		DATE: 10/16/ ALS JOB#: EV23 <sup>-</sup> ALS SAMPLE#: EV23 <sup>-</sup>			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01	D/ COLI	DATE RECEIVED: COLLECTION DATE: WDOE ACCREDITATION:			PM
CLIENT SAMPLE ID	S4-BU_092723		WDOE AC	CCREDITATION:	C601		
		SAMPLE D	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	97.2				10/09/2023	DHM

Page 24 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICAT	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: ALS JOB#: ALS SAMPLE#:			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish S4-CD 092723	PN 30159457.01	D/ COLI WDOE AC	ATE RECEIVED: LECTION DATE:	10/02/20 9/27/202 C601	023 23 9:35:00 /	AM
	0100_002120	SAMPLE D	DATA RESULTS		0001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	105				10/09/2023	DHM

Page 25 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: ALS JOB#: ALS SAMPLE#:			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish S4-CU 092723	PN 30159457.01	D/ COLI WDOE AC	ATE RECEIVED: LECTION DATE: CCREDITATION:	10/02/20 9/27/202 C601	)23 23 10:30:00	) AM
		SAMPLE [	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	95.1				10/09/2023	DHM

Page 26 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2023 ALS JOB#: EV23100004 ALS SAMPLE#: EV23100004-26			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish 5-W-14, 092623	PN 30159457.01	D/ COLI WDOE AC	ATE RECEIVED: LECTION DATE:	10/02/20 9/26/202 C601	023 23 3:08:00	PM
	<u> </u>	SAMPLE D	DATA RESULTS	DOREDITATION.	0001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	98.4				10/10/2023	DHM

Page 27 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2023 ALS JOB#: EV23100004 ALS SAMPLE#: EV23100004-2 <sup>-</sup>			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish 5-W-16, 092623	PN 30159457.01	D/ COLI WDOE AC	ATE RECEIVED: LECTION DATE:	10/02/20 9/26/202 C601	023 23 5:00:00	PM
	3 W 10_032023	SAMPLE D	DATA RESULTS	DOREDITATION.	0001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	100				10/10/2023	DHM

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2023 ALS JOB#: EV23100004 ALS SAMPLE#: EV23100004-2			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish 5-W-17 092923	PN 30159457.01	D/ COLI WDOE AC	ATE RECEIVED: LECTION DATE: CCREDITATION:	10/02/20 9/29/202 C601	)23 23 11:10:00	) AM
		SAMPLE D	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	98.0				10/10/2023	DHM

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2 ALS JOB#: EV2310 ALS SAMPLE#: EV2310			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01		ATE RECEIVED: LECTION DATE:	ECEIVED: 10/02/2023 ON DATE: 9/29/2023 11:55:0 DITATION: C601		
CLIENT SAMPLE ID	5-10-10-092925	SAMPLE D	DATA RESULTS	JOREDITATION.	001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	103				10/10/2023	DHM

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2 ALS JOB#: EV231( ALS SAMPLE#: EV231)			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01		DATE RECEIVED: 10/02/2023 COLLECTION DATE: 9/29/2023 12 DOE ACCREDITATION: C601			) PM
	3-10-19_092923	SAMPLE [		CREDITATION.	001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	97.0				10/10/2023	DHM

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		CERTIFICAT	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2 ALS JOB#: EV231 ALS SAMPLE#: EV231			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	ichelle Nguyen NSF Skykomish PN 30159457.01 CC W-51 092923 WDOE			DATE RECEIVED:         10/02/2023           LECTION DATE:         9/29/2023 10:30:00 A		
CLIENT SAMPLE ID	5-W-51_092923		WDOE AC	CCREDITATION:	C601		
		SAMPLE D	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	530	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	220	100	1	UG/L	10/10/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	98.6				10/10/2023	DHM

Chromatogram indicates that it is likely that sample contains highly weathered diesel and an unidentified oil range product. Oil range product results biased high due to diesel range product overlap.

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		CERTIFICAT	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2 ALS JOB#: EV2310 ALS SAMPLE#: EV2310				
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish 5-W-55, 092823	PN 30159457.01	01 DATE RECEIVED: WDOE ACCREDITATION:			10/02/2023 9/28/2023 3:50:00 PM C601		
	0 11 00_002020	SAMPLE D	DATA RESULTS		0001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	97.1				10/10/2023	DHM	

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		CERTIFICAT	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2023 ALS JOB#: EV23100004 ALS SAMPLE#: EV23100004			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	lichelle Nguyen NSF Skykomish PN 30159457.01		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/28/2023 3:30:00 PM	
CLIENT SAMPLE ID	5-W-56_092823		WDOE AC	CCREDITATION:	C601		
		SAMPLE D	ATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	1400	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	710	100	1	UG/L	10/10/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	81.2				10/10/2023	DHM

Chromatogram indicates that it is likely that sample contains an unidentified diesel range product and an unidentified oil range product.

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16 ALS JOB#: EV23 ALS SAMPLE#: EV23			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish FD-3_092923	PN 30159457.01	DA COLI WDOE AC	DATE RECEIVED: 10/02/2 COLLECTION DATE: 9/29/20 WDOE ACCREDITATION: C601			
	_	SAMPLE [	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	590	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	290	100	1	UG/L	10/10/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	100				10/10/2023	DHM

Chromatogram indicates that it is likely that sample contains highly weathered diesel and an unidentified oil range product. Oil range product results biased high due to diesel range product overlap.

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/ ALS JOB#: EV23 <sup>7</sup> ALS SAMPLE#: EV23 <sup>7</sup>			)/16/2023 V23100004 V23100004-35	
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	chelle NguyenDATE RECEIVED:1ISF Skykomish PN 30159457.01COLLECTION DATE:9-W-40_092823WDOE ACCREDITATION:0			10/02/2023 9/28/2023 1:02:00 PM			
	ZA-W-40_092823	SAMPLE [		CREDITATION.	001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	106				10/10/2023	DHM	

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		CERTIFICAT	E OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , Uni Seattle, WA 98101	t 2400		DATE: ALS JOB#: ALS SAMPLE#:		10/16/2023 EV23100004 EV23100004-36		
CLIENT CONTACT:	Michelle Nguyen		D	DATE RECEIVED:		10/02/2023		
CLIENT PROJECT:	BNSF Skykomish P	N 30159457.01	COL	LECTION DATE:	9/28/202	23 11:05:00	) AM	
CLIENT SAMPLE ID	2A-W-41_092823		WDOE AG	CCREDITATION:	C601			
		SAMPLE D	ATA RESULTS					
ANAI YTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	400	100	1	UG/L	10/10/2023	DHM	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX w/ SGA	240	50	1	UG/L	10/16/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	120	100	1	UG/L	10/10/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX w/ SGA	U	100	1	UG/L	10/16/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	104				10/10/2023	DHM	
C25 CAS: 629-99-2	NWTPH-DX w/ SGA	132 SUR11				10/16/2023	DHM	

SUR11 - Surrogate outside of control limits due to sporadic marginal failure. No corrective action taken. U - Analyte analyzed for but not detected at level above reporting limit.

Chromatogram indicates that it is likely that sample contains highly weathered diesel and an unidentified oil range product. Oil range product results biased high due to diesel range product overlap.

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		CERTIFICAT	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/ ALS JOB#: EV23 <sup>-</sup> ALS SAMPLE#: EV23 <sup>-</sup>			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	Iichelle NguyenDATE RECEIVED:NSF Skykomish PN 30159457.01COLLECTION DATE:A-W-42_092823WDOE ACCREDITATION:			10/02/2023 9/28/2023 10:01:00 AM		
CLIENT SAMPLE ID	2A-W-42_092823			CCREDITATION:	C601		
		SAMPLE L	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	120	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	103				10/10/2023	DHM

Chromatogram indicates that it is likely that sample contains an unidentified diesel range product.

Page 38 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/20 ALS JOB#: EV2310 ALS SAMPLE#: EV2310			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	NguyenDATE RECEIVED:1ykomish PN 30159457.01COLLECTION DATE:9092723WDOE ACCREDITATION:0			10/02/2023 9/27/2023 5:30:00 PM		
	10-00-23_092723	SAMPLE D	DATA RESULTS	CREDITATION.	001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	86.5				10/10/2023	DHM

Page 39 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2023 ALS JOB#: EV23100004 ALS SAMPLE#: EV23100004-39			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01	D/ COLI	DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/27/2023 1:00:00 PM	
CLIENT SAMPLE ID	1C-W-7_092723		WDOE AC	CREDITATION:	C601		
		SAMPLE D	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	120	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	97.0				10/10/2023	DHM

Chromatogram indicates that it is likely that sample contains an unidentified diesel range product.

Page 40 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2023 ALS JOB#: EV23100004 ALS SAMPLE#: EV23100004-40			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	lichelle NguyenDATE RECEIVED:NSF Skykomish PN 30159457.01COLLECTION DATE:C-W-8 092723WDOE ACCREDITATION:			10/02/2023 9/27/2023 2:45:00 PM		
CLIENT SAMPLE ID	10-10-8_092723	SAMPLE F		CREDITATION:	C601		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	96.7				10/10/2023	DHM

Page 41 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2023 ALS JOB#: EV23100004 ALS SAMPLE#: EV23100004-41				
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish PN 30159457.01 5-W-43_092923		D/ COLI WDOF AC	DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/29/2023 11:30:00 AM		
	0 11 40_002020	SAMPLE D	DATA RESULTS		0001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	93.3				10/10/2023	DHM	

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		CERTIFICAT	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2023 ALS JOB#: EV23100004 ALS SAMPLE#: EV23100004-42				
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	Michelle Nguyen BNSF Skykomish PN 30159457.01		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/29/2023 4:03:00 PM		
CLIENT SAMPLE ID	MW-4_092923		WDOE AC	CREDITATION:	C601			
		SAMPLE D	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	290	100	1	UG/L	10/10/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	100	100	1	UG/L	10/10/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	95.2				10/10/2023	DHM	

Chromatogram indicates that it is likely that sample contains an unidentified diesel range product.

Page 43 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2023 ALS JOB#: EV23100004 ALS SAMPLE#: EV23100004-43				
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	/lichelle Nguyen BNSF Skykomish PN 30159457.01 D-1_092723		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/27/2023		
	FD-1_092725	SAMPLE [	DATA RESULTS	CREDITATION.	001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	100	100	1	UG/L	10/10/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	220	100	1	UG/L	10/10/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	115				10/10/2023	DHM	

Chromatogram indicates that it is likely that sample contains an unidentified diesel range product and an unidentified oil range product.

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 9810	nit 2400		DATE: 10/16/2023 ALS JOB#: EV23100004 ALS SAMPLE#: EV23100004-44				
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	Michelle Nguyen BNSF Skykomish PN 30159457.01		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/27/2023 5:10:00 PM		
CLIENT SAMPLE ID	EB-1_092723		WDOE AC	CREDITATION:	C601			
		SAMPLE D	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	88.2				10/10/2023	DHM	

Page 45 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICAT	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/20 ALS JOB#: EV2310 ALS SAMPLE#: EV2310			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	Michelle Nguyen BNSF Skykomish PN 30159457.01		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/27/2023	
CLIENT SAMPLE ID	FD-2_092923		WDOE AC	WDOE ACCREDITATION: C60			
		SAMPLE D	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	89.2				10/10/2023	DHM

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2 ALS JOB#: EV231( ALS SAMPLE#: EV231(			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	Michelle Nguyen BNSF Skykomish PN 30159457.01		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/29/2023	
CLIENT SAMPLE ID	FD-4_092923	FD-4_092923		CREDITATION:	C601		
		SAMPLE D	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	93.2				10/10/2023	DHM

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### CERTIFICATE OF ANALYSIS

DATE:

10/16/2023

C601

EV23100004

CLIENT:	Arcadis U.S., Inc.	DATE:
	1420 - 5th Ave , Unit 2400	ALS SDG#:
	Seattle, WA 98101	WDOE ACCREDITATION:
CLIENT CONTACT:	Michelle Nguyen	
CLIENT PROJECT:	BNSF Skykomish PN 30159457.01	

#### LABORATORY BLANK RESULTS

# MB-100623W - Batch 201638 - Water by NWTPH-DX

				REPORTING	ANALYSIS	ANALYSIS
ANALYTE	METHOD	RESULTS	UNITS	LIMITS	DATE	BY
TPH-Diesel Range	NWTPH-DX	U	UG/L	100	10/09/2023	DHM
TPH-Oil Range	NWTPH-DX	U	UG/L	100	10/09/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit.

#### MB-100823W - Batch 201641 - Water by NWTPH-DX

				REPORTING	ANALYSIS	ANALYSIS
ANALYTE	METHOD	RESULTS	UNITS	LIMITS	DATE	BY
TPH-Diesel Range	NWTPH-DX	U	UG/L	100	10/10/2023	DHM
TPH-Oil Range	NWTPH-DX	U	UG/L	100	10/10/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit.

#### MB2-100623W - Batch 201639 - Water by NWTPH-DX

				REPORTING	ANALYSIS	ANALYSIS
ANALYTE	METHOD	RESULTS	UNITS	LIMITS	DATE	BY
TPH-Diesel Range	NWTPH-DX	U	UG/L	50	10/10/2023	DHM
TPH-Oil Range	NWTPH-DX	U	UG/L	100	10/10/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit.

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### CERTIFICATE OF ANALYSIS

CLIENT:	Arcadis U.S., Inc.
	1420 - 5th Ave , Unit 2400
	Seattle, WA 98101
CLIENT CONTACT:	Michelle Nguyen
CLIENT PROJECT:	BNSF Skykomish PN 30159457.01

DATE: 10/ ALS SDG#: EV WDOE ACCREDITATION: C6

10/16/2023 EV23100004 C601

LABORATORY CONTROL SAMPLE RESULTS

## ALS Test Batch ID: 201638 - Water by NWTPH-DX

				LIM	LIMITS		ANALYSIS BY
SPIKED COMPOUND	METHOD	%REC	RPD QUAL	MIN	MAX	DATE	
TPH-Diesel Range - BS	NWTPH-DX	95.1		67	125	10/09/2023	DHM
TPH-Diesel Range - BSD	NWTPH-DX	96.3	1	67	125	10/09/2023	DHM

### ALS Test Batch ID: 201639 - Water by NWTPH-DX

					LIN	AITS	ANALYSIS	ANALYSIS BY
SPIKED COMPOUND	METHOD	%REC	RPD	QUAL	MIN	MAX	DATE	
TPH-Diesel Range - BS	NWTPH-DX	92.2			67	125	10/10/2023	DHM
TPH-Diesel Range - BSD	NWTPH-DX	96.0	4		67	125	10/10/2023	DHM

### ALS Test Batch ID: 201641 - Water by NWTPH-DX

	2				LIMI	TS	ANALYSIS	ANALYSIS BY
SPIKED COMPOUND	METHOD	%REC	RPD	QUAL	MIN	MAX	DATE	
TPH-Diesel Range - BS	NWTPH-DX	99.5			67	125	10/10/2023	DHM
TPH-Diesel Range - BSD	NWTPH-DX	97.7	2		67	125	10/10/2023	DHM

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CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , Unit 2400 Seattle, WA 98101	DATE: ALS SDG#: WDOE ACCREDITATION:	10/16/2023 EV23100004 C601
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish PN 30159457.01		
	/		

MATRIX SPIKE RESULTS

# ALS Test Batch ID: 201638 - Water

Parent Sample: S2-BU\_092923 MS/MSD

SPIKED COMPOUND		METHOD	%REC	RPD	QUAL	SPIKE Added	PARENT SAMPLE RESULT	CALC RESULT*	MIN	LIMITS MAX	RPD	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range - MS		NWTPH-DX	141		SQ2	493	1000	700 SQ2	67	125		10/09/2023	DHM
TPH-Diesel Range - MSD		NWTPH-DX	158	5	MS14	500	1000	790 MS14	67	125	15.2	10/09/2023	DHM
Parent Sample:	S3-CU_092723	MS/MD											
SPIKED COMPOUND		METHOD	%REC	RPD	QUAL	SPIKE ADDED	PARENT SAMPLE RESULT	CALC RESULT*	MIN	LIMITS MAX	RPD	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range - MS		NWTPH-DX	97.0			493	16.0	480	67	125		10/09/2023	DHM
TPH-Diesel Range - MSD		NWTPH-DX	98.5	1		493	16.0	480	67	125	15.2	10/09/2023	DHM

MS14 - MS/MSD recoveries were above the control limits, due to matrix interference. The associated LCS recoveries and MS/MSD RPD were within the control limits.

SQ2 - Spike outside of control limits due to matrix effect.

\*Calc Result = (Sample Result - Parent Sample Result)

APPROVED BY

Rob Greer Laboratory Director

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York, PA +1 717 505 5280 EUZSIOODY

				ALS Project Mai	nager:			AL	S Work Order #			
	Customer Information		Project Inform	lation			Para	meter/N	Aethod Request	for Analys	sis	
Purchase Order		Project Name	BNSF Skykom	iish PN 30159457	.01	A 210 D	M X		•			
Work Order		Project Number					1					
Company Name	Arcadis U.S., Inc.	Bill To Company	Arcadis U.S., I	nc.	0	210_D	KSGA_W	-				
Send Report To	Michelle Nguyen	Invoice Attn	Accounts Payi	able		0						
Advoco	1420 - 5th Ave		630 Plaza Driv	/e		- 111						
Address	Unit 2400	Address	Suite 600		bite							
City/State/Zip	Seattle, WA 98101	City/State/Zip	Highlands Rar	1ch CO 80129	0	48						
Phone	(206) 325-5254	Phone	(303) 471-369	D								
Fax	(206) .32-5.82	Fax										
e-Mail Address	Michelle.Nguyen@arcadis.com	e-Mail Address	invoices_us@	arcadis.com								
No.	Sample Description	Date	ime Matrix	Pres, #E	Bottles	AB	υ	0	ц Ц	H	ſ	Hold
1 OWT NO	T SAMPLED		Water		)	×						
12 GW2 _ U	52828	H1 22/22/10	:05 Water	-		×				)	_	
28 GW3-09	2723	17:554791	2723Water	-	2	×	×			1	- 7	
3 4 GW4 -09	12723	9127123 12	3 SU Water	-	~	×				1	~	
4 5 EW1 - 00	72823	9/20123 16	:42 Water	-		×					5	
5 6 EW2A_0	92723	9127123 13	: 50 Water	-	i	×					- ~	
8 S1-AD _04	92823	9/28/23 17	: 25 Water			×					ى	
A ST-AU DA	12923	9/28/23 17	1:25 Water	Ţ		×				1	r	
9 S1-BD0	92823	9/28/23 17	:50 Water	Ŧ		×				1	-90	
101 S1-BU _ 06	92823	9/28/23 17	:55 Water	1	1	×				)	05	
Sampler(s) Please Pr	rint & Sign	Shipment Met	B Pod	equired Turnaround	Time: (Ch	eck Box)	Other		Res	ults Due Dai	te:	
Kyle Junson	Why per	Droph	off X	STD 10 WK Days	2 W	k Days	2WkC	s/ie	24 Hour			
Relinquished by:	MASON Date: 10/2/2	3 Time: 1220 Recei	lear by:	Viokas v	N NUCK!!	otes:						
Relinquished by:	Date:	Time:	ved by (Laboratory):	Eren		Cooler ID	Cooler	Temp.	C Package: (Check (	One Box Belov	ŝ	
Logged by (Laboratory)	: Date:	Time: Chec	(ed by (Laboratory):						Level III Std QC	law Date	TRRP Chi TRRP Lev	ecklist /el IV
Preservative Key:	1-HCI 2-HNO <sub>3</sub> 3-H <sub>2</sub> SO <sub>4</sub> 4-N	VaOH 5-Na2S2O3 6	-NaHSO4 7-Ot	her 8-4°C 9-	5035				Other	, L-		
Note: 1. Any change:	s must be made in writing once samples a	nd COC Form have been s	ubmitted to ALS E	nvironmental.					Copyrigh	t 2011 by A	LS Enviro	nmental.

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C.	ALS)	Everett, WA +1 425 356 2600	Holland, Mi +1 616 399 6070		age 2 of 5	26	Middletown, PA +1 717 944 5541	Salt Lake City, UT +1 801 266 7700	York, PA +1 717 505 5280
					ALS Project Manage	2	ALS	S Work Order #:	-
	Customer Informatic	on		Project Informa	ation		Parameter/M	lethod Request for A	Analysis
Purchase Order			Project Name	<b>BNSF Skykom</b>	ish PN 30159457.01	A 210 C	W_W		
Work Order			Project Number			8			
Company Name	Arcadis U.S., Inc.		Bill To Company	Arcadis U.S., I	nc.	C 210 L	XSGA W		
Send Report To	Michelle Nguyen		Invoice Attn	Accounts Paya	able	D	8		
	1420 - 5th Ave			630 Plaza Driv	Q	ш			
Address	Unit 2400		Address	Suite 600		L			
City/State/Zip	Seattle, WA 98101		City/State/Zip	Highlands Ran	Ich CO 80129	U			
Phone	(206) 325-5254		Phone	(303) 471-369(	0	I			
Fax	(206) .32-5.82		Fax						
e-Mail Address	Michelle.Nguyen@	arcadis.com	e-Mail Address	invoices_us@a	arcadis.com	P			
No.	Sample Description		Date TI	me Matrix	Pres. # Bottle	s A B	D C	н 5	Hold
A 1 S2-AD - C	742423		9/ 29/23 1	542 Water	-	×			<u>_</u>
11 2 S2-AU - C	792923		9/29/23 15	18 Water		×			2 =
h 3 S2-BD _@	392923		9124/23 12	42 Water	-	×			1
B 4 S2-BU -0	19282859/24-	092923	9/22/23 10	ty Water	-	×			1.2 1
M 5 S3-AD 0	×22260		9127123 16:	Z i Water	-	×			2
16 83-AU_0	92723		9127/23 16:	26 Water	-	×			
16 7 S3-BD _0	528291		9/28/23 09.	30 Water		×			11,
Ŋ ₿ <sup>S3-BU</sup> _ C	292823		128/23 101	+S Water	1	×			
18 9 S3-CD	092723		9127/2315	Sis Water	1	×			81-
19 10 S3-CU - 0	M 22226	S/MSD 6	9/27/23 16:	25 Water	(M)	×			6
Sampler(s) Please F	Print & Sign		Shipment Meth	od Re	equired Turnaround Time.	(Check Box)	Other	Results D	ue Date:
hyle Jehnsen	any proce		W oped	XI (140	STD 10 Wk Days	5 WK Days	2 Wk Days	24 Hour	
Ky (e Joh	12500	Date: 10/2/23	ime: 1220 Beceiv	ed by:	Tokki Iliba	Notes:			×
Reliñquišhed by:		Date:	Time:	ed by (Laboratory): AU EVEN	from	Cooler ID	Cooler Temp.	C Package: (Check One Bo	ox Below)
Logged by (Laborator)	y):	Date: T	Time: Check	ed by (Laboratory):				Level II Std QC/Raw Date	E TRRP Level IV
Preservative Key:	1-HCI 2-HNO <sub>3</sub>	3-H2SO4 4-NaC	0H 5-Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> 6-	NaHSO4 7-Oth	ler 8-4°C 9-5035			Level IV SWB46/CLP	

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coc ID: 289091 of M Page\_

ALS Project Manager:

Project Information

Customer Information

Purchase Order

Work Order

Project Name

Project Number

Spring City, PA +1 610 948 4903 Houston, TX +1 281 530 5656 Middletown, PA +1 717 944 5541

South Charleston, WV +1 304 356 3168

York, PA +1 717 505 5280

Salt Lake City, UT +1 801 266 7700

ALS Work Order #:

5123/0000V

Parameter/Method Request for Analysis 210 DXSGA W 210 DX W υ 4 ш m BNSF Skykomish PN 30159457.01

Accounts Payable Arcadis U.S., Inc.

Invoice Attn

Bill To Company

Arcadis U.S., Inc. Michelle Nguyen

Send Report To Company Name

1420 - 5th Ave

Hold TRRP Checklist TRRP Level IV - 20 122 12 - 26 13 -- 3 22 5 38 S Results Due Date: QC Package: (Check One Box Below) 1 1 Level III Std QC/Raw Date Т Level IV SWB46/CLP Level II Std QC G 24 Hour ш X ш Cooler Temp. Ω 2 Wk: Days Other 0 m Cooler ID Required Turnaround Time: (Check Box) 5 Wk Days Notes: ∢ × ×  $\times$ × × × × × × × ш G Т 7 # Bottles 252 2230 X STD 10 WK Days Highlands Ranch C:O 80129 invoices\_us@arcadis.com Pres. -5 -<del>~</del> -Received by Aaboratory: 630 Plaza Drive (303) 471-3699 Matrix Water Checked by (Laboratory) Suite 600 09:28 1155 9:35 10:24 9/26/23 15:08 00: L1 22/92/16 9127/23 111:37 13:10 10:30 Repetved by: oft Time 0111 Shipment Method Phone City/State/Zip e-Mail Address Address Fax 9/29/23 27/23 123 drop 9127123 9127173 9127123 9/27/23 Time: 1220 Date 129 Time: 5 8 10/2/13 Date: Michelle.Nguyen@arcadis.com Date: Date: Seattle, WA 98101 Sample Description (206) 325-5254 (206) .32-5.82 ~ 220260-226220-22220--092623 -092723 st-cu-092723 042923 - 092923 ~27290-22 2260-**Unit 2400** Sampler(s) Please Print & Sign Johnson Kyle Johnson Ry Logged by (Laboratory): City/State/Zip Phone Fax e-Mail Address Address 5-W-16 nquished by: 5-W-14 5-W-18 S4-CD Relinguished by S4-AD 5-W-17 S4-BD S4-BU S4-AU 2617 29 10 9 8 4 24 5 20. R ष्ट्र 3 80 2 3

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Other

9-5035

8-4°C

7-Other

6-NaHSO

5-Na2S203

4-NaOH

3-H<sub>2</sub>SO<sub>4</sub>

2-HNO<sub>3</sub>

1-HCI

Preservative Key:
		Cincinnati, OH +1 513 733 5330	Fort Collins, CO +1 970 490 151	Chi	ain of Cus	stody Fo	rm	Housto +1 281	1, ТХ 530 5656	Spring +1 610	City, PA 948 4903	South Char +1 304 356	leston, WV 3168
A	(S)	Everett, WA +1 425 356 2600	Holland, MI +1 616 399 607	0	Page 4 of COC ID: 2	کا 8909	0	Middlet +1 717	own, PA 944 5541	Salt La +1 801	ike City, UT 266 7700	York, PA +1 717 505	5280
					ALS Projec	t Manager:			ALS	Work Or	der #:		
	Customer Information	L		Project Inf	ormation			Para	meter/Me	thod Re	quest for /	Analysis	
Purchase Order			Project Name	BNSF Sky	komish PN 3015	59457.01	A 210	DX_W					
Work Order			Project Number				ß						
Company Name	Arcadis U.S., Inc.		Bill To Company	Arcadis U.	S., Inc.		c 210	DXSGA V	>				
Send Report To	Michelle Nguyen		Invoice Attn	Accounts	Payable								
	1420 - 5th Ave			630 Plaza	Drive		ш						
Address	Unit 2400		Address	Suite 600			ш						
City/State/Zip	Seattle, WA 98101		City/State/Zip	Highlands	Ranch CO 801	29	U						
Phone	(206) 325-5254		Phone	(303) 471-	3699		н						
Fax	(206) .32-5.82		Fax				-						
e-Mail Address	Mi chelle.Nguyen@ar	rcadis.com	e-Mail Address	invoices_L	Is@arcadis.com		ſ				8		
No.	Sample Description		Date	Time M	atrix Pres.	# Bottles	A	C B	D	ш	н	۲ ۱	Hold
301 5-W-19_6	292923		7/29/231	240 Wat	er 1	-	×					127	
2 \$ 5-W-51 _ C	292923		9/29/23 10	SC Wat	er 1		×					200	
3NB 5-W-55 - 6	292822		9/28/23 15	SU Wat	er 1		×					1 2 2	
22 4 5-W-56 - C	72823	7	9/28/23 15	-30 Wat	er 1	موت	×					- 22	
M 6 2AW 9 XJ	124 FT	7-3-01242	3 9124123	Wat	er -	-	×					1 20	
35 6 2A-W-40	092823		9/28/23 13	: 62 Wat	er 1	_	×					- 1	
20 1 2A-W-41	092823		9128123 11	: US Wat	er 1		×	×				2%	
37 8 2A-W42 - (	092823		9/28/2310	: 0   Wet	er 1		×					2	
38 9 1E-W23	092723		912712317	: 30 Wat	er 1	- venant	×					200	
10 10W4- 1	VOT SAMPL	C P	•	Wat	er		×					<i>7</i> 2	
Sampler(s) Please P	Print & Sign		Shipment Met	pou	Required Turnal	round Time: (C	heck Boy	) Other			Results D	ue Date:	
Kyle Johnso	. Why held		acro	ff	X STD 10 WK De	ays	Mk Days	2Wk	Days	24 Hour			
Relinquished by:	Johnson	Date: (0/22)	Time: 12.1-0 Recei	ved by:	Und V	3 12:30	Notes:						
Relinquished by:		Date:	Time:	ved by (Laborato	ASMAT	ž	Cooler I	D Cooler	Temp. QC	Package: (	Check One Bo	x Below)	
Logged by (Laboratory	):	Date:	Time: Checi	ked by (Laborato	ry):						ttd QC/Raw Date		Checklist Level IV
Preservative Key:	1-HCI 2-HNO <sub>3</sub> 3	3-H2SO4 4-Na0	OH 5-Na2S2O3 6	-NaHSO4	7-Other 8-4°C	9-5035				Other	WNH4 BICL		
Note: 1 Any change	se muet ha mada in whiting	han onlar on the	COC Example to be a second	TA A to Attended	0 Thursday				1	1			

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South Charleston, WV +1 304 356 3168 York, PA +1 717 505 5280 Salt Lake City, UT +1 801 266 7700 EV73100004

			ALS Project Manage	er:	A	LS Work Order #:	
	Customer Information		Project Information		Parameter/	Method Request for	Analysis
Purchase Order		Project Name	BNSF Skykomish PN 30159457.01	A 210 DX W			
Work Order		Project Number		8			
Company Name	Arcadis U.S., Inc.	Bill To Company	Arcadis U.S., Inc.	C 210 DXSG	A W		
Send Report To	Michelle Nguyen	Invoice Attn	Accounts Payable	D			
Address	1420 - 5th Ave Unit 2400	Address	630 Plaza Drive Suite 600	ETUIN	1 Wet	15 200.8	KJ SIZY
City/State/Zip	Seattle, WA 98101	City/State/Zip	Highlands Ranch CO 80129	U			
Phone	(206) 325-5254	Phone	(303) 471-3699	I			
Fax	(206) .32-5.82	Fax		-			
e-Mail Address	Mi chelle.Nguyen@arcadis.com	e-Mail Address	invoices_us@arcadis.com	7			
No.	Sample Description	Date T	Time Matrix Pres. # Bottl	es A B	۵ د	E F	H L I
20 1 1CW7	092723	9/27/23 13	100 Water 1 1	×			- 29
W 2 1C-W-8	22 E2 60	912712314	: 4 5 Water 1 L	×			505-
VL3 5-W43	092323	4/29/23 H	Nater 1	×			15-1
VIE MW4 - C	226261	9/29/23/	6:03 Water 1	×			(h-
W35 FD-1-	- 042 <b>2</b> 23	9/22/2) -	Water 1	×			17-
NG E B-1-	-092723	9/27/23 17	ilo Water 1 1	$\times$			1
A H-05-1	09262023	9126/23 15	:00 Water 1,2 3	×		KN 3129	
1 8 7-03-1	5202.9260	9126123 14	:40 Waler 1,2 3	X		(12-a/29	
4-9-1 8 W	- 012723	9/23/23 -	1 mater 1	X			ر رو ا
101 FO- 4	1-012123	9129123 -	- water 1	$\checkmark$			46
Sampler(s) Please I	Print & Sign	Shipment Met	hod Required Turnaround Time	e: (Check Box)	Other	Results D	Due Date:
Myle Johnson	When the C	drop c	TH STD 10 WK Days	5 Wk Days	2 Wk Days	24 Hour	
Relinquished by:	Johnson Date: 10/2/23	Time: 1228 Repert	ved by: iolicles in the	Notes:			
Relinquished by:	Date:	Time:	ved by (Laboratory):	Cooler ID	Cooler Temp.	QC Package: (Check One Bo	ox Below)
			AND FURNERY				

Hold

Note: 1. Any changes must be made in writing once samples and COC Form have been submitted to ALS Environmental. 2. Unless otherwise agreed in a formal contract, services provided by ALS Environmental are expressly limited to the terms and conditions stated on the reverse. 3. The Chain of Custody is a legal document. All information must be completed accurately.

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TRRP Checklist TRRP Level IV

Level III Std QC/Raw Date

Level II Std QC

×

Level IV SW846/CLP

Other

77

9-5035

8-4°C

7-Other

6-NaHSO4

5-Na2S203

4-NaOH

3-H<sub>2</sub>SO<sub>4</sub>

2-HNO<sub>3</sub>

1-HCI

Preservative Key:

Checked by (Laboratory):

Time:

Date:

Logged by (Laboratory):

# ALS ENVIRONMENTAL Sample Receiving Checklist

Client: Avcadis	ALS Job #:	EV23	30000	4	
Project: BNSF SKykomish PN 3015945	7.01				_
Received Date: 10 2 23 Received Time: 12	.30	Ву: 🧕	re		_
Type of shipping container: Cooler 🖉 Box	Other				
Shipped via: FedEx Ground UPS Mail FedEx Express	Courier	H	land Deli	vered 📐	_
Were custody seals on outside of shipping container?         If yes, how many?       Where?         Custody seal date:       Seal name:	-	Yes	<u>No</u>	<u>N/A</u>	
Was Chain of Custody properly filled out (ink, signed, dated, e	etc.)?	$\varphi$			
Did all bottles have labels?		Ø			
Did all bottle labels and tags agree with Chain of Custody?		0 <del></del>	p		
Were samples received within hold time?		<u>v</u>			
Did all bottles arrive in good condition (unbroken, etc.)?		<u>\</u>			
Was sufficient amount of sample sent for the tests indicated?		P_			
Was correct preservation added to samples?		Q			
If no, Sample Control added preservative to the following: <u>Sample Number</u> <u>Reagent</u> <u>Analyte</u> 					
Were VOA vials checked for absence of air bubbles? Bubbles present in sample #:	_			Ø	
Temperature of cooler upon receipt: $\frac{1.3^{\circ}/1.8^{\circ}}{1.8^{\circ}}$ Contraction Contractio	old Cool	Ambie	ent N/A	A	
5W-43+ 43 times Many times Vary.	#35 h	as,2	Samp	es dif	Frimes
Was client contacted? Who was called?	By whom?	1059	Date:	14B	
Outcome of call:					



October 24, 2023

Mr. Kyle Haslam Arcadis U.S., Inc. 1420 - 5th Ave , Unit 2400 Seattle, WA 98101

Dear Mr. Haslam,

On October 17th, 2 samples were received by our laboratory and assigned our laboratory project number EV23100095. The project was identified as your 30159457. The sample identification and requested analyses are outlined on the attached chain of custody record.

No abnormalities or nonconformances were observed during the analyses of the project samples.

Please do not hesitate to call me if you have any questions or if I can be of further assistance.

Sincerely,

**ALS Laboratory Group** 

Rob Greer Laboratory Director

Page 1
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ALS Group USA, Corp dba ALS Environmental

www.alsglobal.com



# CERTIFICATE OF ANALYSIS Arcadis U.S., Inc. DATE:

CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U	nit 2400		DATE: ALS JOB#:	10/24/20 EV2310	)23 0095	
	Seattle, WA 98101			ALS SAMPLE#:	EV2310	0095-01	
CLIENT CONTACT:	Kyle Haslam		DA	ATE RECEIVED:	10/17/20	)23	
CLIENT PROJECT:	30159457		COLI	ECTION DATE:	10/17/20	023 12:40:00	) PM
CLIENT SAMPLE ID	GW-1_101723		WDOE AC	CREDITATION:	C601		
		SAMPLE	DATA RESULTS				
ΔΝΔΙ ΥΤΕ	METHOD	BESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	150	100	1	UG/L	10/23/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	110	100	1	UG/L	10/23/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	100				10/23/2023	DHM

Chromatogram indicates that it is likely that sample contains an unidentified diesel range product and an unidentified oil range product.

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: ALS JOB#: ALS SAMPLE#:	10/24/20 EV2310 EV2310	)23 0095 0095-02	
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam 30159457		D/ COLI	ATE RECEIVED: LECTION DATE:	10/17/20 10/17/20	)23 )23	
CLIENT SAMPLE ID	DUP-1		WDOE AC	CREDITATION:	C601		
		SAMPLE	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	140	100	1	UG/L	10/23/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	130	100	1	UG/L	10/23/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	101				10/23/2023	DHM

Chromatogram indicates that it is likely that sample contains an unidentified diesel range product and an unidentified oil range product.

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#### CERTIFICATE OF ANALYSIS

CLIENT:	Arcadis U.S., Inc.	DATE:	10/24/2023
	1420 - 5th Ave , Unit 2400	ALS SDG#:	EV23100095
	Seattle, WA 98101	WDOE ACCREDITATION:	C601
CLIENT CONTACT:	Kyle Haslam		
CLIENT PROJECT:	30159457		

#### LABORATORY BLANK RESULTS

### MB-102023W - Batch 202366 - Water by NWTPH-DX

				REPORTING	ANALYSIS	ANALYSIS
ANALYTE	METHOD	RESULTS	UNITS	LIMITS	DATE	BY
TPH-Diesel Range	NWTPH-DX	U	UG/L	100	10/23/2023	DHM
TPH-Oil Range	NWTPH-DX	U	UG/L	100	10/23/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit.

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#### CERTIFICATE OF ANALYSIS

#### CLIENT:

CLIENT CONTACT: CLIENT PROJECT: Arcadis U.S., Inc. 1420 - 5th Ave , Unit 2400 Seattle, WA 98101 Kyle Haslam 30159457 DATE: ALS SDG#: WDOE ACCREDITATION:

10/24/2023 EV23100095 C601

#### LABORATORY CONTROL SAMPLE RESULTS

#### ALS Test Batch ID: 202366 - Water by NWTPH-DX

	· · · · · · · · · · · · · · · · · · ·			LIN	IITS	ANALYSIS	ANALYSIS BY
SPIKED COMPOUND	METHOD	%REC	RPD QUAL	MIN	MAX	DATE	
TPH-Diesel Range - BS	NWTPH-DX	82.2		67	125	10/23/2023	DHM
TPH-Diesel Range - BSD	NWTPH-DX	84.0	2	67	125	10/23/2023	DHM

APPROVED BY

Rob Greer Laboratory Director

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Revenue     Source (1)     Construction of the state of the s
PCB by EPA 8082     Pesticides by EPA 8081       Metals-MTCA-5     RCRA-8     Pri Pol     TAL       Metals Other (Specify)     TCLP-Metals     VOA     Semi-Vol     Pest       Herbs     TCLP-Metals     VOA     Semi-Vol     Pest     Herbs       Date     Date     Date     Date     Date     Date       Date     Date     Date     Date     Date     Date
Image: Constraint of the constr

*Turnaround
request les
ss than sta
ndard may
r incur Rus
h Charges

# ALS ENVIRONMENTAL Sample Receiving Checklist

Client: Arcadis	ALS Job #: _	er.	2360	NGS
Project: 30159457				
Received Date: 1017103 Received Time: 15	2	Ву:	Shu	1
Type of shipping container: Cooler Box	Other			
Shipped via: FedEx Ground UPS Mail FedEx Express	Courier	]	Hand Deliv	vered
Were custody seals on outside of shipping container?         If yes, how many?       Where?         Custody seal date:       Seal name:	_	<u>Yes</u>	<u>No</u>	<u>N/A</u>
Was Chain of Custody properly filled out (ink, signed, dated,	etc.)?			
Did all bottles have labels?				
Did all bottle labels and tags agree with Chain of Custody?				
Were samples received within hold time?			) 	<u> </u>
Did all bottles arrive in good condition (unbroken, etc.)?			) 	
Was sufficient amount of sample sent for the tests indicated?			·	
Was correct preservation added to samples?		_		
If no, Sample Control added preservative to the following:         Sample Number       Reagent         Analyte				
Were VOA vials checked for absence of air bubbles? Bubbles present in sample #:		·	<u></u>	
Temperature of cooler upon receipt: Mice	Cold Cool	Amb	ient N/	A
Explain any discrepancies:				
Was client contacted? Who was called? Outcome of call:	_ By whom?		Date	):



**Data Validation Reports** 



# **BNSF Skykomish**

# **DATA REVIEW**

# Skykomish, Washington

Total Petroleum Hydrocarbon (TPH) Analyses

SDG #: EV23040003

Analyses Performed By: ALS Environmental Everett, Washington

Report #: 49616R Project: 30159458.02

# **1** Summary

This data quality assessment summarizes the review of Sample Delivery Group (SDG) # EV23040003 for samples collected in association with the BNSF Skykomish, Washington. The review was conducted as a Tier II evaluation and included review of data package completeness. Only analytical data as reported by the laboratory were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody records. Analyses were performed on the following samples:

Comula ID		Sample Collection		le Collection Barant Sample	
		Matrix	Date	Parent Sample	ТРН
1C-W-8	EV23040003-01	Water	03/28/2023		Х
5-W-17	EV23040003-02	Water	03/28/2023		Х
5-W-16	EV23040003-03	Water	03/28/2023		Х
5-W-55	EV23040003-04	Water	03/28/2023		Х
1C-W-4	EV23040003-05	Water	03/28/2023		Х
5-W-56	EV23040003-06	Water	03/28/2023		Х
5-W-14	EV23040003-07	Water	03/28/2023		Х
5-W-19	EV23040003-08	Water	03/28/2023		Х
5-W-18	EV23040003-09	Water	03/28/2023		Х
DUP-1	EV23040003-10	Water	03/28/2023	5-W-14	Х
EW-2A	EV23040003-11	Water	03/29/2023		Х
MW-4	EV23040003-12	Water	03/29/2023		Х
EW-1	EV23040003-13	Water	03/29/2023		Х
5-W-43	EV23040003-14	Water	03/29/2023		Х
2-A-W-40	EV23040003-15	Water	03/29/2023		Х
GW-1	EV23040003-16	Water	03/29/2023		Х
GW-3	EV23040003-17	Water	03/29/2023		Х
GW-2	EV23040003-18	Water	03/29/2023		Х
5W-51	EV23040003-19	Water	03/29/2023		Х
1B-W-23	EV23040003-20	Water	03/29/2023		Х
2A-W-9	EV23040003-21	Water	03/29/2023		Х
1C-W-7	EV23040003-22	Water	03/29/2023		Х
2A-W-41	EV23040003-23	Water	03/29/2023		Х
GW-4	EV23040003-24	Water	03/30/2023		Х
S3-CD	EV23040003-25	Water	03/30/2023		Х
S4-CD	EV23040003-26	Water	03/30/2023		Х
S4-AD	EV23040003-27	Water	03/30/2023		Х
S4-BD	EV23040003-28	Water	03/30/2023		Х

0			Sample Collection		Analysis
Sample ID	Lab ID	Matrix	Date	Parent Sample	ТРН
S3-AD	EV23040003-29	Water	03/30/2023		Х
S1-BU	EV23040003-30	Water	03/30/2023		Х
S4-AU	EV23040003-31	Water	03/30/2023		Х
S1-AU	EV23040003-32	Water	03/30/2023		Х
S3-BD	EV23040003-33	Water	03/30/2023		Х
S4-CU	EV23040003-34	Water	03/30/2023		Х
S3-CU	EV23040003-35	Water	03/30/2023		Х
S4-BU	EV23040003-36	Water	03/30/2023		Х
DUP-2	EV23040003-37	Water	03/29/2023	2-A-W-40	Х
DUP-3	EV23040003-38	Water	03/29/2023	EW-2A	Х
S1-BD	EV23040003-39	Water	03/30/2023		Х
S2-BU	EV23040003-40	Water	03/30/2023		Х
S2-BD	EV23040003-41	Water	03/30/2023		Х
S3-AU	EV23040003-42	Water	03/30/2023		Х
S1-AD	EV23040003-43	Water	03/30/2023		Х
S3-BU	EV23040003-44	Water	03/30/2023		Х
S2-AD	EV23040003-45	Water	03/30/2023		Х
2A-W-42	EV23040003-46	Water	03/30/2023		Х
S2-AU	EV23040003-47	Water	03/30/2023		Х
DUP-4	EV23040003-48	Water	03/30/2023	S3 AU	Х
EQUIPMENT BLANK	EV23040003-49	Water	03/30/2023		Х

# 2 Analytical Data Package Documentation

Items Reviewed		Reported		Performance Acceptable		Not
		No	Yes	No	Yes	Required
1.	Sample receipt condition		X		Х	
2.	Requested analyses and sample results		Х		Х	
3.	Master tracking list		X		Х	
4.	Methods of analysis		X		Х	
5.	Reporting limits		Х		Х	
6.	Sample collection date		Х		Х	
7.	Laboratory sample received date		X		Х	
8.	Sample preservation verification (as applicable)		Х		Х	
9.	Sample preparation/extraction/analysis dates		X		Х	
10.	Fully executed Chain-of-Custody (COC) form		Х		Х	
11.	Narrative summary of Quality Assurance (QA) or sample problems provided		х		Х	
12.	Data Package Completeness and Compliance		Х		Х	

The table below is the evaluation of the data package completeness.

## **3 Organic Analysis Introduction**

Analyses were performed according to United States Environmental Protection Agency (USEPA) Method NWTPH-DX. Data were reviewed in accordance with USEPA CLP National Functional Guidelines for Organic Superfund Methods Data Review, document number EPA 540-R-20-005, November 2020 (with reference to the historical USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, OSWER 9240.1-05A-P, October 1999, as appropriate).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and had already been subjected to sufficient quality review prior to submission.

During the review process, laboratory qualified and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes in accordance with USEPA National Functional Guidelines:

- J The compound was positively identified; however, the associated numerical value is an estimated concentration only.
- J+ The result is an estimated quantity, but the result may be biased high.
- J- The result is an estimated quantity, but the result may be biased low.
- UJ The compound was not detected above the reported sample quantitation limit. However, the reported limit is approximate and may or may not represent the actual limit of quantitation.
- NJ The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification. The associated numerical value is an estimated concentration only.
- U The compound was analyzed for but not detected. The associated value is the compound quantitation limit.
- R The sample results are rejected as unusable. The compound may or may not be present in the sample.

Two facts should be noted by all data users. First, the "R" flag means that the associated value is unusable. In other words, due to significant quality control (QC) problems, the analysis is invalid and provides no information as to whether the compound is present or not. "R" values should not appear on data tables because they cannot be relied upon, even as a last resort. The second fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

# 4 Total Petroleum Hydrocarbons (TPH) Analyses

### 4.1 Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
NWTPH-DX	Water	<ul> <li>14 days from collection to extraction and 40 days from extraction to analysis (preserved)</li> <li>7 days from collection to extraction and 40 days from extraction to analysis (Unpreserved)</li> </ul>	Cool to <6 °C

The analyses that exceeded the holding are presented in the following table.

Sample IDs	Holding Time	Criteria	
1C-W-8			
5-W-17			
5-W-16			
5-W-55			
1C-W-4			
5-W-56			
5-W-14			
5-W-19			
5-W-18			
DUP-1			
EW-2A	6.4°C	Cool to <6 °C	
MW-4			
EW-1			
5-W-43	0.4 C		
2-A-W-40			
GW-1			
GW-3			
GW-2			
5W-51			
1B-W-23			
2A-W-9			
1C-W-7			
2A-W-41			
GW-4			
S3-CD			
S4-CD			

Sample IDs	Holding Time	Criteria
S4-AD		
S4-BD		
S3-AD		
S1-BU		
S4-AU		
S1-AU		
S3-BD		
S4-CU		
S3-CU		
S4-BU		
DUP-2		
DUP-3		
S1-BD		
S2-BU		
S2-BD		
S3-AU		
S1-AD		
S3-BU		
S2-AD		
2A-W-42		
S2-AU		
DUP-4		
EQUIPMENT BLANK		

Sample results associated with sample locations analyzed by analytical method NWTPH-DX were qualified, as specified in the table below. All other holding times were met.

	Qualification			
Criteria	Detected Analytes	Non-detect Analytes		
Analysis completed past holding time	J	UJ		

### 4.2 Blank Contamination

Quality assurance (QA) blanks (i.e. laboratory method blanks and equipment rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Rinse blanks also measure contamination of samples during field operations. Target compounds were not detected above the RL in the associated blanks; therefore, detected sample results are not associated with blank contamination.

### 4.3 Surrogates/System Monitoring Compounds

All samples to be analyzed for organic compounds are spiked with surrogate compounds prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique. The analysis requires surrogate compounds exhibit recoveries within the laboratory-established acceptance limits.

All samples exhibited surrogate recoveries within the control limits with the exceptions noted below.

Sample IDs	Surrogate	Recovery
EW-2A GW-1	C25	> UL

Note:

UL Upper control limit

The criteria used to evaluate the surrogate recoveries are presented in the following table. In the case of a surrogate deviation, the sample results are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
S10	Non-detect	No Action
	Detect	J
$\sim 11$ but > 10%	Non-detect	UJ
	Detect	J
< 10%	Non-detect	R
	Detect	J
Surrogates diluted below the calibration curve due to the high	Non-detect	UJ <sup>1</sup>
concentration of a target compounds	Detect	J <sup>1</sup>

Note:

<sup>1</sup> A more concentrated analysis was not performed with surrogate compounds within the calibration range; therefore, no determination of extraction efficiency could be made.

### 4.4 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the laboratory-established acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must exhibit an RPD within the laboratory-established acceptance limits.

Note: The MS/MSD recovery control limits do not apply for MS/MSD performed on samples where the compound concentration detected in the parent sample exceeds the MS/MSD concentration by a factor of four or greater.

MS/MSD analysis was performed on a sample S4-AU. MS/MSD analysis exhibited recoveries and RPDs within the control limits.

## 4.5 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) Analysis

The LCS/LCSD analysis is used to assess the precision and accuracy of the analytical method independent of matrix interferences. The compounds associated with the LCS/LCSD analysis must exhibit a percent recovery within the laboratory-established acceptance limits. The RPD between the LCS and LCSD results must be within the laboratory-established acceptance limits.

All compounds associated with the LCS/LCSD analyses exhibited recoveries and RPDs within the control limits.

### 4.6 Field Duplicate Sample Analysis

The field duplicate sample analysis is used to assess the precision of the field sampling procedures and analytical method. The control limit of 30% for water matrices and 50% for soil matrices is applied to the RPD between the parent sample and the field duplicate sample results. In the instance when the parent and/or duplicate sample concentrations are less than or equal to five times the reporting limit (RL), a control limit of two times the RL for water matrices or three times the RL for soil matrices is applied to the difference between the results.

Sample ID/Duplicate ID	Compound	Sample Result (UG/L)	Duplicate Result (UG/L)	RPD
5-W-14 / DUP-1	All compounds	U	U	AC
2-A-W-40 / DUP-2	TPH-Oil Range	280	330	AC
EW-2A / DUP-3	All compounds	U	U	AC
S3-AU / DUP-4	TPH-Diesel Range	160	170	AC

Results for duplicate samples are summarized in the following table.

Note:

AC Acceptable

The calculated RPDs between the parent sample and field duplicate were acceptable.

### 4.7 Compound Identification

The retention times of all quantitated peaks must fall within the calculated retention time windows.

All identified compounds met the specified criteria.

## 4.8 System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

### 4.9 **Data Validation Checklist for Total Petroleum** Hydrocarbon (TPH)

TPH: NWTPH-DX		Reported		mance otable	Not Required
	No	Yes	No	Yes	Required
Gas Chromatography/Flame- and Photo- Ionization Detect	ors (GC/F	ID/PID)			
Tier II Validation					
Holding Times/Preservation		Х	Х		
Reporting Limits (Units)		Х		X	
Blanks					
A. Method Blanks		Х		Х	
B. Trip Blanks	Х				Х
C. Equipment Blanks		Х		X	
Surrogates Accuracy (%R)		Х	Х		
Matrix Spike (MS) %R		Х		Х	
Matrix Spike Duplicate (MSD) %R		Х		Х	
MS/MSD Precision (RPD)		Х		Х	
Laboratory Control Sample (LCS) %R		Х		Х	
Laboratory Control Sample Duplicate (LCSD) %R		Х		Х	
LCS/LCSD RPD		Х		Х	
Laboratory Duplicate Sample RPD	Х				Х
Field Duplicate Sample RPD		Х		Х	
Dilution Factor		Х		X	
Moisture Content	Х				Х
Notes:					

%R - percent recovery RPD - relative percent difference

Validation Performed By:	Hareesha Naik
Signature:	Halic
Date:	May 09, 2023
Peer Review:	Jennifer Singer
Date:	May 9, 2023

											EVa	230	40	2003
Company Namerau	*****	Billing Infor	mation:					An	alvsis /	Containe	er / Preservative	Paratzanti		Chain of Custody Page <u>1</u> of
Arcadis - <del>Chevron - WA</del>		Attn: Acc	ounts Pavable		Pres									
		630 Plaza	Dr., Ste. 600		Chk	X			:			1.11		Para
1100 Olive Way		Highland	s Ranch, CO 80	129		š/IU					1209.00			PEOPLE ADVANCING SCIENCE
Suite 800						lor	· . [				Alexand .			
Report to:	-	Email To:	KYLE. HAS	LAMOI	FRIA	る王	CON							MT JULIET, TN
James O'Connell/Sydney Clark K	YLE HASLA	M <del>Sydney.Cla</del>	rk@arcadis.com;A	manda.Bowr	ing@a	Aec		5		1				12065 Lebanon Rd Mount Juliet, TN 37122 Submitting a sample via this chain of custody
Project Description: 200410 BUSF SKY	Colle	State ected: SKXK0	MISH, WA	Please Cir PT MT C	cle: T ET	Wh/dm	a l	ml/Si	consect.		and and a second			constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard- terms.pdf
Phone: <del>206-325-5254-</del> 206 726 4753	Client Project # 3 30053829.25.2 BNSF SK	0144053 F LYKOMES4	Lab Project # CHEVARCWA	200410	-	40mlA	CIL-NoP	1eOH10	NoPres					sdg # EJ2040003
Collected by (print): FIIZABENH SCHELLER	Site/Facility ID # 15510 AURORA	AVEN	P.O. #			260Ľ	a <del>80</del> 2	W/qu	əzClr					Acctnum: CITEVARCWA
Collected by (signature)	Rush? (Lab M	IUST Be Notified)	Quote #			DC 8	silic	imlAi	10'8'					Template:1220745-
Immedia <u>tely</u> Packed on Ice NY	Same Day Next Day Two Day Three Day	Five Day 5 Day (Rad Only) 10 Day (Rad Only)	Date Results	Needed	No. of	M,EDB,E	HDX no	HGX 40	Lead 60					Pret <del>ogin, 19<b>67072</b></del> PM <del>: 110 - Brian Ford -</del> PB:
Sample ID	Comp/Grab Ma	atrix * Depth	Date	Time	Cntrs	BTEXI	ITWN	ITWI	<b>fotal</b>					Shipped Via: Remarks Sample # (lab only)
1C -W-8	G1 GW	<del>~ 22</del>	3-28-23	0945	1		*							
5-W-17	1 GW	ss.		0950	1		$\mathbf{x}$						2	
5- W- 16		-55-		1115	1		×						3	
5-W-55		-55-4		1610	1.		X						ý	
1C-W-4		<u>ss</u>		1100	1		X						5	
5-W-56		-55-		1605	] ]		×						6	
5- W- 14		55		1240			×						7	
5- W- 19		-55-		1408	ł		X						8	
5-W-18		<del>-ss</del>		<b>\$</b> 1510			×						9	
DUP-1	* *	-55	*		1		$\left  \right\rangle$	i suite and					10	
* Matrix: SS - Soil AIR - Air F - Filter GW - Groundwater B - Bioassay	marks: STD -	TAT							pН		Temp	COC Se COC Si Bottle	Sampl al Pre gned/A s arri	e Receipt Checklist sent/Intact: NP Y N. sccurate: Y N ve intact: Y N
WW - WasteWater DW - Drinking Water OT - Other	mples returned via:		Trackir	g#					Flow		Other	Correc Suffic	t bott ient v	les used: Y N olume sent: Y N If Applicable
Relinquished by-(Signature)	UPS FedEx		: Receiv	by: (Signa)	ure)			UU. T	rip Blan	k Receiv	ed: Yes/No	VOA Ze Preser RAD Sc	ro Hea vation reen <	dspace:YN Correct/Checked:YN 0.5 mR/nr:YN
	- 3-3	51-23 15	20/2		-	3-31	-23	15:20			TBR	14		
keiinquishea ny : (>gnature)	Date:	lime		eu by: (Signat	ure)			T	emp:	°C	Dornes Received:	iii prese	ivation	required by Login: Date/Time
Relinquished by : (Signature)	Date:	Time	: Receive	ed for lab by:	(Signat	ure)		D	)ate:		Time:	Hold:	28	Condition: NCF / OK

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Arcadic - Chovron - WA			Billing Infor	mation:					<u></u>	nalvsis	/ Contain	er / Preservative	•		Chain of Custody Page 2 of 6
	-		Attn: Acc	ounts Payable	•	Pres					(Periodia)	20504			~ ~
1100 Olive Way			630 Plaza	Dr., Ste. 600	1120		l β V		100				a la composition de la compo	<u> </u>	Pace
Suite 800			mgmanu	s ranch, cu o	5129		Ĩ								PEOPLE ADVANCING SCIENCE
Seattle. WA 98101							Ę								
James O'Connell/Sydney Clark			Email To: Sydney.Cla	rk@arcadis.com;/	manda.Bow	ing@a	eÕ		and the second sec						12065 Lebanon Rd Mount Juliet, TN 37122
Project Description:		City/State			Please Ci	rcle:	W/	t.	/S/II		. J		101		Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the
200410		Collected:			PT MT C	TET	ф Мр	1es	Ĩ	. 1896) 1	S				Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard- terms.pdf
Phone: 206-325-5254	Client Project	t# <del>.25.21</del> F <i>S</i> K-Y	Kows	Lab Project # CHEVARCWA	-200410		40mlA	CI-Nor	IeOH10	NoPres	s/v				SDG # EU23040003
Collected by (print):	Site/Facility 15510 AU	id # RORA AVE	N	P.O. #			260D	1 <del>803</del>	W/qu	izClr-					Table #
Collected by (signature):	Rush?	(Lab MUST Be	Notified)	Quote #			C 8	IIIce	IAn	80	X				Acctnum: CHEVARCVVA
	Same I	Day Five I	Day				ED	0 S	- MO	01(	Ó		Actor 1		Prelogin: <b>P967077</b>
Immediately	Next D Two D	ay5 Day ay10 Da	(Rad Only) IV (Rad Only)	Date Result	s Needed	No	DB	ХЛ	X	9 P	t				PM: 110 - Brian Ford
Packed on Ice N Y	Three	Day				of	A,E	Э.Н.С	E E	Lea					PB:
Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	Cntrs	STEX	WWTF	IWTF	otal	NN				Shipped Via:     Remarks       Remarks     Sample # (lab only)
EW- ZA	6	<del>59</del> 614	J	3-29-23	1702	1		$\times$						11	
MW-4	1	- 44			1015	1		×						12	
EW-1		-99-			127()			×						12	
5-W- 42;		55			1250	1		×						ID IV	
2-A-W-40		55			1445	1		X						15	
GW-1					1210			≫				1000		16	
GW-3		.55-	1		1700	2		×			$\mathbf{X}$			17	
GW-Z		.ss			1345			×						19	
5W-51		<del>55</del>			1300	Ī		×						19	
1B-W-Z3	*	* بور		×	1535	1		$\mathbf{\hat{\mathbf{x}}}$						20	
* Matrix: SS - Soil AIR - Air F - Filter GW - Groundwater B - Bioassay WW - WasteWater	lemarks:	STO	INT.	-						pH Flow		Temp	COC Se COC Si Bottle	Sampl al Pre gned/1 s arr	e Receipt Checklist sent/Intact: NP Y N Accurate: Y N ive intact: Y N
DW - Drinking Water OT - Other	Samples returned UPS FedEx	d via: ( Courier		Trackir	ng #			-1909.				The design of the second	Suffic	ient v	volume sent: Y N If Applicable
Relinquished by : (Signature)	> D	ate:	Time:	Receiv	ed by: (Signat	ure)			Т	rip Blar	ık Receive	ed: Yes/No	VOA Ze Preser	ro Hea vation	Adspace: Y N 1 Correct/Checked: Y N CO 5 mB/hr: Y
X	l'	5312	3 12	ZO B	beg	3-3	1-23	<i>lT=</i> ₄	20			HCL / MeoH TBR			
Relinquished by : (Signature)	D	ate:	Time:	Receiv	ed by: (Signat	ure)			T	emp:	°C	Bottles Received:	If prese	rvation	required by Login: Date/Time
Relinquished by : (Signature)	D	ate:	Time:	Receiv	ed for lab by:	(Signat	ure)		D	ate:	oundaide Said	Time:	Hold:		Condition: NCF. / OK
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Company Name/Address:				Billing Infor	mation:						Ar	alvsis	/ Contain	er / Preservative		3	Chain of Custody Page 3 of 6
Arcadis - Chevron - WA	L			Attn: Acc 630 Plaza	ounts	Payable te. 600	2	Pres Chk	*				ndbatts net:				R
1100 Olive Way Suite 800 Seattle. WA 98101				Highland	s Rancl	h, CO 80	0129		10ml/s			:					PEOPLE ADVANCING SCIENCE
Report to:				Email To:					E								MT JULIET, TN
James O'Connell/Sydney Clark-				Sydney.Cla	rk@arca	dis.com,	manda.Bowi	ing@a	Vel		¥		J				12065 Lebanon Rd Mount Juliet, TN 37122 Submitting a sample via this chain of custody
Project Description:			City/State Collected:				Please Ci PT MT C	rcle: T ET	l/quu	4	ml/S		5				constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard- terms.odf
Phone <del>: <b>206-325-525</b>4</del>	Client Pro <b>300638</b>	oject # 329.2	5.21 5.221	r DMG 1	Lab Pro CHEV	iject # ARCWA	-200410		40mlA	an Nop	eOH10	NoPres	3				SDG #
Collected by (print):	Site/Faci	ility ID i AURC	# ORA-AVE I	¥	P.O. #				260D	\$02(	W/qu	NZCIF-I					Table #
Collected by (signature):	Rusi	<b>h?</b> (La ame Day	b MUST Be l	Notified) Day	Quote	#			S,EDC 8	no sillo	40mlAr	5010.80	XQ			-	Template <b>T220745</b> Prelogin: <b>P967072</b>
Immediately Packed on Ice N Y	Tv Th	wo Day nree Day	5 Day 10 Da /	y (Rad Only)	Da	te Kesult	s Needed	No. of	VI,EDE	ХОНо	HGX	Lead	E				PM: 110 - Brian Ford PB:
Sample ID	Comp/G	Grab	Matrix *	Depth	D	ate	Time	Cntrs	втехи	NWTF	NWTF	<b>Fotal</b>	32		- 194 - 194		Shipped Via: Remarks Sample # (lab only)
24- W-9	G	л ((	W 557		3-24	1-23	1155	1	100	$\times$				10.82536		21	
1C-W-7	1		-55-			1	1410	1		~		w				22	
2A- W- 41			-55-	Ì	1	$\star$	1600	2		$\times$	da la j		$ \mathbf{X} $			23	
6w-4			-55-		3-	50-23	1750			×					1.22	24	
53-CD				,	l	1	1449	1		×						ar	
54 - CD			_SS_	İ			1655	1		×						26	
SH-AD			55				1549	1		$\checkmark$		*****				a7	
54 - BD			-35				1624			$\times$						28	
53- AD			55-				1316	1		×						29	
SI-BU	>	K	¥ 55		-	×	1205	1		$\boldsymbol{\times}$						30	
* Matrix: SS - Soil AIR - Air F - Filter GW - Groundwater B - Bioassay WW - WasteWater	Remarks:	Sin	DIA									pH Flow		Temp Other	_ COC S COC S Bottl Corre	Samp eal Pr igned/ es arr ct bot	le Receipt Checklist esent/Intact: _NP _Y _N Accurate: _Y _N ive intact: _Y _N tles used: _Y _N
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Relinquished by (Signature)		Date	e:	Time:	C	Receiv	ed by: (Signat	ure)			Te	emp:	°C	Bottles Received	if pres	ervation	required by Login: Date/Time
Relinquished by : (Signature)		Date	e:	Time:	:	Receiv	ed for lab by:	(Signat	ure)		D	ate:	1.46	Time:	Hold:		Condition: NCF / OK

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Company Name/Address:			Billing Infor	mation:	**************	Ι			Ar	nalvsis /	/ Contair	ner / Pres	ervative			Chain of Custody	Page <b>4</b> of <b>6</b>
Arcadis - Chevron - WA			Attn: Acc	ounts Paya	able	Pres											
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James O'Connell/Sydney Clark			Sydney_Cla	rk@arcadis.e	em;Amanda.Bow	ring@a	vie(		5							12065 Lebanon Rd Mou Submitting a sample via	nt Juliet, TN 37122 this chain of custody
Project Description: 200410		City/State Collected:			Please Ci PT MT C	rcle: T ET	mb//	E.	s/Im	in an						constitutes acknowledge Pace Terms and Condition https://info.pacelabs.co terms.pdf	nent and acceptance of the ms found at: m/hubfs/pas-standard-
Phone: <del>2<b>06-325-5254</b></del>	Client Project 30063829	ct# 7.25.21 * SKYK0	MDIT	Lab Project : CHEVARC	# WA-200410	>	40mlA	St-Not	eOH10	NoPres						SDG #	
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Collected by (signature):	Rush?	(Lab MUST Be Day Five I	Notified) Day	Quote #			EDC 8	o silica	OmlAn	010.80						Template: <b>T22</b>	VARCIVA 0745 7072
Immediately Packed on Ice N Y	Next I Two D Three	Day5 Day Day10 Da Day	(Rad Only) y (Rad Only)	Date Re	esults Needed	No. of	A,EDB,	n XOH	HGX 4	Lead 6						PM: 110 - Brian PB:	Ford
Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	Cntrs	зтехи	WWTP	WWTP	otal				1		Shipped Via: Remarks	Sample # (lab only)
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<u>Ms</u>					1550	╡╌		$\succ$						1.0	3		
-MSD					1550	,	_	柬									
SI- AV		55			1235			$\times$							34	32	
53- BD		55-			1355		0.00	$\succ$							35	33	
S4 - CU		55			1700	1		×							36	34	
53-CU		-53			1449	, 1		$\times$							37-	35	
54 - BV	····	35		X	1630	)		$\times$					-		38	36	
DUP-2		. S <del>S</del> -		3-29	23	)		$\times$			1000		6		37	37	
DUP-3	×	*55		3-29-	13 -	1	1.43y	$\times$							50	33	
* Matrix: Re SS - Soil AIR - Air F - Filter GW - Groundwater B - Bioassay WW - WasteWater	emarks:	STO	TAT							pH Flow		_ Temp_		COC Se COC S: Bottle	<u>Sampl</u> eal Pre igned/ <i>R</i> es arri	e Receipt Che sent/Intact: accurate: ve intact:	$ \begin{array}{c} \underline{\overset{\text{acklist}}{\overset{\text{NP}}{=} \overset{\text{Y}}{=} \overset{\text{N}}{\overset{\text{Y}}{=} \overset{\text{N}}{\overset{\text{N}}{=} \overset{\text{N}}{\overset{\text{Y}}{=} \overset{\text{N}}{\overset{\text{N}}{=} \overset{\text{N}}{\overset{\text{Y}}{=} \overset{\text{N}}{\overset{\text{N}}{=} \overset{\text{N}}{\overset{\text{Y}}{=} \overset{\text{N}}{\overset{\text{N}}{=} \overset{\text{N}}{\overset{N}}{\overset{\text{N}}{=} \overset{\text{N}}{\overset{N}}{\overset{N}} \overset{\text{N}}{\overset{N}}{\overset{N}} \overset{\text{N}}{\overset{N}}{\overset{N}}{\overset{N}}{\overset{N}}{\overset{N}}{\overset{N}}{\overset{N}}{\overset{N}}{\overset{N}}{\overset{N}}{\overset{N}} \overset{N}{\overset{N}}{$
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Company Name/Address:			Billing Infor	mation:		Ì			Ar	nalvsis /	Contain	er / Pres	ervative	-		Chain of Custod	y Page <b>S</b> o	f
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James-O'Connell/Sydney Clark			Sydney.Cla	rk@arcadis.com;A	manda.Bowi	ing@a	eO									12065 Lebanon Rd M	ount Juliet, TN 37122	
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Packed on Ice N Y	Three	Day .	iy (Kau Ohiy)			No.	Ľ.	Q	9 T	ea						PB:		
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Relinquished by : (Signature)	D	ate:	Time:	Receive	ed for lab by:	(Signat	ure)		D	ate:		Time:		Hold:			Condition	
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Company Name/Address:			Billing Infor	mation:			L		Δ	nalvsis /	Contain	er / Preservati	ve .	kana ana		Chain of Cust	ody Page 6 of
Arcadis - Chevron - WA			Attn: Acc	ounts Pavable	e	Pres		1.4									-
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Seattle. WA 98101 Report to:			Email To:				Ŧ			ан. А.		(A)				МТ	UNET TN
Ja <del>mes O'Connell/Sydney</del> Clark	_		Sydney Cla	rk@a <del>rcadis.com;</del>	Amanda.Bow	ring@a	e O									12065 Lebanon Rd	Mount Juliet, TN 37122
Project Description:	-	City/State	<u> </u>	<u> </u>	Planca Ci		- X		Syi							Submitting a samp constitutes acknow	le via this chain of custody vledgment and acceptance of the
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\* **\*** . . . . .



#### CERTIFICATE OF ANALYSIS

CLIENT:	Arcadis U.S., Inc.			DATE:	4/12/202	23		
	1100 Olive Way, Si	uite 800		ALS JOB#:	EV2304	0003		
	Seattle, WA 98101			ALS SAMPLE#:	EV2304	0003-01		
CLIENT CONTACT:	Kyle Haslam		D	ATE RECEIVED:	03/31/20	)23		
CLIENT PROJECT:	BNSF Skykomish		COL	LECTION DATE:	3/28/202	23 9:45:00 A	М	
CLIENT SAMPLE ID	1C-W-8		WDOE A	CCREDITATION:	C601			
		SAMPLE	DATA RESULTS					
	METHOD		REPORTING LIMITS	DILUTION FACTOR		ANALYSIS A	ANALYSIS BY	3
TPH-Diesel Range	NWTPH-DX		100	1	UNITS UG/L	04/07/2023	DHM	
TPH-Oil Range	NWTPH-DX	J 03	100	1	UG/L	04/07/2023	DHM	
		•				ANALYSIS A		S
SURROGATE	METHOD	%REC				DATE	BY	
C25	NWTPH-DX	103				04/07/2023	DHM	

U - Analyte analyzed for but not detected at level above reporting limit.

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:	4/12/202 EV2304 EV2304	23 0003 0003-02	
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/28/202	)23 23 9:50:00 /	λM
CLIENT SAMPLE ID	5-00-17	SAMPLE I	DATA RESULTS	CREDITATION:	C601		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	Ψ . υ.ι	100	1	UG/L	04/07/2023	DHM
TPH-Oil Range	NWTPH-DX	UV SC	100	1	UG/L	04/07/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	116				04/07/2023	DHM

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		CERTIFIC	ATE OF ANALYSI	S			
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:	4/12/202 EV2304 EV2304	23 0003 0003-03	
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish 5-W-16		CO	DATE RECEIVED: LLECTION DATE:	03/31/20 3/28/202 C601	)23 23 11:15:00	AM
	5-00-10	SAMPLE	E DATA RESULTS	COREDITATION.	001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	Ψ UJ	100	1	UG/L	04/07/2023	DHM
TPH-Oil Range	NWTPH-DX	UV	100	1	UG/L	04/07/2023	
SURROGATE	METHOD	%REC				DATE	ВҮ
C25	NWTPH-DX	100				04/07/2023	DHM

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		CERTIFICA	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:	4/12/202 EV2304 EV2304	23 0003 0003-04	
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/28/202	)23 23 4:10:00 F	PM
CLIENT SAMPLE ID	5-00-55	SAMPLE	DATA RESULTS	COREDITATION.	001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	ΨlUJ	100	1	UG/L	04/07/2023	DHM
TPH-Oil Range	NWTPH-DX	U \V	100	1	UG/L	04/07/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	108				04/07/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit..

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		CERTIFICA	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:	4/12/202 EV2304 EV2304	23 0003 0003-05	
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish 1C-W-4		D/ COLI WDOE AC	ATE RECEIVED: LECTION DATE: CCREDITATION:	03/31/20 3/28/202 C601	)23 23 11:00:00	AM
		SAMPLE	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	100 J 🏹 UJ	100 100	1 1	UG/L UG/L	04/07/2023 04/07/2023	DHM DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	104				04/07/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit. Chromatogram indicates that it is likely that sample contains an unidentified diesel range product.

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		CERTIFIC	CATE OF ANALYSIS	S			
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:	4/12/202 EV2304 EV2304	23 0003 0003-06	
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish 5-W-56		ו CO WDOE A	DATE RECEIVED: LLECTION DATE: ACCREDITATION:	03/31/20 3/28/202 C601	)23 23 4:05:00 F	PM
		SAMPL	E DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	2800 J	500	5	UG/L	04/09/2023	DHM
TPH-Oil Range	NWTPH-DX	1800 🗸	500	5	UG/L	04/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 5X Dilution	NWTPH-DX	87.6				04/09/2023	DHM

Chromatogram indicates that it is likely that sample contains an unidentified diesel range product and an unidentified oil range product.

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:		4/12/2023 EV23040003 EV23040003-07		
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish 5-W-14		D COL WDOE A	DATE RECEIVED: COLLECTION DATE: WDOE ACCREDITATION:		03/31/2023 3/28/2023 12:40:00 PM C601		
	• • • • •	SAMPLE	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	Ψ [	100	1	UG/L	04/08/2023	DHM	
TPH-Oil Range	NWTPH-DX		100	1	UG/L	04/08/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	99.6				04/08/2023	DHM	

U - Analyte analyzed for but not detected at level above reporting limit.

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/20 ALS JOB#: EV230 ALS SAMPLE#: EV230				
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish 5-W-19		D, COLI WDOF AC	ATE RECEIVED: LECTION DATE:	03/31/20 3/28/202 C601	03/31/2023 3/28/2023 2:08:00 PM C601		
	0 11 10	SAMPLE	DATA RESULTS		0001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	Y I UJ	100	1	UG/L	04/08/2023	DHM	
TPH-Oil Range	NWTPH-DX	↓ ↓	100	1	UG/L	04/08/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	109				04/08/2023	DHM	

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/20 ALS JOB#: EV230 ALS SAMPLE#: EV230				
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish 5-W-18			ATE RECEIVED: LECTION DATE:	03/31/20 3/28/202 C601	03/31/2023 3/28/2023 3:10:00 PM C601		
	5 10 10	SAMPLE	DATA RESULTS	DOILEDITATION.	0001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	ΨUJ	100	1	UG/L	04/08/2023	DHM	
TPH-Oil Range	NWTPH-DX	0 🗸	100	1	UG/L	04/08/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	106				04/08/2023	DHM	

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/20 ALS JOB#: EV2304 ALS SAMPLE#: EV2304			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish DUP-1		D COL WDOE A	DATE RECEIVED: 03/31/2023 COLLECTION DATE: 3/28/2023 WDOE ACCREDITATION: C601			
		SAMPLE	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	Ψluj	100	1	UG/L	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	l √	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	107				04/08/2023	DHM

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		CERTIFICA	<b>ATE OF ANALYSIS</b>				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2023 ALS JOB#: EV230400 ALS SAMPLE#: EV230400			
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/29/202	PM	
CLIENT SAMPLE ID	EVV-ZA	SAMPLE	DATA RESULTS	CREDITATION:	C601		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	ΨUJ	100	1	UG/L	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	ប់ 🗸	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	150 SUR01				04/08/2023	DHM

SUR01 -One or more surrogate recoveries were above the upper control limits. The sample results may be biased high. U - Analyte analyzed for but not detected at level above reporting limit.

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		CERTIFI	CATE OF ANALYSIS	8			
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/20 ALS JOB#: EV2304 ALS SAMPLE#: EV2304			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish MW-4			DATE RECEIVED: LECTION DATE:	03/31/20 3/29/202 C601	)23 23 10:15:00	AM
		SAMPL	E DATA RESULTS		0001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	140 J 160 V	100 100	1 1	UG/L UG/L	04/08/2023 04/08/2023	DHM DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	105				04/08/2023	DHM

Chromatogram indicates that it is likely that sample contains an unidentified diesel range product and light oil. Diesel range product results biased high due to oil range product overlap.

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		CERTIFIC/	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2023 ALS JOB#: EV230400 ALS SAMPLE#: EV230400				
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish		D COL	ATE RECEIVED: LECTION DATE:	03/31/20 3/29/202	03/31/2023 3/29/2023 12:20:00 PM C601		
CLIENT SAMPLE ID	EVV-1	SAMPLE	DATA RESULTS	CCREDITATION:	C601			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	Ψ	100	1	UG/L	04/08/2023	DHM	
TPH-Oil Range	NWTPH-DX	UV SS	100	1	UG/L	04/08/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	110				04/08/2023	DHM	

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800	DATE: 4/12/2023 ALS JOB#: EV23040003 ALS SAMPLE#: EV23040003-14				
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/29/202	03/31/2023 3/29/2023 12:50:00 PM C601	
CLIENT SAMPLE ID	5-W-43	SAMPLE	WDOE AC	CCREDITATION:	C601		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	ΨLUJ	100	1	UG/L	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	ų√ °°	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	111				04/08/2023	DHM

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2023 ALS JOB#: EV23040003 ALS SAMPLE#: EV23040003-15			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish 2-A-W-40		D/ COLI WDOE AC	ATE RECEIVED: LECTION DATE: CCREDITATION:	03/31/20 3/29/202 C601	)23 23 2:45:00 F	PM
	-	SAMPLE	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	280 J	100 100	1	UG/L UG/L	04/08/2023 04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	106				04/08/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit. Chromatogram indicates that it is likely that sample contains weathered lube oil.

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/20 ALS JOB#: EV230 ALS SAMPLE#: EV230			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish GW-1		D, COLI WDOE AC	ATE RECEIVED: LECTION DATE:	03/31/20 3/29/202 C601	PM	
	0111	SAMPLE	DATA RESULTS	DOILEDITATION.	0001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	ΨLUJ	100	1	UG/L	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	u√ ~~	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	161 SUR01				04/08/2023	DHM

SUR01 -One or more surrogate recoveries were above the upper control limits. The sample results may be biased high.

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		CERTIFICA	TE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, Sui Seattle, WA 98101	e 800 DATE: ALS JOB#: ALS SAMPLE#:			4/12/2023 EV23040003 EV23040003-17				
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20	03/31/2023 3/29/2023 5:00:00 PM C601			
CLIENT SAMPLE ID	GW-3		WDOE AC	CREDITATION:	C601				
		SAMPLE	DATA RESULTS						
ANALYTE TPH-Diesel Range	<b>METHOD</b> NWTPH-DX w/ SGA	RESULTS 160 J	REPORTING LIMITS 100	DILUTION FACTOR	UNITS UG/L	ANALYSIS DATE 04/09/2023	ANALYSIS BY DHM		
TPH-Oil Range	NWTPH-DX w/ SGA	℃ UJ	100	1	UG/L	04/09/2023	DHM		
TPH-Diesel Range	NWTPH-DX	490	100	1	UG/L	04/08/2023	DHM		
TPH-Oil Range	NWTPH-DX	140 🗸	100	1	UG/L	04/08/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25	NWTPH-DX w/ SGA	105				04/09/2023	DHM		
C25	NWTPH-DX	106				04/08/2023	DHM		

U - Analyte analyzed for but not detected at level above reporting limit. Chromatogram indicates that it is likely that sample contains highly weathered diesel and an unidentified oil range product.

Oil range product results biased high due to diesel range product overlap.

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/20 ALS JOB#: EV2304 ALS SAMPLE#: EV2304				
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/29/202	03/31/2023 3/29/2023 1:45:00 PM C601		
	GW-2	SAMPLE	DATA RESULTS	CREDITATION.	001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	Y UJ	100	1	UG/L	04/08/2023	DHM	
TPH-Oil Range	NWTPH-DX	<b>↓ ↓</b>	100	1	UG/L	04/08/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	106				04/08/2023	DHM	

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		CERTIF	ICATE OF ANALYSIS	8			
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4 ALS JOB#: 1 ALS SAMPLE#: 1			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish 5W-51		נ CO WDOE A	DATE RECEIVED: LLECTION DATE: CCREDITATION:	03/31/20 3/29/202 C601	023 23 1:00:00 I	ЪМ
	011 01	SAMP	LE DATA RESULTS		0001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	270 J	100	1	UG/L	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	120	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	95.7				04/08/2023	DHM

Chromatogram indicates that it is likely that sample contains highly weathered an unidentified diesel range product and an unidentified oil range product.

Oil range product results biased high due to diesel range product overlap.

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2 ALS JOB#: EV230 ALS SAMPL F#: EV230				
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish 1B-W-23		D/ COLI WDOE AC	ATE RECEIVED: LECTION DATE: CCREDITATION:	03/31/20 3/29/202 C601	03/31/2023 3/29/2023 3:35:00 PM C601		
		SAMPLE [	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	ΨΙυJ	100	1	UG/L	04/08/2023	DHM	
TPH-Oil Range	NWTPH-DX	$\downarrow \downarrow$	100	1	UG/L	04/08/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	95.1				04/08/2023	DHM	

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		CERTIF	ICATE OF ANALYSIS	6				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2023 ALS JOB#: EV23040003 ALS SAMPLE#: EV23040003-21				
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish 24-W-9			DATE RECEIVED: LLECTION DATE:	03/31/20 3/29/202	03/31/2023 3/29/2023 11:55:00 AM C601		
	28-11-3	SAMP	LE DATA RESULTS	COREDITATION.	0001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	350	100	1	UG/L	04/08/2023	DHM	
TPH-Oil Range	NWTPH-DX	220 🗸 🤳	100	1	UG/L	04/08/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	91.9				04/08/2023	DHM	

Chromatogram indicates that it is likely that sample contains highly weathered diesel and lube oil.

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2023 ALS JOB#: EV23040 ALS SAMPLE#: EV23040			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish 1C-W-7		D. COL WDOE A0	ATE RECEIVED: LECTION DATE: CCREDITATION:	03/31/20 3/29/202 C601	۶M	
		SAMPLE	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	100 J ℃ UJ	100 100	1	UG/L UG/L	04/08/2023 04/08/2023	DHM DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	89.9				04/08/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit. Chromatogram indicates that it is likely that sample contains an unidentified diesel range product.

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, Su Seattle, WA 98101	ite 800		DATE: 4/12/20 ALS JOB#: EV230 ALS SAMPLE#: EV230			
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish		DA COLL	TE RECEIVED: ECTION DATE:	03/31/20 3/29/202	023 23 4:00:00 I	PM
CLIENT SAMPLE ID	2A-W-41		WDOE AC	CREDITATION:	C601		
		SAMPLE	DATA RESULTS				
ANALYTE TPH-Diesel Range	<b>METHOD</b> NWTPH-DX w/ SGA	RESULTS 110 J	REPORTING LIMITS 100	DILUTION FACTOR	UNITS UG/L	ANALYSIS DATE 04/09/2023	ANALYSIS BY DHM
TPH-Oil Range	NWTPH-DX w/ SGA	ъ UJ	100	1	UG/L	04/09/2023	DHM
TPH-Diesel Range	NWTPH-DX	310 <mark>J</mark>	100	1	UG/L	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	A n	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX w/ SGA	91.1				04/09/2023	DHM
C25	NWTPH-DX	92.9				04/08/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit. Chromatogram indicates that it is likely that sample contains highly weathered diesel.

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2 ALS JOB#: EV23 ALS SAMPLE#: EV23				
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	03/31/2023 3/30/2023 5:50:00 PM C601		
CLIENT SAMPLE ID	GW-4	SAMPLE	DATA RESULTS	CREDITATION:	C601			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	UJ UJ	100	1	UG/L	04/08/2023	DHM	
SURROGATE C25	METHOD NWTPH-DX	%REC 92.1	100	<u> </u>	UG/L	ANALYSIS DATE 04/08/2023	ANALYSIS BY DHM	

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/1 ALS JOB#: EV ALS SAMPLE#: EV				
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	03/31/2023 3/30/2023 2:49:00 PM C601		
	33-00	SAMPLE	DATA RESULTS	CCREDITATION.	001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	Ψl uj	100	1	UG/L	04/08/2023	DHM	
TPH-Oil Range	NWTPH-DX	μΛ	100	1	UG/L	04/08/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	88.6				04/08/2023	DHM	

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		CERTIFIC	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/ ALS JOB#: EV2: ALS SAMPLE#: EV2:				
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	03/31/2023 3/30/2023 4:55:00 PM C601		
CLIENT SAMPLE ID	<u>34-CD</u>	SAMPLE	DATA RESULTS	CCREDITATION.	001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	Ψ	100	1	UG/L	04/08/2023	DHM	
TPH-Oil Range	NWTPH-DX		100	1	UG/L	04/08/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	90.9				04/08/2023	DHM	

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		CERTIFIC	ATE OF ANALYSIS	5				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/ ALS JOB#: EV23 ALS SAMPLE#: EV23				
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish		COL	DATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	03/31/2023 3/30/2023 3:49:00 PM C601		
CLIENT SAMPLE ID	S4-AD		WDOE A	CCREDITATION:	C601			
		SAMPLE	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	Ψ UJ	100	1	UG/L	04/08/2023	DHM	
TPH-Oil Range	NWTPH-DX	υV	100	1	UG/L	04/08/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	94.2				04/08/2023	DHM	

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		CERTIFIC/	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2023 ALS JOB#: EV23040 ALS SAMPLE#: EV23040				
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish		D COL	ATE RECEIVED: LECTION DATE:	03/31/20 3/29/202	03/31/2023 3/29/2023 4:24:00 PM C601		
CLIENT SAMPLE ID	S4-BD		WDOE A	CCREDITATION:	C601			
		SAMPLE	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	h nì	100	1	UG/L	04/08/2023	DHM	
TPH-Oil Range	NWTPH-DX	⊎ <b>√</b>	100	1	UG/L	04/08/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	95.2				04/08/2023	DHM	

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		CERTIFIC	ATE OF ANALYSIS	\$			
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2 ALS JOB#: EV230 ALS SAMPLE#: EV230			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish S3-AD		E COI WDOE A	ATE RECEIVED: LECTION DATE: CCREDITATION:	03/31/20 3/30/202 C601	PM	
	••••	SAMPLE	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	Ų UJ	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC	100	1	UG/L	ANALYSIS DATE	
C25	NWTPH-DX	91.4				04/08/2023	DHM

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/20 ALS JOB#: EV230 ALS SAMPLE#: EV230				
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	03/31/2023 3/30/2023 12:05:00 PM C601		
CLIENT SAMPLE ID	S1-BU	SAMPLE	WDOE AC	CREDITATION:	C601			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	Y L UJ	100	1	UG/L	04/08/2023	DHM	
TPH-Oil Range	NWTPH-DX	U ↓ 00	100	1	UG/L	04/08/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	94.0				04/08/2023	DHM	

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2 ALS JOB#: EV230 ALS SAMPLE#: EV230			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish S4-AU		D/ COL WDOE AC	ATE RECEIVED: LECTION DATE: CCREDITATION:	⊳M		
		SAMPLE [	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	Ψluj	100	1	UG/L	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	U V	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	80.4				04/08/2023	DHM

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		CERTIF	ICATE OF ANALYSIS	5			
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/20 ALS JOB#: EV2304 ALS SAMPLE#: EV2304			
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	PM	
CLIENT SAMPLE ID	S1-AU	SAMP	LE DATA RESULTS	CCREDITATION:	C601		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	ΨUJ	J 100	1	UG/L	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	մ 🗸	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	92.7				04/08/2023	DHM

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/20 ALS JOB#: EV2304 ALS SAMPLE#: EV2304				
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	03/31/2023 3/30/2023 1:55:00 PM C601		
CLIENT SAMPLE ID	<u></u>	SAMPLE I	DATA RESULTS	CREDITATION.	001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	ΨΙυJ	100	1	UG/L	04/08/2023	DHM	
TPH-Oil Range	NWTPH-DX	$\psi \psi$	100	1	UG/L	04/08/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	95.3				04/08/2023	DHM	

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		CERTIFICA	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2 ALS JOB#: EV230 ALS SAMPLE#: EV230			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish S4-CU		DA COLL WDOE AC	ATE RECEIVED: LECTION DATE: CREDITATION:	03/31/20 3/30/202 C601	)23 23 5:00:00 F	PM
		SAMPLE	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	130 J ₩ UJ	100 100	1	UG/L UG/L	04/08/2023 04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	93.0				04/08/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit. Chromatogram indicates that it is likely that sample contains an unidentified diesel range product.

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		CERTIFIC/	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/20 ALS JOB#: EV230 ALS SAMPLE#: EV230				
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish S3-CU		D COL WDOE AU	ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	03/31/2023 3/30/2023 2:48:00 PM C601		
	00-00	SAMPLE	DATA RESULTS	BOREDITATION.	0001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	Ψ∣ UJ	100	1	UG/L	04/08/2023	DHM	
TPH-Oil Range	NWTPH-DX	ψŲ	100	1	UG/L	04/08/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25	NWTPH-DX	90.7				04/08/2023	DHM	

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		CERTIFIC/	ATE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/20: ALS JOB#: EV2304 ALS SAMPLE#: EV2304				
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish S4-BU		D COL WDOE A	ATE RECEIVED: LECTION DATE: CCREDITATION:	03/31/20 3/30/202 C601	03/31/2023 3/30/2023 4:30:00 PM C601		
		SAMPLE	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range	NWTPH-DX	UU ا	100	1	UG/L	04/08/2023	DHM	
SURROGATE C25	METHOD NWTPH-DX	%REC 93.1	100		UG/L	04/08/2023 ANALYSIS DATE 04/08/2023	ANALYSIS BY DHM	

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/20 ALS JOB#: EV2304 ALS SAMPLE#: EV2304			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish DUP-2		DATE RECEIVED: 03/31/2023 COLLECTION DATE: 3/29/2023 WDOE ACCREDITATION: C601				
		SAMPLE	DATA RESULTS				
	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	
TPH-Diesel Range	NWTPH-DX NWTPH-DX	دن مر 330 ا	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	101				04/08/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit. Chromatogram indicates that it is likely that sample contains weathered lube oil.

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2023 ALS JOB#: EV230400 ALS SAMPLE#: EV230400			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish DUP-3		DATE RECEIVED: 03/31/2023 COLLECTION DATE: 3/29/2023 WDOE ACCREDITATION: C601				
		SAMPLE	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	4   UJ	100	1	UG/L	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	u ↓	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	96.9				04/08/2023	DHM

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		CERTIFICA	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/20 ALS JOB#: EV230 ALS SAMPLE#: EV230			
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish		D. COL	ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	)23 23 11:20:00	AM
CLIENT SAMPLE ID	S1-BD		WDOE AG	CCREDITATION:	C601		
		SAMPLE	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	Ψluj	100	1	UG/L	04/08/2023	DHM
TPH-Oil Range	NWTPH-DX	<b>υ</b> 🗸	100	1	UG/L	04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	101				04/08/2023	DHM

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		CERTIFIC	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2023 ALS JOB#: EV230400 ALS SAMPLE#: EV230400			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish S2-BU		D COL WDOE A0	ATE RECEIVED: LECTION DATE: CCREDITATION:	RECEIVED: 03/31/2023 TON DATE: 3/30/2023 9:55:00 AN EDITATION: C601		
		SAMPLE	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	360 J 110 V	100 100	1	UG/L UG/L	04/08/2023 04/08/2023	DHM DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	91.4				04/08/2023	DHM

Chromatogram indicates that it is likely that sample contains highly weathered diesel and an unidentified oil range product. Oil range product results biased high due to diesel range product overlap.

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		CERTIFICAT	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2 ALS JOB#: EV23 ALS SAMPLE#: EV23			
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	)23 23 9:07:00 A	АM
CLIENT SAMPLE ID	52-BD	SAMPLE D	WDOE AC	CREDITATION:	C601		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	U UJ	100 100	1 1	UG/L UG/L	04/08/2023 04/08/2023	DHM DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	94.5				04/08/2023	DHM

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		CERTIFICA	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: 4/12/2023 ALS JOB#: EV23040003 ALS SAMPLE#: EV23040003-4			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish S3-AU		D/ COLI WDOE AC	ATE RECEIVED: LECTION DATE: CCREDITATION:	03/31/20 3/30/202 C601	)23 23 1:56:00 F	PM
		SAMPLE	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range TPH-Oil Range	NWTPH-DX NWTPH-DX	160 J ~₩- UJ	100 100	1	UG/L UG/L	04/08/2023 04/08/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	98.7				04/08/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit. Chromatogram indicates that it is likely that sample contains an unidentified diesel range product.

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800	DATE: 4/12/20 ALS JOB#: EV230 ALS SAMPLE#: EV230			2023 6040003 6040003-43	
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish		D/ COLI	ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	)23 23 11:26:00	AM
CLIENT SAMPLE ID	S1-AD		WDOE AC	CREDITATION:	C601		
		SAMPLE D	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	Ψ Ι	100	1	UG/L	04/09/2023	DHM
TPH-Oil Range	NWTPH-DX	$\psi \psi^{0}$	100	1	UG/L	04/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	100				04/09/2023	DHM

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:	4/12/202 EV2304 EV2304	23 0003 0003-44	
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish S3-BU		D. COL WDOF AG	ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202 C601	)23 23 1:21:00	РМ
	00.00	SAMPLE	DATA RESULTS		0001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	Ų UJ	100	1	UG/L	04/09/2023	DHM
TPH-Oil Range	NWTPH-DX	J V	100	1	UG/L	04/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	93.0				04/09/2023	DHM

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:	4/12/202 EV2304 EV2304	23 0003 0003-45	
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	)23 23 9:05:00 /	٨M
CLIENT SAMPLE ID	S2-AD	SAMPLE F	WDOE AC	CREDITATION:	C601		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	Ψ Ι	100	1	UG/L	04/09/2023	DHM
TPH-Oil Range	NWTPH-DX	$\downarrow \downarrow 03$	100	1	UG/L	04/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	93.8				04/09/2023	DHM

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:	4/12/202 EV2304 EV2304	23 0003 0003-46	
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish 2A-W-42		D/ COLI WDOF AC	ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202 C601	)23 23 6:18:00 F	PM
	2/(1/	SAMPLE I	DATA RESULTS		0001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	ΨΙυJ	100	1	UG/L	04/09/2023	DHM
TPH-Oil Range	NWTPH-DX	ΨΨ	100	1	UG/L	04/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	96.9				04/09/2023	DHM

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:	4/12/202 EV2304 EV2304	23 0003 0003-47	
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish S2-AU		D/ COLI WDOF AC	ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202 C601	)23 23 9:45:00 /	٩M
	02710	SAMPLE	DATA RESULTS		0001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	Ψιυ	100	1	UG/L	04/09/2023	DHM
TPH-Oil Range	NWTPH-DX	ψ 🗸 😳	100	1	UG/L	04/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	96.1				04/09/2023	DHM

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		CERTIFIC/	ATE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:	4/12/202 EV2304 EV2304	23 0003 0003-48	
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Kyle Haslam BNSF Skykomish DUP-4		D. COL WDOE A0	ATE RECEIVED: LECTION DATE: CCREDITATION:	03/31/20 3/30/202 C601	)23 23	
		SAMPLE	DATA RESULTS				
		RESULTS	REPORTING LIMITS	DILUTION FACTOR		ANALYSIS DATE	
TPH-Oil Range	NWTPH-DX	- <del>U-</del> UJ	100	1	UG/L	04/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25	NWTPH-DX	96.7				04/09/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit. Chromatogram indicates that it is likely that sample contains an unidentified diesel range product.

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	CERTIFIC	ATE OF ANALYSIS				
Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101	uite 800		DATE: ALS JOB#: ALS SAMPLE#:	4/12/202 EV2304 EV2304	23 0003 0003-49	
Kyle Haslam BNSF Skykomish			ATE RECEIVED: LECTION DATE:	03/31/20 3/30/202	)23 23 1:00:00 F	PM
EQUIPMENT BLA	SAMPLE	DATA RESULTS	CCREDITATION.	001		
METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
NWTPH-DX	l n	100	1	UG/L	04/09/2023	DHM
METHOD NWTPH-DX	Ψ ¥ %REC 92.9	100	1	UG/L	04/09/2023 ANALYSIS DATE 04/09/2023	ANALYSIS BY DHM
	Arcadis U.S., Inc. 1100 Olive Way, S Seattle, WA 98101 Kyle Haslam BNSF Skykomish EQUIPMENT BLAN METHOD NWTPH-DX NWTPH-DX	CERTIFIC.         Arcadis U.S., Inc.         1100 Olive Way, Suite 800         Seattle, WA 98101         Kyle Haslam         BNSF Skykomish         EQUIPMENT BLANK         SAMPLE         METHOD       RESULTS         NWTPH-DX       UJ         NWTPH-DX       UJ         NWTPH-DX       92.9	Arcadis U.S., Inc. 1100 Olive Way, Suite 800 Seattle, WA 98101 Kyle Haslam D BNSF Skykomish COL EQUIPMENT BLANK WDOE AC EQUIPMENT BLANK WDOE AC SAMPLE DATA RESULTS NWTPH-DX UJ 100 NWTPH-DX 100 METHOD %REC NWTPH-DX 92.9	CERTIFICATE OF ANALYSISArcadis U.S., Inc.DATE:1100 Olive Way, Suite 800ALS JOB#:Seattle, WA 98101ALS SAMPLE#:Kyle HaslamDATE RECEIVED:BNSF SkykomishCOLLECTION DATE:EQUIPMENT BLANKWDOE ACCREDITATION:SAMPLE DATA RESULTSMETHODWUTPH-DXNWTPH-DXUJ1001NWTPH-DXUJMETHOD%RECNWTPH-DX92.9	CERTIFICATE OF ANALYSISArcadis U.S., Inc.DATE:4/12/2021100 Olive Way, Suite 800ALS JOB#:EV2304Seattle, WA 98101ALS SAMPLE#:EV2304Kyle HaslamDATE RECEIVED:03/31/202BNSF SkykomishCOLLECTION DATE:3/30/202EQUIPMENT BLANKWDOE ACCREDITATION:C601COLLECTION DATE:SAMPLE DATA RESULTSMETHOD%RECNWTPH-DXU1001UUJ1001WTPH-DX92.992.9	Arcadis U.S., Inc.       DATE:       4/12/2023         1100 Olive Way, Suite 800       ALS JOB#:       EV2304∪003         Seattle, WA 98101       ALS SAMPLE#:       EV2304∪003-49         Kyle Haslam       DATE RECEIVED:       03/31/2023         BNSF Skykomish       COLLECTION DATE:       3/30/2023         EQUIPMENT BLANK       WDOE ACCREDITATION:       C601         SAMPLE DATA RESULTS         METHOD       RESULTS       100       1       04/09/2023         NWTPH-DX       U       U       04/09/2023       04/09/2023         NWTPH-DX       U       100       1       04/09/2023         NWTPH-DX       U       00       1       04/09/2023         NWTPH-DX       U       04/09/2023       04/09/2023         NWTPH-DX       U       04/09/2023       04/09/2023         METHOD       %REC       04/09/2023       04/09/2023   <

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## **BNSF Skykomish**

# **DATA REVIEW**

## Skykomish, Washington

Total Petroleum Hydrocarbon (TPH) Analyses

SDG #: EV23100004

Analyses Performed By: ALS Environmental Everett, Washington

Report #: 52032R Project: 30159458.02

## **1** Summary

This data quality assessment summarizes the review of Sample Delivery Group (SDG) # EV23100004 for samples collected in association with the BNSF Skykomish, Washington. The review was conducted as a Tier II evaluation and included review of data package completeness. Only analytical data as reported by the laboratory were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody records. Analyses were performed on the following samples:

Sample ID		Motrix	Sample Collection	Doront Comple	Analysis
		Matrix	Date		ТРН
GW-2_092823	EV23100004-01	Water	09/28/2023		Х
GW-3_092723	EV23100004-02	Water	09/27/2023		Х
GW-4_092723	EV23100004-03	Water	09/27/2023		Х
EW-1_092823	EV23100004-04	Water	09/28/2023		Х
EW-2A_092723	EV23100004-05	Water	09/27/2023		Х
S1-AD_092823	EV23100004-06	Water	09/28/2023		Х
S1-AU_092823	EV23100004-07	Water	09/28/2023		Х
S1-BD_092823	EV23100004-08	Water	09/28/2023		Х
S1-BU_092823	EV23100004-09	Water	09/28/2023		Х
S2-AD_092923	EV23100004-10	Water	09/29/2023		Х
S2-AU_092923	EV23100004-11	Water	09/29/2023		Х
S2-BD_092923	EV23100004-12	Water	09/29/2023		Х
S2-BU_092923 MS/MSD	EV23100004-13	Water	09/29/2023		Х
S3-AD_092723	EV23100004-14	Water	09/27/2023		Х
S3-AU_092723	EV23100004-15	Water	09/27/2023		Х
S3-BD_092823	EV23100004-16	Water	09/28/2023		Х
S3-BU_092823	EV23100004-17	Water	09/28/2023		Х
S3-CD_092723	EV23100004-18	Water	09/27/2023		Х
S3-CU_092723 MS/MD	EV23100004-19	Water	09/27/2023		Х
S4-AD_092723	EV23100004-20	Water	09/27/2023		Х
S4-AU_092723	EV23100004-21	Water	09/27/2023		Х
S4-BD_092723	EV23100004-22	Water	09/27/2023		Х
S4-BU_092723	EV23100004-23	Water	09/27/2023		Х
S4-CD_092723	EV23100004-24	Water	09/27/2023		Х
S4-CU_092723	EV23100004-25	Water	09/27/2023		Х
5-W-14_092623	EV23100004-26	Water	09/26/2023		Х
5-W-16_092623	EV23100004-27	Water	09/26/2023		Х
5-W-17_092923	EV23100004-28	Water	09/29/2023		Х

O annu la ID		<b>88</b> - 4 vite	Sample Collection	Devent Operation	Analysis
Sample ID		Matrix	Date	Parent Sample	ТРН
5-W-18_092923	EV23100004-29	Water	09/29/2023		Х
5-W-19_092923	EV23100004-30	Water	09/29/2023		Х
5-W-51_092923	EV23100004-31	Water	09/29/2023		Х
5-W-55_092823	EV23100004-32	Water	09/28/2023		Х
5-W-56_092823	EV23100004-33	Water	09/28/2023		Х
FD-3_092923	EV23100004-34	Water	09/29/2023	5-W-51_092923	Х
2A-W-40_092823	EV23100004-35	Water	09/28/2023		Х
2A-W-41_092823	EV23100004-36	Water	09/28/2023		Х
2A-W-42_092823	EV23100004-37	Water	09/28/2023		Х
1B-W-23_092723	EV23100004-38	Water	09/27/2023		Х
1C-W-7_092723	EV23100004-39	Water	09/27/2023		Х
1C-W-8_092723	EV23100004-40	Water	09/27/2023		Х
5-W-43_092923	EV23100004-41	Water	09/29/2023		Х
MW-4_092923	EV23100004-42	Water	09/29/2023		Х
FD-1_092723	EV23100004-43	Water	09/27/2023	S3-CU_092723 MS/MD	Х
EB-1_092723	EV23100004-44	Water	09/27/2023		Х
FD-2_092723	EV23100004-45	Water	09/27/2023		Х
FD-4_092923	EV23100004-46	Water	09/29/2023	5-W-43_092923	Х

Note:

TPH = Total Petroleum Hydrocarbons

Sample FD-2\_092723 is a field duplicate sample. The parent sample could not be identified.

### **2** Analytical Data Package Documentation

Items Reviewed		R	eported	Perfo Acc	rmance eptable	Not
		No	Yes	No	Yes	Required
1.	Sample receipt condition		Х		Х	
2.	Requested analyses and sample results		Х		Х	
3.	Master tracking list		Х		Х	
4.	Methods of analysis		Х		Х	
5.	Reporting limits		Х		Х	
6.	Sample collection date		Х	Х		
7.	Laboratory sample received date		Х		Х	
8.	Sample preservation verification (as applicable)		Х		Х	
9.	Sample preparation/extraction/analysis dates		Х		Х	
10.	Fully executed Chain-of-Custody (COC) form		Х		Х	
11.	Narrative summary of Quality Assurance (QA) or sample problems provided		Х		Х	
12.	Data Package Completeness and Compliance		Х		Х	

The table below is the evaluation of the data package completeness.

Note:

6. Sample ID mismatch observed between chain of custody and analysis report. Details are presented in the following table. Field sample id was considered as per chain of custody.

Field Sample ID on COC	Field Sample ID on Analysis Report
FD-2_092723	FD-2_092923

10. The Sample Receiving Checklist notes that there was disagreement between the collection times listed on the sample labels and chain of custody. The samples were logged in using the times listed on the chain of custody.

### **3 Organic Analysis Introduction**

Analyses were performed according to United States Environmental Protection Agency (USEPA) Method NWTPH-DX. Data were reviewed in accordance with USEPA CLP National Functional Guidelines for Organic Superfund Methods Data Review, document number EPA 540-R-20-005, November 2020 (with reference to the historical USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, OSWER 9240.1-05A-P, October 1999, as appropriate).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and had already been subjected to sufficient quality review prior to submission.

During the review process, laboratory qualified and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes in accordance with USEPA National Functional Guidelines:

- Concentration (C) Qualifiers
  - U The compound was analyzed for but not detected. The associated value is the compound quantitation limit.
  - B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
- Quantitation (Q) Qualifiers
  - E The compound was quantitated above the calibration range.
  - D Concentration is based on a diluted sample analysis.
- Validation Qualifiers
  - J The compound was positively identified; however, the associated numerical value is an estimated concentration only.
  - UJ The compound was not detected above the reported sample quantitation limit. However, the reported limit is approximate and may or may not represent the actual limit of quantitation.
  - JN The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification. The associated numerical value is an estimated concentration only.
  - UB Compound considered non-detect at the listed value due to associated blank contamination.
  - N The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification.
  - R The sample results are rejected.

Two facts should be noted by all data users. First, the "R" flag means that the associated value is unusable. In other words, due to significant quality control (QC) problems, the analysis is invalid and provides no information as to whether the compound is present or not. "R" values should not appear on data tables because they cannot be relied upon, even as a last resort. The second fact to keep in mind is that no compound concentration, even

if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

### 4 Total Petroleum Hydrocarbons (TPH) Analyses

#### 4.1 Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
NWTPH-DX	Water	<ul> <li>14 days from collection to extraction and 40 days from extraction to analysis (preserved)</li> <li>7 days from collection to extraction and 40 days from extraction to analysis (Unpreserved)</li> </ul>	Cool to <6 °C

All samples were analyzed within the specified holding time criteria.

#### 4.2 Blank Contamination

Quality assurance (QA) blanks (i.e. laboratory method blanks and equipment rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Rinse blanks also measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank (common laboratory contaminant compounds are calculated at ten times) is calculated for QA blanks containing concentrations greater than the reporting limit (RL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

Compounds were not detected above the RL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

#### 4.3 Surrogates/System Monitoring Compounds

All samples to be analyzed for organic compounds are spiked with surrogate compounds prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique. The analysis requires surrogate compounds exhibit recoveries within the laboratory-established acceptance limits.

All samples exhibited surrogate recoveries within the control limits with the exceptions noted below.

Sample ID	Surrogate	Recovery
2A-W-41_092823	C25 (NWTPH-DX w/ SGA)	> UL

Note:

UL = upper control limit

The criteria used to evaluate the surrogate recoveries are presented in the following table. In the case of a surrogate deviation, the sample results are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
S 10	Non-detect	No Action
	Detect	J
	Non-detect	UJ
< LL Dui > 10%	Detect	J
- 100/	Non-detect	R
	Detect	J
Surrogates diluted below the calibration curve due to the high	Non-detect	UJ <sup>1</sup>
concentration of a target compounds	Detect	J <sup>1</sup>

Note:

<sup>1</sup> A more concentrated analysis was not performed with surrogate compounds within the calibration range; therefore, no determination of extraction efficiency could be made.

#### 4.4 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the laboratory-established acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must exhibit an RPD within the laboratory-established acceptance limits.

Note: The MS/MSD recovery control limits do not apply for MS/MSD performed on samples where the compound concentration detected in the parent sample exceeds the MS/MSD concentration by a factor of four or greater.

MS/MSD analysis was performed on samples S2-BU\_092923 and S3-CU\_092723. MS/MSD analysis exhibited recoveries and RPDs within the control limits with the exceptions noted below.

Sample ID	Compound	MS Recovery	MSD Recovery
S2-BU_092923	TPH-Diesel Range	>UL	>UL

The criteria used to evaluate the MS/MSD recoveries are presented in the following table. In the case of an MS/MSD deviation, the sample results are qualified as documented in the table below.

Control Limit	Sample Result	Qualification
> the upper central limit (III )	Non-detect	No Action
	Detect	J
< the lower central limit (1.1.) but > 100/	Non-detect	UJ
< the lower control limit (LL) but > 10%	Detect	J
< 100/	Non-detect	R
	Detect	J

Control Limit	Sample Result	Qualification
Parent sample concentration > four times the MS/MSD spiking	Detect	No Action
solution concentration.	Non-detect	NO ACTION

### 4.5 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) Analysis

The LCS/LCSD analysis is used to assess the precision and accuracy of the analytical method independent of matrix interferences. The compounds associated with the LCS/LCSD analysis must exhibit a percent recovery within the laboratory-established acceptance limits. The RPD between the LCS and LCSD results must be within the laboratory-established acceptance limits.

All compounds associated with the LCS/LCSD analyses exhibited recoveries and RPDs within the control limits.

#### 4.6 Field Duplicate Sample Analysis

The field duplicate sample analysis is used to assess the precision of the field sampling procedures and analytical method. The control limit of 30% for water matrices and 50% for soil matrices is applied to the RPD between the parent sample and the field duplicate sample results. In the instance when the parent and/or duplicate sample concentrations are less than or equal to five times the reporting limit (RL), a control limit of two times the RL for water matrices is applied to the difference between the results.

Sample ID/Duplicate ID	Compound	Sample Result (UG/L)	Duplicate Result (UG/L)	RPD
S3-CU_092723 MS/MD /	TPH-Diesel Range	100 U	100	AC
FD-1_092723	TPH-Oil Range	100 U	220	AC
5-W-51_092923 /	TPH-Diesel Range	530	590	10.7%
FD-3_092923	TPH-Oil Range	220	290	AC
5-W-43_092923 / FD-4_092923	All compounds	U	U	AC

Results for duplicate samples are summarized in the following table.

Notes:

AC = acceptable

U = non-detect

The calculated RPDs between the parent sample and field duplicate were acceptable.

#### 4.7 Compound Identification

The retention times of all quantitated peaks must fall within the calculated retention time windows.

All identified compounds met the specified criteria.

### 4.8 System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

#### 4.9 **Data Validation Checklist for Total Petroleum** Hydrocarbon (TPH)

TPH: NWTPH-DX	Rep	orted	Perfor Accep	mance otable	Not Required
	No	Yes	No	Yes	Required
Gas Chromatography/Flame- and Photo- Ionization Detect	ors (GC/F	ID/PID)			
Tier II Validation					
Holding Times/Preservation		Х		Х	
Reporting Limits (Units)		Х		Х	
Blanks					
A. Method Blanks		Х		Х	
B. Trip Blanks	Х				Х
C. Equipment Blanks		Х		X	
Surrogates Accuracy (%R)		Х	Х		
Matrix Spike (MS) %R		Х	Х		
Matrix Spike Duplicate (MSD) %R		Х	Х		
MS/MSD Precision (RPD)		Х		Х	
Laboratory Control Sample (LCS) %R		Х		Х	
Laboratory Control Sample Duplicate (LCSD) %R		Х		Х	
LCS/LCSD RPD		Х		Х	
Laboratory Duplicate Sample RPD	Х				Х
Field Duplicate Sample RPD		Х		Х	
Dilution Factor		Х		Х	
Moisture Content	Х				Х
Notes:					

%R - percent recovery RPD - relative percent difference

Validation Performed By:	Hareesha Naik
Signature:	Halin
Date:	November 28, 2023
Peer Review:	Jennifer Singer
Date:	November 29, 2023

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e-Mail Address	Michelle.Nguyen@arc	adis.com	e-Mail Addre	ess	invoices	ices_us@arcadis.com			J										
No.	Sample Description	17. Sec. 19.	Date	Ti	me	Matrix	Pres.	# Bottles	A	В	С	D	E	F	G	Н	Ŀ	J	Hold
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12 GW-2_0	92823	9	128/23	14	:05 V	Vater	1	l	Х	(							_	1	
23 GW-3_00	2723	1	7:5547	91:	27/23	Vater	1	2	Х	(	Х						_	2	
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5 6 EW-2A_C	92723	C	1/27/23	13	.50 V	Vater	1	1	Х									5	
6 7 S1-AD_0	92823	9	128123	17	: 25 V	Vater	1	l	Х								-	6	
7 & S1-AUA	12823		9/28/23	17	:25 V	Vater	1	t	Х								-	7	
9 S1-BD	092823	0	128123	17	:50 V	Vater	1	1	Х								-	g	
10 S1-BU_0	92823	c	7/28/23	17	:55 V	Vater	1	1	Х								-	9	
Sampler(s) Please	Print & Sign		Shipment	t Metho Γ Ω	od	Req	uired Turnaro	ound Time: (0	Chec Wk D	k Box)	Othe	e Davs	Г	<b>1</b> 24 H	_ Re	esults I	Due Dat	e:	
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e-Mail Addres	s Michelle.Nguyen@a	rcadis.com	e-Mail Address	invoices_us(	@arcadis.com		J			_					
No.	Sample Description		Date T	ime Matr	rix Pres.	# Bottles	A	В	C D	Е	F	G	Н	I J	Hold
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12 3 S2-BD	092923	C	1/29/23 12	42 Water	1	L	X	(						- 17	
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21	5 S4-CD	92723		9/27/2	29	35	Water	1	1	Х									2	
20	6 S4-CU_0	97772		9/27/23	10	130	Water	1	1	Х									27	
20	7 5-W-14	197672		alailaz	1	·	Water	1	1	Х									25	
21	5-W-16	112023		116665	12	-08	Water	1		X									26	
001	5-W-17	16665		1116125		00	Water	1	1	X								;	27	
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e-Mail Address	Michelle.Nguyen@ar	cadis.com	e-Mail Address	in∨oi	ces_us@an	cadis.com		J										
No.	Sample Description		Date	Time	Matrix	Pres.	# Bottles	A	В	С	D	Е	F	G	Н	T	J	Hold
30 0-02-19	092923		9/29/23	240	Water	1	1	X								_	30	
3 2 5-00-51	092923		9/29/23 1	0:30	Water	1	1	X								-	31	
34 3 5-W-55 -	.092822		9/28/23 19	5:50	Water	1	1	X								_	22	
23 4 5-W-56 _	092823	2	9/28/23 10	5:30	Water	1	-	X								_	22	
31 5 -2A-149-K	54124 FE	7-3-01292	3 9/29/23	/	Water	1	(	X								_	24	
35 6 2A-W-40 -	-092823		9128123 13	3:02	Water	1	1	X									2-	
30 + 2A-W-41_	-092823		9128/23 1	11:05	Water	1		X		Х						_	36	
378 24	.092823		9/28/23 16	10:01	Water	1	ì	Х								_	-27	
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		Everett, WA +1 425 356 2600	Holland, MI +1 616 399 (	6070	Pag	e <u>S</u> of _	5	0		Middle +1 717	etown, 7 944 5	PA 541	Salt +1	t Lake Cit 801 266 7	y, UT 700	Yor +1	k, PA 717 505	5280
				_			8908	9			E	_V2	510	,000	94			
	Customer Information	1			Al Project Informati	S Project	Manager:			Dev		ALS	Work	Order #	1: 			
Purchase Order			Project Nam	ne l						Par	amet	er/ivie	τησα ι	Reques	t tor <i>i</i>	Analys	IS	
Work Order			Project Numb	er	BINST Skykomish	PN 30159	457.01	В	210_D	K_W								
Company Name	Arcadis U.S., Inc.		Bill To Compar	ny /	Arcadis U.S., Inc.			C	210 0	VOCA 1	A/							
Send Report To	Michelle Nguyen		Invoice At	tn /	Accounts Payable	9		D	210_0/	NOOM_I	/ V							
Address	1420 - 5th Ave Unit 2400		Addres	ss (	530 Plaza Drive Suite 600			E	- <del>T</del> 6-	Fal	Me	tal:	5 6	200.	8	_ KJ	5 9/	29
City/State/Zip	Seattle, WA 98101		City/State/Z	ip	-lighlands Ranch	CO 80129	)	G										
Phone	(206) 325-5254		Phor	ne (	303) 471-3699			н										
Fax	(206) .32-5.82		Fa	ax				1										
e-Mail Address	Michelle.Nguyen@arc	cadis.com	e-Mail Addres	is i	nvoices_us@arc	adis.com		J										
No.	Sample Description		Date	Tim	e Matrix	Pres.	# Bottles	A	В	С	D	E	F	G	Н	I	J	Hold
P 1 1C-V-7	092723	9	127/23 1	13:	00 Water	1	i	Х								-	39	
V6 2 1C-VV-8	092723	9	127/231	4:	45 Water	1	L	Х								-	40	
V23 5-VV-43 - 1	092923	0	1/29/23	l(:	36 Water	1	1	Х								_1	41	
V18 + MVV4 - 0	92923	9	129123	16	:03 Water	1	1	Х								-	41	
V35 FD-1_	092923	9	127/2)	~	Water	ł	l	X	<							-1	43	
Ma EB-1_	-092723	9	127/23 1	7:	iu Water	۱	۱	$ \chi$								- '	44	
X61 05	09262023	- 9	126/23 1	5:0	ou water	1,2	3	X				X	K.	7 9/2	29		-	
8 8- T-03-1	59262023	91	126/23 1	4:	40 Water	1,2	3	X				X	1<3	19/29				
Mrg FD-2	-092723	9	1/27/23		- water		1	$\times$								_	fr	
4010 FD-4	-092923	0	1/29/23	_	- water	L	1	×	4								46	
Sampler(s) Please F Kyle Johnson	Vint & Sign		Shipment I	Method A	Requ	iired Turnaro	und Time: (C		k Box)	Other	n		1 24 14	_ Res	sults E	Jue Date	Ð:	
Relinquished by:	Johnson	Date: 10/2/23 Tin	ne: 1225 Re	evelved	by:	Jallas	1)21-1-	Note	es:	2.741	2010	lines	24170					
Relinquished by:		Date: Tin	ne:	eceived	by (Laboratory):	what)	la repa	С	ooler ID	Coole	er Temp	. QC	Package	e: (Check	One Bo	ox Below	)	
Logged by (Laboratory	):	Date: Tin	ne: Cl	hecked	by (Laboratory):	<u>}</u>							Level I	II Std QC	law Date	e	TRRP ( TRRP (	Checklist .evel IV
Preservative Key:	1-HCI 2-HNO3 3	-H <sub>2</sub> SO <sub>4</sub> 4-NaOH	5-Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	6-N	aHSO <sub>4</sub> 7-Other	8-4°C	9-5035						Other	IV 3VV840/C	, L)**			

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#### CERTIFICATE OF ANALYSIS

CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/ ALS JOB#: EV231 ALS SAMPLE#: EV232			
CLIENT CONTACT:	Michelle Nguyen		D	ATE RECEIVED:	10/02/20	023	
CLIENT PROJECT:	BNSF Skykomish	3NSF Skykomish PN 30159457.01		LECTION DATE:	9/28/2023 2:05:00 PM		
CLIENT SAMPLE ID	GW-2_092823		WDOE ACCREDITATION:				
		SAMPLE D	ATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	93.8				10/09/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit.

Page 2
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		CERTIFICAT	E OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , Uni Seattle, WA 98101	t 2400		DATE: ALS JOB#: ALS SAMPLE#:			
CLIENT CONTACT:	Michelle Nguyen		D	ATE RECEIVED:	10/02/2023		
CLIENT PROJECT:	BNSF Skykomish P	BNSF Skykomish PN 30159457.01		LECTION DATE:	9/27/202	23 5:55:00	PM
CLIENT SAMPLE ID	GW-3_092723		WDOE AG	WDOE ACCREDITATION:			
		SAMPLE D	ATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	250	100	1	UG/L	10/09/2023	DHM
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX w/ SGA	110	100	1	UG/L	10/16/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX w/ SGA	U	100	1	UG/L	10/16/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	90.4				10/09/2023	DHM
C25 CAS: 629-99-2	NWTPH-DX w/ SGA	101				10/16/2023	DHM

U - Analyte analyzed for but not detected at level above reporting limit. Chromatogram indicates that it is likely that sample contains highly weathered diesel.

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		CERTIFICAT	<b>FE OF ANALYSIS</b>						
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/ ALS JOB#: EV23 <sup>/</sup> ALS SAMPLE#: EV/23 <sup>/</sup>			10/16/2023 EV23100004 EV23100004-03		
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	lichelle Nguyen NSF Skykomish PN 30159457.01		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/27/2023 12:30:00 PM			
CLIENT SAMPLE ID	GW-4_092723		WDOE AC	C601					
		SAMPLE D	ATA RESULTS						
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	130	100	1	UG/L	10/09/2023	DHM		
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	690	100	1	UG/L	10/09/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25 CAS: 629-99-2	NWTPH-DX	93.8				10/09/2023	DHM		

Chromatogram indicates that it is likely that sample contains an unidentified diesel range product and an unidentified oil range product.

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2023 ALS JOB#: EV23100004 ALS SAMPLE#: EV23100004-04				
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01		DATE RECEIVED: 10 COLLECTION DATE: 9,		10/02/2023 9/28/2023 4:42:00 PM		
CLIEINT SAMPLE ID	EVV-1_092823	SAMPLE D	DATA RESULTS	CREDITATION.	001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	95.0				10/09/2023	DHM	

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		CERTIFICAT	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2023 ALS JOB#: EV23100004 ALS SAMPLE#: EV23100004-05				
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish EW-2A 092723	Ile NguyenDATE RECEIVED:Skykomish PN 30159457.01COLLECTION DATE:A_092723WDOE ACCREDITATION:			10/02/2023 9/27/2023 1:50:00 PM C601			
		SAMPLE D	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	250	100	1	UG/L	10/09/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	115				10/09/2023	DHM	

Chromatogram indicates that it is likely that sample contains an unidentified oil range product.

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2023 ALS JOB#: EV23100004 ALS SAMPLE#: EV23100004-06			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	/lichelle Nguyen BNSF Skykomish PN 30159457.01		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/28/2023 5:25:00 PM	
CLIENT SAMPLE ID	51-AD_092623	SAMPLE D	DATA RESULTS	CREDITATION.	001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	93.0				10/09/2023	DHM

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2 ALS JOB#: EV231 ALS SAMPLE#: EV231			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/28/2023 5:25:00 PM	
	31-A0_092023	SAMPLE D	DATA RESULTS	CREDITATION.	001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	82.6				10/09/2023	DHM

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		CERTIFICAT	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 9810	nit 2400		DATE: ALS JOB#: ALS SAMPLE#:		10/16/2023 EV23100004 EV23100004-08		
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	chelle Nguyen ISF Skykomish PN 30159457.01		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/28/2023 5:50:00 PM		
CLIENT SAMPLE ID	S1-BD_092823	092823 WDOE ACCREDITATION: C						
		SAMPLE D	ATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	93.3				10/09/2023	DHM	

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2 ALS JOB#: EV231 ALS SAMPLE#: EV231			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish S1-BU 092823	PN 30159457.01	D/ COLI WDOE AC	DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/28/2023 5:55:00 PM	
	01 00_002020	SAMPLE D	DATA RESULTS	DOILEDITATION.	0001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	86.3				10/09/2023	DHM

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 9810	nit 2400		DATE: 10/16/20 ALS JOB#: EV2310 ALS SAMPLE#: EV2310			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	/lichelle Nguyen BNSF Skykomish PN 30159457.01		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/29/2023 3:42:00 PM	
CLIENT SAMPLE ID	S2-AD_092923	092923 WDOE ACCREDITATION: C6			C601		
		SAMPLE D	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	96.9				10/09/2023	DHM

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2 ALS JOB#: EV2310 ALS SAMPLE#: EV2310			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/29/2023 3:18:00 PM	
	32-A0_092923	SAMPLE F	DATA RESULTS	CREDITATION.	001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	94.5				10/09/2023	DHM

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		CERTIFICAT	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2 ALS JOB#: EV2310 ALS SAMPLE#: EV2310			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	Michelle Nguyen BNSF Skykomish PN 30159457.01		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/29/2023 12:42:00 PI	
CLIENT SAMPLE ID	S2-BD_092923			CCREDITATION:	C601		
		SAMPLE L	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	140	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	93.7				10/09/2023	DHM

Chromatogram indicates that it is likely that sample contains an unidentified oil range product.

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		CERTIFICA	TE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: ALS JOB#: ALS SAMPLE#:			10/16/2023 EV23100004 EV23100004-13		
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01	D/ COL	DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/29/2023 12:03:00 PM			
CLIENT SAMPLE ID	S2-BU_092923 MS/MSD		WDOE AC	WDOE ACCREDITATION:		C601			
		SAMPLE [	DATA RESULTS						
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	1000 J	100	1	UG/L	10/09/2023	DHM		
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	200	100	1	UG/L	10/09/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25 CAS: 629-99-2	NWTPH-DX	97.6				10/09/2023	DHM		

Chromatogram indicates that it is likely that sample contains weathered diesel and an unidentified oil range product. Oil range product results biased high due to diesel range product overlap.

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 9810	nit 2400		DATE: 10/16/2 ALS JOB#: EV231 ALS SAMPLE#: EV231			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01		ATE RECEIVED: LECTION DATE:	D: 10/02/2023 E: 9/27/2023 4:51:00 PM		
CLIENT SAMPLE ID	S3-AD_092723	SAMPLED		CREDITATION:	C601		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	92.8				10/09/2023	DHM

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		CERTIFICAT	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2 ALS JOB#: EV231 ALS SAMPLE#: EV231			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01		ATE RECEIVED: LECTION DATE:	10/02/20 9/27/202	/2023 2023 4:26:00 PM	
	33-AU_092723	SAMPLE D	DATA RESULTS	CREDITATION.	001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	95.0				10/09/2023	DHM

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 9810	nit 2400		DATE: 10/16/2023 ALS JOB#: EV23100004 ALS SAMPLE#: EV23100004			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01	D/ COLI	ATE RECEIVED: LECTION DATE:	10/02/2023 9/28/2023 9:30:00 AM		
CLIENT SAMPLE ID	S3-BD_092823		WDOE AC	CREDITATION:	C601		
		SAMPLE D	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	91.7				10/09/2023	DHM

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 1 ALS JOB#: E ALS SAMPLE#: E			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01		ATE RECEIVED: LECTION DATE:	10/02/20 9/28/202	)23 23 10:45:00	) AM
CLIENT SAMPLE ID	S3-BU_092823			CCREDITATION:	C601		
		SAMPLE L	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	97.7				10/09/2023	DHM

Page 18 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICAT	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 9810	nit 2400		DATE: 10/16 ALS JOB#: EV23 ALS SAMPLE#: EV23				
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01	D/ COLI	ATE RECEIVED: LECTION DATE:	10/02/20 9/27/202	10/02/2023 9/27/2023 3:55:00 PM		
CLIENT SAMPLE ID	S3-CD_092723		WDOE AC	CREDITATION:	C601			
		SAMPLE D	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	100				10/09/2023	DHM	

Page 19 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2023 ALS JOB#: EV23100004 ALS SAMPLE#: EV23100004·			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01	DA COLI	ATE RECEIVED: LECTION DATE:	10/02/20 9/27/202	023 23 4:25:00	PM
CLIENT SAMPLE ID	S3-CU_092723 N	IS/MD	WDOE AC	CREDITATION:	N: C601		
		SAMPLE [	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	95.1				10/09/2023	DHM

Page 20 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICAT	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2 ALS JOB#: EV231 ALS SAMPLE#: EV231			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01	D/ COLI	ATE RECEIVED: LECTION DATE:	10/02/20 9/27/202	10/02/2023 9/27/2023 9:28:00 AM	
CLIENT SAMPLE ID	S4-AD_092723		WDOE AC	CREDITATION:	C601		
		SAMPLE D	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	100				10/09/2023	DHM

Page 21 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/1 ALS JOB#: EV2 ALS SAMPLE#: EV2			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01		ATE RECEIVED: LECTION DATE:	10/02/20 9/27/202	)23 23 10:24:00	) AM
	34-AU_092723	SAMPLE [	DATA RESULTS	CREDITATION.	001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	95.9				10/09/2023	DHM

Page 22 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: ALS JOB#: ALS SAMPLE#:			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01	D/ COLI	ATE RECEIVED: LECTION DATE:	10/02/20 9/27/202	)23 23 11:37:00	AM
CLIENT SAMPLE ID	S4-BD_092723		WDOE AC	CREDITATION:	C601		
		SAMPLE D	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	101				10/09/2023	DHM

Page 23 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 9810	nit 2400		DATE: 10/16 ALS JOB#: EV23 ALS SAMPLE#: EV23			10/16/2023 EV23100004 EV23100004-23		
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01	D/ COLI	ATE RECEIVED: LECTION DATE:	10/02/20 9/27/202	10/02/2023 9/27/2023 1:10:00 PM			
CLIENT SAMPLE ID	S4-BU_092723		WDOE AC	CCREDITATION:	C601				
		SAMPLE D	DATA RESULTS						
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM		
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25 CAS: 629-99-2	NWTPH-DX	97.2				10/09/2023	DHM		

Page 24 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICAT	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2 ALS JOB#: EV2310 ALS SAMPLE#: EV2310			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish S4-CD 092723	PN 30159457.01	D/ COLI WDOE AC	ATE RECEIVED: LECTION DATE:	10/02/20 9/27/202 C601	023 23 9:35:00 /	AM
	0100_002120	SAMPLE D	DATA RESULTS		0001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	105				10/09/2023	DHM

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16 ALS JOB#: EV23 ALS SAMPLE#: EV23			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish S4-CU 092723	PN 30159457.01	D/ COLI WDOE AC	ATE RECEIVED: LECTION DATE: CCREDITATION:	10/02/20 9/27/202 C601	)23 23 10:30:00	) AM
		SAMPLE [	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/09/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	95.1				10/09/2023	DHM

Page 26 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 1 ALS JOB#: E ALS SAMPLE#: E			10/16/2023 EV23100004 EV23100004-26		
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish 5-W-14, 092623	PN 30159457.01	D/ COLI WDOE AC	DATE RECEIVED: 10/02/2023 COLLECTION DATE: 9/26/2023 3:0 WDOE ACCREDITATION: C601			PM		
	<u> </u>	SAMPLE D	DATA RESULTS	DOREDITATION.	0001				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM		
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25 CAS: 629-99-2	NWTPH-DX	98.4				10/10/2023	DHM		

Page 27 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 1 ALS JOB#: E ALS SAMPLE#: E			10/16/2023 EV23100004 EV23100004-27		
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish 5-W-16, 092623	PN 30159457.01	D/ COLI WDOE AC	DATE RECEIVED: 10/02/2023 COLLECTION DATE: 9/26/2023 5:00: WDOE ACCREDITATION: C601			PM		
	3 W 10_032023	SAMPLE D	DATA RESULTS	DOREDITATION.	0001				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM		
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25 CAS: 629-99-2	NWTPH-DX	100				10/10/2023	DHM		

Page 28 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2 ALS JOB#: EV231 ALS SAMPLE#: EV231			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish 5-W-17 092923	PN 30159457.01	D/ COLI WDOE AC	ATE RECEIVED: LECTION DATE: CCREDITATION:	10/02/20 9/29/202 C601	)23 23 11:10:00	) AM
		SAMPLE D	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	98.0				10/10/2023	DHM

Page 29 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10 ALS JOB#: E ALS SAMPLE#: E			10/16/2023 EV23100004 EV23100004-29		
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01		ATE RECEIVED: LECTION DATE:	10/02/20 9/29/202	)23 23 11:55:00	) AM		
CLIENT SAMPLE ID	5-10-10-092925	SAMPLE D	DATA RESULTS	JOREDITATION.	001				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM		
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25 CAS: 629-99-2	NWTPH-DX	103				10/10/2023	DHM		

Page 30 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10 ALS JOB#: EN ALS SAMPLE#: EN			10/16/2023 EV23100004 EV23100004-30		
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01		ATE RECEIVED: LECTION DATE:	10/02/20 9/29/202	)23 23 12:40:00	) PM		
	3-10-19_092923	SAMPLE [		CREDITATION.	001				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM		
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25 CAS: 629-99-2	NWTPH-DX	97.0				10/10/2023	DHM		

Page 31 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICAT	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2 ALS JOB#: EV231 ALS SAMPLE#: EV231			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01	D/ COLI	ATE RECEIVED: LECTION DATE:	10/02/2023 9/29/2023 10:30:00 Al		) AM
CLIENT SAMPLE ID	5-W-51_092923		WDOE AC	CCREDITATION:	C601		
		SAMPLE D	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	530	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	220	100	1	UG/L	10/10/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	98.6				10/10/2023	DHM

Chromatogram indicates that it is likely that sample contains highly weathered diesel and an unidentified oil range product. Oil range product results biased high due to diesel range product overlap.

Page 32 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICAT	TE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: ALS JOB#: ALS SAMPLE#:			10/16/2023 EV23100004 EV23100004-32		
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish 5-W-55, 092823	PN 30159457.01	D/ COLI WDOF AC	DATE RECEIVED: 10/02/2023 COLLECTION DATE: 9/28/2023 3:50 WDOE ACCREDITATION: C601			PM		
	0 11 00_002020	SAMPLE D	DATA RESULTS		0001				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM		
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25 CAS: 629-99-2	NWTPH-DX	97.1				10/10/2023	DHM		

Page 33 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICAT	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2023 ALS JOB#: EV23100004 ALS SAMPLE#: EV23100004-33			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01	D/ COLI	DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/28/2023 3:30:00 PM	
CLIENT SAMPLE ID	5-W-56_092823		WDOE AC	CCREDITATION:	C601		
		SAMPLE D	ATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	1400	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	710	100	1	UG/L	10/10/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	81.2				10/10/2023	DHM

Chromatogram indicates that it is likely that sample contains an unidentified diesel range product and an unidentified oil range product.

Page 34 ADDRESS 8620 Holly Drive, Suite 100, Everett, WA 9820 | PHONE 425-356-2600 | FAX 425-356-2626 ALS Group USA, Corp dba ALS Environmental

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2 ALS JOB#: EV2310 ALS SAMPLE#: EV2310			
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish FD-3_092923	PN 30159457.01	DA COLI WDOE AC	ATE RECEIVED: LECTION DATE: CCREDITATION:	10/02/20 9/29/202 C601	)23 23	
	_	SAMPLE [	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	590	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	290	100	1	UG/L	10/10/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	100				10/10/2023	DHM

Chromatogram indicates that it is likely that sample contains highly weathered diesel and an unidentified oil range product. Oil range product results biased high due to diesel range product overlap.

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		CERTIFICA	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/16/2 ALS JOB#: EV231 ALS SAMPLE#: EV231			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01		DATE RECEIVED: 10/02/ COLLECTION DATE: 9/28/2 WDOE ACCREDITATION: C601			PM
	ZA-W-40_092823	SAMPLE [		CREDITATION.	001		
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	106				10/10/2023	DHM

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		CERTIFICAT	E OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , Uni Seattle, WA 98101	Arcadis U.S., Inc. 1420 - 5th Ave , Unit 2400 Seattle, WA 98101		DATE: 10/16/2023 ALS JOB#: EV23100004 ALS SAMPLE#: EV23100004-36		023 0004 0004-36	
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish P 2A-W-41 092823	N 30159457.01	D. COL WDOE AC	DATE RECEIVED: 10/02/2023 COLLECTION DATE: 9/28/2023 11:05:4 WDOE ACCREDITATION: C601			
		SAMPLE D	ATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	400	100	1	UG/L	10/10/2023	DHM
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX w/ SGA	240 J	50	1	UG/L	10/16/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	120	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX w/ SGA	U	100	1	UG/L	10/16/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	104				10/10/2023	DHM
C25 CAS: 629-99-2	NWTPH-DX w/ SGA	132 SUR11				10/16/2023	DHM

SUR11 - Surrogate outside of control limits due to sporadic marginal failure. No corrective action taken. U - Analyte analyzed for but not detected at level above reporting limit.

Chromatogram indicates that it is likely that sample contains highly weathered diesel and an unidentified oil range product. Oil range product results biased high due to diesel range product overlap.

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		CERTIFICAT	TE OF ANALYSIS				
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: ALS JOB#: ALS SAMPLE#:			
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	PN 30159457.01	D/ COLI	ATE RECEIVED: LECTION DATE:	10/02/20 9/28/202	) AM	
CLIENT SAMPLE ID	2A-W-42_092823			CCREDITATION:	C601		
		SAMPLE L	DATA RESULTS				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	120	100	1	UG/L	10/10/2023	DHM
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY
C25 CAS: 629-99-2	NWTPH-DX	103				10/10/2023	DHM

Chromatogram indicates that it is likely that sample contains an unidentified diesel range product.

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	Arcadis U.S., Inc. 1420 - 5th Ave , Unit 2400 Seattle, WA 98101		DATE: ALS JOB#: ALS SAMPLE#:		10/16/2023 EV23100004 EV23100004-38		
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish PN 30159457.01			DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/27/2023 5:30:00 PM		
	10-00-23_092723	SAMPLE D	DATA RESULTS	CREDITATION.	001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	86.5				10/10/2023	DHM	

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		CERTIFICA	TE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	Arcadis U.S., Inc. 1420 - 5th Ave , Unit 2400 Seattle, WA 98101		DATE: ALS JOB#: ALS SAMPLE#:			10/16/2023 EV23100004 EV23100004-39		
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish PN 30159457.01		D/ COLI	DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/27/2023 1:00:00 PM			
CLIENT SAMPLE ID	1C-W-7_092723		WDOE AC	CREDITATION:	C601				
		SAMPLE D	DATA RESULTS						
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	120	100	1	UG/L	10/10/2023	DHM		
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25 CAS: 629-99-2	NWTPH-DX	97.0				10/10/2023	DHM		

Chromatogram indicates that it is likely that sample contains an unidentified diesel range product.

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		CERTIFICA	TE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	Arcadis U.S., Inc. 1420 - 5th Ave , Unit 2400 Seattle, WA 98101		DATE: ALS JOB#: ALS SAMPLE#:			10/16/2023 EV23100004 EV23100004-40		
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish PN 30159457.01			DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/27/2023 2:45:00 PM			
CLIENT SAMPLE ID	10-10-092723	SAMPLE F	DATA RESULTS	CREDITATION.	001				
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM		
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25 CAS: 629-99-2	NWTPH-DX	96.7				10/10/2023	DHM		

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , Unit 2400 Seattle, WA 98101			DATE: ALS JOB#: ALS SAMPLE#:		10/16/2023 EV23100004 EV23100004-41		
CLIENT CONTACT: CLIENT PROJECT: CLIENT SAMPLE ID	Michelle Nguyen BNSF Skykomish PN 30159457.01		D/ COLI WDOF AC	DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/29/2023 11:30:00 AM		
	0 11 40_002020	SAMPLE D	DATA RESULTS		0001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	93.3				10/10/2023	DHM	

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		CERTIFICAT	TE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	Arcadis U.S., Inc. 420 - 5th Ave , Unit 2400 Seattle, WA 98101		DATE: ALS JOB#: ALS SAMPLE#:			10/16/2023 EV23100004 EV23100004-42		
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	Michelle Nguyen BNSF Skykomish PN 30159457.01		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/29/2023 4:03:00 PM			
CLIENT SAMPLE ID	MW-4_092923		WDOE AC	CREDITATION:	C601				
		SAMPLE D	DATA RESULTS						
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	290	100	1	UG/L	10/10/2023	DHM		
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	100	100	1	UG/L	10/10/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25 CAS: 629-99-2	NWTPH-DX	95.2				10/10/2023	DHM		

Chromatogram indicates that it is likely that sample contains an unidentified diesel range product.

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	Arcadis U.S., Inc. 1420 - 5th Ave , Unit 2400 Seattle, WA 98101		DATE: ALS JOB#: ALS SAMPLE#:		10/16/2023 EV23100004 EV23100004-43		
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish PN 30159457.01			DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/27/2023		
	FD-1_092725	SAMPLE [	DATA RESULTS	CREDITATION.	001			
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	100	100	1	UG/L	10/10/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	220	100	1	UG/L	10/10/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	115				10/10/2023	DHM	

Chromatogram indicates that it is likely that sample contains an unidentified diesel range product and an unidentified oil range product.

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		CERTIFICA	TE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 9810	nit 2400		DATE: 10/16/2 ALS JOB#: EV231 ALS SAMPLE#: EV231			;/2023 :100004 :100004-44		
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish PN 30159457.01		D/ COLI	DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/27/2023 5:10:00 PM			
CLIENT SAMPLE ID	EB-1_092723		WDOE AC	CREDITATION:	C601				
		SAMPLE D	DATA RESULTS						
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM		
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25 CAS: 629-99-2	NWTPH-DX	88.2				10/10/2023	DHM		

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , Unit 2400 Seattle, WA 98101			DATE: ALS JOB#: ALS SAMPLE#:		10/16/2023 EV23100004 EV23100004-45		
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish PN 30159457.01		D/ COLI	DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/27/2023		
CLIENT SAMPLE ID	FD-2_092923	-D-2_092723	WDOE AC	CREDITATION:	C601			
		SAMPLE [	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	89.2				10/10/2023	DHM	

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		CERTIFICA	TE OF ANALYSIS					
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , Unit 2400 Seattle, WA 98101			DATE: ALS JOB#: ALS SAMPLE#:				
CLIENT CONTACT: CLIENT PROJECT:	Michelle Nguyen BNSF Skykomish	Michelle Nguyen BNSF Skykomish PN 30159457.01		DATE RECEIVED: COLLECTION DATE:		10/02/2023 9/29/2023		
CLIENT SAMPLE ID	FD-4_092923		WDOE AC	CREDITATION:	C601			
		SAMPLE D	DATA RESULTS					
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY	
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM	
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	U	100	1	UG/L	10/10/2023	DHM	
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY	
C25 CAS: 629-99-2	NWTPH-DX	93.2				10/10/2023	DHM	

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## **BNSF Skykomish**

# **DATA REVIEW**

## Skykomish, Washington

Total Petroleum Hydrocarbon (TPH) Analyses

SDG #: EV23100095

Analyses Performed By: ALS Environmental Everett, Washington

Report #: 52033R Project: 30159458.02

## 1 Summary

This data quality assessment summarizes the review of Sample Delivery Group (SDG) # EV23100095 for samples collected in association with the BNSF Skykomish, Washington. The review was conducted as a Tier II evaluation and included review of data package completeness. Only analytical data as reported by the laboratory were reviewed for this validation. Field documentation was not included in this review. Included with this assessment are the validation annotated sample result sheets, and chain of custody records. Analyses were performed on the following samples:

Sample ID	Lab ID	Lab ID Matrix Sample Collection Date		Parant Sampla	Analysis
Sample ID				Farent Sample	ТРН
GW-1_101723	EV23100095-01	Water	10/17/2023		Х
DUP-1	EV23100095-02	Water	10/17/2023	GW-1_101723	Х

Note:

TPH = Total Petroleum Hydrocarbons

## 2 Analytical Data Package Documentation

	Items Reviewed		Reported		rmance eptable	Not	
		No	Yes	No	Yes	Required	
1.	Sample receipt condition		Х		Х		
2.	Requested analyses and sample results		Х		Х		
3.	Master tracking list		Х		Х		
4.	Methods of analysis		Х		Х		
5.	Reporting limits		Х		Х		
6.	Sample collection date		Х		Х		
7.	Laboratory sample received date		Х		Х		
8.	Sample preservation verification (as applicable)		Х		Х		
9.	Sample preparation/extraction/analysis dates		Х		Х		
10.	Fully executed Chain-of-Custody (COC) form		Х		Х		
11.	Narrative summary of Quality Assurance (QA) or sample problems provided		х		х		
12.	Data Package Completeness and Compliance		Х		Х		

The table below is the evaluation of the data package completeness.
### **3 Organic Analysis Introduction**

Analyses were performed according to United States Environmental Protection Agency (USEPA) Method NWTPH-DX. Data were reviewed in accordance with USEPA CLP National Functional Guidelines for Organic Superfund Methods Data Review, document number EPA 540-R-20-005, November 2020 (with reference to the historical USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, OSWER 9240.1-05A-P, October 1999, as appropriate).

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and had already been subjected to sufficient quality review prior to submission.

During the review process, laboratory qualified and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes in accordance with USEPA National Functional Guidelines:

- Concentration (C) Qualifiers
  - U The compound was analyzed for but not detected. The associated value is the compound quantitation limit.
  - B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
- Quantitation (Q) Qualifiers
  - E The compound was quantitated above the calibration range.
  - D Concentration is based on a diluted sample analysis.
- Validation Qualifiers
  - J The compound was positively identified; however, the associated numerical value is an estimated concentration only.
  - UJ The compound was not detected above the reported sample quantitation limit. However, the reported limit is approximate and may or may not represent the actual limit of quantitation.
  - JN The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification. The associated numerical value is an estimated concentration only.
  - UB Compound considered non-detect at the listed value due to associated blank contamination.
  - N The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification.
  - R The sample results are rejected.

Two facts should be noted by all data users. First, the "R" flag means that the associated value is unusable. In other words, due to significant quality control (QC) problems, the analysis is invalid and provides no information as to whether the compound is present or not. "R" values should not appear on data tables because they cannot be relied upon, even as a last resort. The second fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

### 4 Total Petroleum Hydrocarbons (TPH) Analyses

#### 4.1 Holding Times

The specified holding times for the following methods are presented in the following table.

Method	Matrix	Holding Time	Preservation
NWTPH-DX	Water	<ul> <li>14 days from collection to extraction and 40 days from extraction to analysis (preserved)</li> <li>7 days from collection to extraction and 40 days from extraction to analysis (Unpreserved)</li> </ul>	Cool to <6 °C

All samples were analyzed within the specified holding time criteria.

#### 4.2 Blank Contamination

Quality assurance (QA) blanks (i.e. laboratory method blanks and equipment rinse blanks) are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Rinse blanks also measure contamination of samples during field operations.

A blank action level (BAL) of five times the concentration of a detected compound in an associated blank (common laboratory contaminant compounds are calculated at ten times) is calculated for QA blanks containing concentrations greater than the reporting limit (RL). The BAL is compared to the associated sample results to determine the appropriate qualification of the sample results, if needed.

Compounds were not detected above the RL in the associated blanks; therefore, detected sample results were not associated with blank contamination.

#### 4.3 Surrogates/System Monitoring Compounds

All samples to be analyzed for organic compounds are spiked with surrogate compounds prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique. The analysis requires surrogate compounds exhibit recoveries within the laboratory-established acceptance limits.

All samples exhibited surrogate recoveries within the control limits.

#### 4.4 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

MS/MSD data are used to assess the precision and accuracy of the analytical method. The compounds used to perform the MS/MSD analysis must exhibit a percent recovery within the laboratory-established acceptance limits. The relative percent difference (RPD) between the MS/MSD recoveries must exhibit an RPD within the laboratory-established acceptance limits.

Note: The MS/MSD recovery control limits do not apply for MS/MSD performed on samples where the compound concentration detected in the parent sample exceeds the MS/MSD concentration by a factor of four or greater.

MS/MSD analysis was not performed on samples from this SDG.

#### 4.5 Laboratory Control Sample (LCS) Analysis

The LCS analysis is used to assess the accuracy of the analytical method independent of matrix interferences. The compounds associated with the LCS analysis must exhibit a percent recovery within the laboratory-established acceptance limits.

All compounds associated with the LCS analyses exhibited recoveries within the control limits.

#### 4.6 Field Duplicate Sample Analysis

The field duplicate sample analysis is used to assess the precision of the field sampling procedures and analytical method. The control limit of 30% for water matrices and 50% for soil matrices is applied to the RPD between the parent sample and the field duplicate sample results. In the instance when the parent and/or duplicate sample concentrations are less than or equal to five times the reporting limit (RL), a control limit of two times the RL for water matrices or three times the RL for soil matrices is applied to the difference between the results.

Results for duplicate samples are summarized in the following table.

Sample ID/Duplicate ID	Compounds	Sample Result (UG/L)	Duplicate Result (UG/L)	RPD
GW/1 101723 / DUP-1	TPH-Diesel Range	150	140	AC
GW-1_1017237 DOI -1	TPH-Oil Range	110	130	AC

Note:

AC = acceptable

The calculated RPDs between the parent sample and field duplicate were acceptable.

#### 4.7 Compound Identification

The retention times of all quantitated peaks must fall within the calculated retention time windows.

All identified compounds met the specified criteria.

#### 4.8 System Performance and Overall Assessment

Overall system performance was acceptable. Other than for those deviations specifically mentioned in this review, the overall data quality is within the guidelines specified in the method.

#### **Data Validation Checklist for Total Petroleum** 4.9 Hydrocarbon (TPH)

TPH: NWTPH-DX		orted	Perfor Accep	mance otable	Not Required	
	No	Yes	No	Yes	Required	
Gas Chromatography/Flame- and Photo- Ionization Detect	ors (GC/F	ID/PID)				
Tier II Validation						
Holding Times/Preservation		Х		Х		
Reporting Limits (Units)		Х		Х		
Blanks						
A. Method Blanks		Х		Х		
B. Trip Blanks	Х				Х	
C. Equipment Blanks	Х				Х	
Surrogates Accuracy (%R)		Х		Х		
Matrix Spike (MS) %R	Х				Х	
Matrix Spike Duplicate (MSD) %R	Х				Х	
MS/MSD Precision (RPD)	Х				Х	
Laboratory Control Sample (LCS) %R		Х		Х		
Laboratory Control Sample Duplicate (LCSD) %R	Х				Х	
LCS/LCSD RPD	Х				Х	
Laboratory Duplicate Sample RPD	Х				Х	
Field Duplicate Sample RPD		Х		Х		
Dilution Factor		Х		Х		
Moisture Content	Х				Х	
Notes:						

%R = percent recovery RPD = relative percent difference

Validation Performed By:	Hareesha Naik					
Signature:	Halic					
Date:	November 28, 2023					
Peer Review:	Jennifer Singer					
Date:	November 29, 2023					

**ALS Environmental** 8620 Holly Drive, Suite 100 Everett, WA 98208 Phone (425) 356-2600 (425) 356-2626 http://www.alsglobal.com Fax

#### Chain Of Custody/ Laboratory Analysis Request

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Ext

ALS Job# (Laboratory Use Only)

EV23100095

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PROJECT ID: 30159457.					AN	ALY	SIS	REC	QUE	STE	<u>D</u>									OT	HER	(Spe	cify)				
REPORT TO COMPANY: Accade	۶					1			:										S								
PROJECT Kyle Flaslen						1									ZO SIN	181	TAL		Hert								
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						3	.	EPA 82	EPA 8(		8260			EPA 8	H) by	ss by I	Pri Po		u								NO
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COMPANY:						2			-	les by	noduu	8260	8260	ic Cor	Hydro		ВС	ify)	AO/							ONT	00
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SAMPLE I.D.	DATE	TIME	TYPE	LAB#	NWTP	NWTP	NWTP	BTEX	MTBE	Haloge	Volatile	EDB /	EDB/	Semivo	Polycy	d BOC	Vletals	Metals	LCLP-							NUMI	ECE
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Received By: 3 1 SAME																											

\*Turnaround request less than standard may incur Rush Charges



# CERTIFICATE OF ANALYSIS Arcadis U.S., Inc. DATE:

CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U	nit 2400		DATE: 10/24/20 ALS JOB#: EV2310						
	Seattle, WA 98101		ALS SAMPLE#: EV2310							
CLIENT CONTACT:	Kyle Haslam		DA	ATE RECEIVED:	10/17/2023					
CLIENT PROJECT:	30159457		COLI	ECTION DATE:	10/17/2023 12:40:00 PM					
CLIENT SAMPLE ID	GW-1_101723		WDOE AC	CREDITATION:	C601					
		SAMPLE	DATA RESULTS							
ΔΝΔΙ ΥΤΕ	METHOD	BESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY			
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	150	100	1	UG/L	10/23/2023	DHM			
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	110	100	1	UG/L	10/23/2023	DHM			
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY			
C25	NWTPH-DX	100				10/23/2023	DHM			

Chromatogram indicates that it is likely that sample contains an unidentified diesel range product and an unidentified oil range product.

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		CERTIFIC	ATE OF ANALYSIS						
CLIENT:	Arcadis U.S., Inc. 1420 - 5th Ave , U Seattle, WA 98101	nit 2400		DATE: 10/24 ALS JOB#: EV23 ALS SAMPLE#: EV23					
CLIENT CONTACT: CLIENT PROJECT:	Kyle Haslam 30159457		D/ COLI	ATE RECEIVED: LECTION DATE:	10/17/20 10/17/20	/2023 /2023			
CLIENT SAMPLE ID	DUP-1		WDOE AC	CREDITATION:	C601				
		SAMPLE	DATA RESULTS						
ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY		
TPH-Diesel Range CAS: ARC-DRO	NWTPH-DX	140	100	1	UG/L	10/23/2023	DHM		
TPH-Oil Range CAS: ARC-TPH-ORO	NWTPH-DX	130	100	1	UG/L	10/23/2023	DHM		
SURROGATE	METHOD	%REC				ANALYSIS DATE	ANALYSIS BY		
C25 CAS: 629-99-2	NWTPH-DX	101				10/23/2023	DHM		

Chromatogram indicates that it is likely that sample contains an unidentified diesel range product and an unidentified oil range product.

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**NWTPH-Dx Trend Plots** 

# **Compliance Monitoring Levee Zone Monitoring Wells**

NWTPH-Dx Cleanup Level of 208 micrograms per liter



- - Groundwater Elevation









# Remediation Performance Monitoring Wells North of Railyard and Outside Levee Zone

NWTPH-Dx Cleanup Level of 477 micrograms per liter

NWTPH-Dx Trend Plot Well GW-1





**NWTPH-Dx Trend Plot** Well GW-3



-NAVD88 datum) Groundwater Elevation (feet above mean sea level-



> -NAVD88 datum) Groundwater Elevation (feet above mean sea level-

2,000 1,800 NWTPH-Dx Concentration (micrograms per liter) 1,600 1,400 1,200 ٨ 1 1,000 1 1/ 1/ 800 1 1 1 1 600 400 200 0 10. 07/01/2012 06/30/2009 -07/01/2010 06/30/2008 07/01/2014 07/02/2015 -07/01/2007 07/01/2016 <sup>07/02/2018</sup> 07/02/2019 07/02/2020 07/01/2011 07/01/2013 07/02/2017



NWTPH-Dx 📮 NWTPH-Dx Reported Detects 🗆 NWTPH-Dx Reported Non-Detects — Remediation Level (477 µg/l) – Groundwater Elevation

2,000 1,800 Ν 11 NWTPH-Dx Concentration (micrograms per liter) 1,600 1 1,400 11 11 1 ,200, I 1 1 ١, 1 1 1 1,000 11 1 800 600 400 200 0 06/30/2009 <sup>07/0</sup>1/2010 + 06/30/2008 07/02/2015 07/02/2018 07/02/2019 07/01/2016 07/01/2007 07/01/2012 07/01/2013 07/01/2014 07/02/2017 07/02/2020 07/01/2011 NWTPH-Dx NWTPH-Dx Reported Non-Detects -NWTPH-Dx Reported Detects -Remediation Level (477 µg/l)

NWTPH-Dx Trend Plot Well 2A-W-40



**NWTPH-Dx Trend Plot** Well 2A-W-41





**NWTPH-Dx Trend Plot** 





NWTPH-Dx concentrations exceeding the plot scale are shown above the plot area with the associated reported concentration value.

### NWTPH-Dx Trend Plot Well 1C-W-8





## Schoolyard Remediation Monitoring Wells

No NWTPH-Dx Cleanup Level

#### Note: Vertical scale is different from other plots; scale increased from 2,000 micrograms per liter

#### **NWTPH-Dx Trend Plot** Well 5-W-51



-NAVD88 datum) Groundwater Elevation (feet above mean sea level-



Note: Vertical scale is different from other plots; scale increased from 2,000  $\mu$ g/l to 7,000 µg/l to show all data points.

#### **NWTPH-Dx Trend Plot** Well 5-W-56



# **Remediation Performance Monitoring Wells Within Railyard**

No NWTPH-Dx Cleanup Level



NWTPH-Dx concentrations exceeding the plot scale are shown above the plot area with the associated reported concentration value.

### **NWTPH-Dx Trend Plot** Well 2A-W-9





**LNAPL Trend Plots**


LNAPL Thickness Trend Plot **RW-07** 



Groundwater Elevation (feet above mean sea level-NAVD88 datum)





**Statistical Analysis** 

# **Mann-Kendall Trend Results**

## Table E-1 Mann-Kendall Trend Results 2023 Annual Long-Term Monitoring Report BNSF Railway Company Former Maintenance and Fueling Facility, Skykomish, WA

		_			Det	ected Resu	ults Summa	ry <sup>1</sup>		Mann-Ker	dall Test <sup>2</sup>	
Well ID	Analyte	Date Range	Figure	FOD	Range	Mean	Median	SD	Result <sup>4</sup>	MK Result Note	P-Value	S Value
1C-W-4	NWTPH-Dx	03/18 - 03/23	E-1	6 / 11	136 - 210	154	143	28	NST		0.162	13
1C-W-7	NWTPH-Dx	03/18 - 09/23	E-2	14 / 17	109 - 260	188	181.5	49.3	NST		0.484	2
2A-W-10	NWTPH-Dx	03/18 - 06/20	E-3	10 / 10	151 - 550	303	278.5	129	NST		0.500	1
2A-W-41	NWTPH-Dx	03/18 - 12/23	E-4	21 / 21	145 - 1130	536	500	290	NST		0.325	-16
2A-W-42	NWTPH-Dx	03/18 - 12/23	E-5	20 / 22	100 - 330	217	222.5	66.9	NST		0.500	-1
2A-W-9	NWTPH-Dx	03/18 - 03/23	E-6	14 / 15	117 - 1040	395	327.75	272	NST		0.260	14
5-W-51	NWTPH-Dx	03/18 - 09/23	E-7	16 / 16	201 - 3200	1060	815	802	DWN		0.012	-51
5-W-56	NWTPH-Dx	03/18 - 09/23	E-8	16 / 16	477 - 5400	1970	1730	1320	NST		0.500	-1
GW-3	NWTPH-Dx	03/18 - 12/23	E-9	18 / 22	131 - 1020	417	365	270	NST		0.325	-17
MW-3	NWTPH-Dx	03/18 - 12/19	E-10	9 / 10	109 - 3170	1700	1860	1090	NST		0.190	11
MW-38R	NWTPH-Dx	03/18 - 03/20	E-11	3/5	131 - 158	147	151	14	NST	5a	0.180	5
MW-4	NWTPH-Dx	03/18 - 09/23	E-12	15 / 17	109 - 600	319	320	134	NST		0.063	38
PZ-7S	NWTPH-Dx	12/18 - 12/20	E-13	10 / 18	123 - 320	198	151	74.5	NST		0.088	35
S2-BU	NWTPH-Dx	03/18 - 12/23	E-14	25 / 29	78.5 - 1640	429	370	312	NST		0.455	7
S4-CU	NWTPH-Dx	03/18 - 12/23	E-15	8 / 14	100 - 510	215	159.25	140	NST		0.061	28
WG-EV	NWTPH-Dx	12/18 - 12/20	E-16	17 / 18	390 - 1010	768	780	168	NST		0.144	-29
WG-WV	NWTPH-Dx	12/18 - 12/20	E-17	18 / 18	129 - 1040	378	330	235	NST		0.099	-35

### Abbreviations:

-- insufficient data for calculating statistics (n < 4) or not available

FOD = frequency of detection (# detects / # samples)

mean = arithmetic mean

SD = standard deviation

S = summary statistic

$$\begin{split} NST &= no \ significant \ trend \\ NT &= no \ trend \\ DWN &= downward \ trend \\ UP &= upward \ trend \\ \mu g/L &= microgram \ per \ liter \end{split}$$

NWTPH-Dx = sum of total petroleum hydrocarbons as diesel-range organics and oil-range organics analyzed using Washington State Department of Ecology Method Notes:

1. All analytical results are in µg/L. Result values less than 10 are reported to 2 significant figures; values greater than 10 are reported to 3 significant figures. P-values are reported to 3 decimal places.

2. Trend results are presented when at least four samples and one detected value are available. Significance of trends evaluated at 95% confidence (alpha = 0.05).

3. Non-detects were assigned a common value less than the minimum detected value, equal to half the minimum reporting limit (RL) in the dataset (USEPA, 2009).

If half the minimum RL was greater than the minimum detected value, then half the minimum detect was assigned.

4. Statistically significant trend defined as having p-value ≤ 0.05, or 95% confidence.

5a. MK Trend results for datasets with fewer than 8 samples may not be reliable and should be treated with caution.

### Reference:

USEPA. 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities. Unified Guidance. EPA/530/R-09/007, 2009.





































# **UCL Summary Statistics**

### Table E-2 UCL Summary Statisitics 2023 Annual Long-Term Monitoring Report BNSF Railway Company Former Maintenance and Fueling Facility, Skykomish, WA

Well ID	NWTPH-Dx ( Cleanup	Groundwater o Target g/l)	Date Range	FOD	Percent of Dectects	NWTPH-Dx 95% UCL <sup>1</sup> (µg/l)	Percent of Sample Results that Exceed the Target (<10% to Pass)	Are any Sample Results Greater than Two Times the Target Concentration?	Does the Well Meet the 3-Part Statistical Test for Compliance?	Is Well under the Influence of an Engineering Control?	Trend Analysis at Wells Exceeding Cleanup Target
Conditional F	oint of Complia	ance Wells (Lev	ee Zone)								
5-W-14	CUL	208	12/19 - 09/23	0 / 10	0%	77	0%	No	Yes	Yes	NA
5-W-16	CUL	208	12/19 - 09/23	0 / 10	0%	77	0%	No	Yes	Yes	NA
5-W-17	CUL	208	12/19 - 09/23	0 / 10	0%	77	0%	No	Yes	Yes	NA
5-W-18	CUL	208	12/19 - 09/23	2 / 10	20%	198	0%	No	Yes	Yes	NA
5-W-19	CUL	208	12/19 - 09/23	1 / 10	10%	127	0%	No	Yes	Yes	NA
Monitoring W	ells North of Ra	ailyard and Out	side the Levee	Zone							
5-W-51	RL	477	09/19 - 09/23	10/10	100.0%	1,010	20%	Yes	No	Yes	Decreasing
5-W-55	RL	477	12/19 - 09/23	3 / 10	30%	120.8	0%	No	Yes	Yes	NA
5-W-56	RL	477	12/19 - 09/23	10 / 10	100.0%	3,716	100%	Yes	No	Yes	Stable
1B-W-23	RL	477	06/21 - 09/23	1 / 10	10%	169.0	0%	No	Yes	Yes	NA
2A-W-40	RL	477	06/21 - 09/23	10 / 10	100.0%	67	0%	No	Yes	Yes	NA
2A-W-41	RL	477	09/21 - 09/23	21 / 21	100.0%	775	60%	Yes	No	Yes	Stable
2A-W-42	RL	477	09/21 - 09/23	10 / 10	100.0%	242	0%	No	Yes	Yes	NA
1C-W-4	RL	477	09/18 - 03/23	5 / 10	50.0%	144.8	0%	No	Yes	Yes	NA
1C-W-7	RL	477	12/19 - 09/23	9 / 10	90.0%	213.7	100%	No	Yes	Yes	NA
1C-W-8	RL	477	12/19 - 09/23	2 / 10	20.0%	340.0	100%	No	Yes	Yes	NA
5-W-43	RL	477	06/21 - 12/23	3 / 10	30%	368.0	0%	No	Yes	Yes	NA
GW-1	RL	477	06/21 - 12/23	6 / 10	60.0%	118.0	0%	No	Yes	Yes	NA
GW-2	RL	477	06/21 - 12/23	4 / 10	40.0%	211.1	0%	No	Yes	Yes	NA
GW-3	RL	477	06/21 - 12/23	2 / 10	20.0%	539.4	30%	No	No	Yes	Stable
GW-4	RL	477	03/21 - 09/23	5 / 10	50.0%	93.7	0%	No	Yes	Yes	NA
Monitoring W	ells within the	Railyard									
2A-W-9	RL	None <sup>2</sup>	03/18 - 03/23	9 / 10	90.0%	558.7	30.0%	Yes	No	No	Stable
MW-4	RL	None <sup>2</sup>	12/19 - 09/23	9 / 10	90.0%	438.8	10.0%	No	No	No	Stable

Abbreviations:

CUL = cleanup level

NA = not applicable

-- insufficient data for calculating statistics (n < 4) or not available

FOD = frequency of detection (# detects / # samples)

RL = remediation level

µg/l = microgram per liter UCL = upper confidence limit

NWTPH-Dx = sum of total petroleum hydrocarbons as diesel-range organics and oil-range organics analyzed using Washington State Department of Ecology Method NWTPH-Dx

### Notes:

<sup>1</sup> Where the number of reported non-detects is greater than 50%, the largest value in the the data set is used in place of the 95% UCL.

<sup>2</sup> Location is within the BNSF railyard and does not have a groundwater cleanup target; however, for statistical evaluation purposes, a cleanup target of 477 µg/l was used.

#### Reference:

USEPA. 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities. Unified Guidance. EPA/530/R-09/007, 2009.



	A	В	С	D	E	F	G	Н			J	K		L
1					UCL Statis	tics for Data	Sets with N	on-Detects						
2				1										
3		User Sele	cted Options											
4	Da	te/Time of Co	omputation	ProUCL 5.12	2/13/2024 8:2	21:39 AM								
5			From File	Pro UCL Da	ta.xls									
6		Ful	I Precision	OFF										
7		Confidence		95%										
8	Number of	of Bootstrap (	Operations	2000										
9	Describ (d.b.)													
10	Result (1D-	W-23)												
11						Canaral	Statistics							
12			Total	Number of C	beenvotione	10	Statistics		Ni	umbo	r of Dictin	at Obsanuatio	ne	7
13			10101	Number	or of Dotocts	1			INU	unbei	Numbor			, 0
14			N		tinct Detects	1			N	lumhe	r of Disti	nct Non-Deter	rts	6
15					liner Delects	1								0
16		Warning: On	lv one distin	ct data value	was detecte	ed! ProUCL	(or any othe	r software) s	should r	not be	used on	such a data	setl	
17	It is suga	ested to use	alternative s	site specific v	/alues deterr	nined by the	Project Tea	am to estima	ate envi	ronme	ental para	ameters (e.a.	. EP	C. BTV).
18											part	(o.g.	,	•, = : : ,:
20				The da	ata set for va	riable Resul	t (1b-w-23) \	was not pro	cessed!					
20							. ,	•						
21														
23	Result (1c-v	w-4)												
24														
25						General	Statistics							
26			Total	Number of C	bservations	10			Nu	umbei	r of Distin	ct Observatio	ns	7
27				Numbe	er of Detects	5					Number	of Non-Dete	cts	5
28			N	umber of Dist	tinct Detects	5			N	lumbe	er of Disti	nct Non-Dete	cts	2
29				Mini	mum Detect	135.5					Minim	num Non-Dete	ect	76
30				Maxi	mum Detect	210					Maxim	num Non-Dete	ect	76.5
31				Varia	ince Detects	939.1					Perce	ent Non-Dete	cts	50%
32				М	ean Detects	156						SD Dete	cts	30.65
33				Mee	dian Detects	144						CV Dete	cts	0.196
34				Skewn	ess Detects	2.073					ł	Kurtosis Dete	cts	4.415
35				Mean of Log	ged Detects	5.036					SD of	Logged Dete	cts	0.178
36														
37					Norm	al GOF Tes	t on Detects	Only	<u></u>					
38			S	hapiro Wilk T	est Statistic	0.714		Data -t- 15	Snapi	ro Wi		est		
39			5% S		Intical Value	0.762	I	Detected Da	na Not N	vorma		agnificance L	evel	
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48			(	90% KM Che	byshev UCI	163 1				c	95% KM (	Chebyshev II		184 5
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50					~; 0.10¥ 00L	L.T.I								
51														

	А	В	С	D	E	F	G	Н		J	K	L		
52				0	amma GOF	Tests on De	etected Obs	ervations Or	nly Anderson De					
53				Α-D	ritical Value	0.778	Detec	ted Data Not	Gamma Dis	tributed at 5%				
54				K-S 1	Test Statistic	0.372	Delee		F					
50				5% K-S C	Critical Value	0.357	Detec	ted Data Not	Gamma Dis	tributed at 5%	6 Significance	e Level		
57				Detecte	ed Data Not (	Gamma Dist	ributed at 5	% Significan	ce Level		0			
58														
59					Gamma	Statistics or	n Detected [	Data Only						
60					k hat (MLE)	37.18			k	star (bias cor	rected MLE)	15		
61				The	ta hat (MLE)	4.196			Theta	star (bias cor	rected MLE)	10.4		
62				r	nu hat (MLE)	371.8				nu star (bia	as corrected)	150		
63				Me	ean (detects)	156								
64														
65				C	amma ROS	Statistics u	sing Impute							
66			GROS may	not be used	when data s	et has > 50%	6 NDs with m							
67		GROS may	y not be used	I when kstar	of detects is s	small such a	s <1.0, espe	e.g., <15-20)						
68			Fc	or such situat	ions, GROS i	method may	yield incorre							
69				 	his is especi	ally true whe	en the sampl	e size is sma	all.	tion on KM of				
70		FOI gai	nina usuibui		Minimum			teu using ga	mma uistribu		Moon	116 /		
71					Maximum	210					Median	117.9		
72					SD	48.22					0.414			
/3					k hat (MLE)	6 243			k	star (hias cor	rected MLE)	4 436		
74				The	ta hat (MLE)	18.64			Theta	star (bias cor	rected MLE)	26.23		
75				r	nu hat (MLE)	124.9				nu star (bia	as corrected)	88.73		
70			Adjusted	Level of Sig	nificance (B)	0.0267								
72		Apr	proximate Ch	i Square Valı	ue (88.73, α)	68.01			Adjusted Ch	ni Square Val	ue (88.73, β)	64.87		
70		95% Gamma	a Approximat	e UCL (use v	vhen n>=50)	151.8		95% G	, amma Adjus	ted UCL (use	when n<50)	159.2		
80														
81				Es	timates of G	amma Para	meters using	g KM Estima	ates					
82					Mean (KM)	116					SD (KM)	44.45		
83				Va	ariance (KM)	1976				SE o	f Mean (KM)	15.71		
84					k hat (KM)	6.811					k star (KM)	4.834		
85					nu hat (KM)	136.2					nu star (KM)	96.69		
86				th	eta hat (KM)	17.03				the	eta star (KM)	24		
87			80%	6 gamma per	centile (KM)	156.5			909	% gamma pei	rcentile (KM)	186.6		
88			95%	6 gamma per	centile (KM)	214.1			999	% gamma pei	rcentile (KM)	272.4		
89														
90					Gamm	a Kaplan-M	eier (KM) St	atistics						
91		App	proximate Ch	i Square Valı	ue (96.69, α)	75.01			Adjusted Ch	i Square Val	ue (96.69, β)	71.69		
92	95%	6 Gamma Ap	proximate KN	/I-UCL (use v	vhen n>=50)	149.5		95% Gamn	na Adjusted I	KM-UCL (use	when n<50)	156.4		
93						E Test P								
94							on Detected Observations Only							
95			5 ۲0/ C		ritical Value	0.747		inificanco Los	uol					
96			5%5		Fest Statistic	0.702				GOF Teet				
97			5	% Lilliefore (	Critical Value	0.343		etected Data		mal at 5% Sic	inificance Lev	/el		
98			J		tected Data	Not Lognorn	nal at 5% Si	anificance I	evel					
99				00		Lognom		9.11100 L						
1001														

				-
101		S Statistics	Using Imputed Non-Detects	4 705
102	Mean in Original Scale	124.8	Mean in Log Scale	4.785
103	SD in Original Scale	39.54	SD In Log Scale	0.304
104	95% t UCL (assumes normality of RUS data)	147.7	95% Percentile Bootstrap UCL	140.4
105		149.0		155.1
106		100.2		
107	Statistics using KM estimates	on Loaaed	Data and Assuming Lognormal Distribution	
108	KM Mean (logged)	4.684	KM Geo Mean	108.2
110	KM SD (logged)	0.37	95% Critical H Value (KM-Log)	2.054
111	KM Standard Error of Mean (logged)	0.131	95% H-UCL (KM -Log)	149.2
112	KM SD (logged)	0.37	95% Critical H Value (KM-Log)	2.054
113	KM Standard Error of Mean (logged)	0.131		
114				
115		DL/2 S	tatistics	
116	DL/2 Normal		DL/2 Log-Transformed	
117	Mean in Original Scale	97.1	Mean in Log Scale	4.34
118	SD in Original Scale	65.36	SD in Log Scale	0.744
119	95% t UCL (Assumes normality)	135	95% H-Stat UCL	193.1
120	DL/2 is not a recommended me	ethod, provi	ded for comparisons and historical reasons	
121	Newser			
122	Nonparame		Ition Free UCL Statistics	
123		Iscemible D	Istribution at 5% Significance Level	
124		Suggested		
125	95% KM (t) UCI	144.8	KW H-UCI	149.2
120	95% KM (BCA) UCL	142.1		
127				
120	Note: Suggestions regarding the selection of a 95%	UCL are pr	ovided to help the user to select the most appropriate 95% UCL.	
130	Recommendations are bas	sed upon dat	ta size, data distribution, and skewness.	
131	These recommendations are based upon the resu	Its of the sin	nulation studies summarized in Singh, Maichle, and Lee (2006).	
100	However, simulations results will not cover all Real W			
132		orld data se	ts; for additional insight the user may want to consult a statisticia	an.
132		orld data se	ts; for additional insight the user may want to consult a statisticia	an.
132 133 134	Result (1c-w-7)	orld data se	ts; for additional insight the user may want to consult a statisticia	an.
132 133 134 135	Result (1c-w-7)	forld data se	ts; for additional insight the user may want to consult a statisticia	an.
132 133 134 135 136	Result (1c-w-7)	General	ts; for additional insight the user may want to consult a statisticia <b>Statistics</b>	an.
132 133 134 135 136 137	Result (1c-w-7) Total Number of Observations	General	ts; for additional insight the user may want to consult a statisticia  Statistics  Number of Distinct Observations  Number of Non Dataste	an. 10
132         133         134         135         136         137         138	Result (1c-w-7) Total Number of Observations Number of Detects Number of Distinct Detects	General	ts; for additional insight the user may want to consult a statisticia  Statistics  Number of Distinct Observations  Number of Non-Detects  Number of Distinct Non-Detects	an. 10 1
132         133         134         135         136         137         138         139	Result (1c-w-7) Total Number of Observations Number of Detects Number of Distinct Detects Minimum Detect	General	ts; for additional insight the user may want to consult a statisticia  Statistics  Number of Distinct Observations Number of Non-Detects Number of Distinct Non-Detects Minimum Non-Detect	an. 10 1 1 76 5
132         133         134         135         136         137         138         139         140	Result (1c-w-7) Total Number of Observations Number of Distinct Detects Minimum Detect Maximum Detect	General 10 9 108.5 260	ts; for additional insight the user may want to consult a statisticia  Statistics  Number of Distinct Observations Number of Non-Detects Number of Distinct Non-Detects Minimum Non-Detect Maximum Non-Detect	an. 10 1 1 76.5 76.5
132         133         134         135         136         137         138         139         140         141         142	Result (1c-w-7) Total Number of Observations Number of Detects Number of Distinct Detects Minimum Detect Maximum Detect Variance Detects	General 10 9 108.5 260 2714	ts; for additional insight the user may want to consult a statisticia Statistics           Statistics           Number of Distinct Observations           Number of Non-Detects           Number of Distinct Non-Detects           Minimum Non-Detect           Maximum Non-Detect           Percent Non-Detects	an. 10 1 1 76.5 76.5 10%
132         133         134         135         136         137         138         139         140         141         142         143	Result (1c-w-7) Total Number of Observations Number of Distinct Detects Minimum Detect Maximum Detect Variance Detects Mean Detects	General 10 9 9 108.5 260 2714 189.6	ts; for additional insight the user may want to consult a statisticia Statistics           Statistics           Number of Distinct Observations           Number of Non-Detects           Number of Distinct Non-Detects           Minimum Non-Detect           Maximum Non-Detects           Percent Non-Detects           SD Detects	an. 10 1 1 76.5 76.5 10% 52.09
132         133         134         135         136         137         138         139         140         141         142         143         144	Result (1c-w-7) Total Number of Observations Number of Detects Number of Distinct Detects Minimum Detect Maximum Detect Variance Detects Mean Detects Median Detects	General           10           9           108.5           260           2714           189.6           187	ts; for additional insight the user may want to consult a statisticia Statistics           Statistics           Number of Distinct Observations           Number of Non-Detects           Number of Distinct Non-Detects           Minimum Non-Detect           Maximum Non-Detects           SD Detects           SD Detects	an. 10 1 1 76.5 76.5 10% 52.09 0.275
132         133         134         135         136         137         138         139         140         141         142         143         144         145	Result (1c-w-7) Total Number of Observations Number of Detects Number of Distinct Detects Minimum Detect Maximum Detect Variance Detects Median Detects Skewness Detects	General 10 9 9 108.5 260 2714 189.6 187 -0.176	ts; for additional insight the user may want to consult a statistician Statistics           Statistics           Number of Distinct Observations           Number of Non-Detects           Number of Distinct Non-Detects           Minimum Non-Detect           Maximum Non-Detects           Percent Non-Detects           SD Detects           CV Detects           Kurtosis Detects	an. 10 1 1 76.5 76.5 10% 52.09 0.275 -1.317
132         133         134         135         136         137         138         139         140         141         142         143         144         145         146	Result (1c-w-7) Total Number of Observations Number of Detects Number of Distinct Detects Minimum Detect Maximum Detect Variance Detects Mean Detects Skewness Detects Mean of Logged Detects	General           10           9           108.5           260           2714           189.6           187           -0.176           5.208	ts; for additional insight the user may want to consult a statisticia Statistics           Statistics           Number of Distinct Observations           Number of Non-Detects           Number of Distinct Non-Detects           Minimum Non-Detect           Maximum Non-Detects           SD Detects           CV Detects           Kurtosis Detects           SD of Logged Detects	an. 10 1 1 76.5 76.5 10% 52.09 0.275 -1.317 0.295
132         133         134         135         136         137         138         139         140         141         142         143         144         145         146         147	Result (1c-w-7) Total Number of Observations Number of Detects Number of Distinct Detects Minimum Detect Maximum Detect Variance Detects Mean Detects Median Detects Skewness Detects Mean of Logged Detects	General           10           9           108.5           260           2714           189.6           187           -0.176           5.208	ts; for additional insight the user may want to consult a statisticia Statistics           Statistics           Number of Distinct Observations           Number of Non-Detects           Number of Distinct Non-Detects           Minimum Non-Detect           Percent Non-Detects           SD Detects           CV Detects           Kurtosis Detects           SD of Logged Detects	an. 10 1 1 76.5 76.5 10% 52.09 0.275 -1.317 0.295
132         133         134         135         136         137         138         139         140         141         142         143         144         145         146         147         148	Result (1c-w-7) Total Number of Observations Number of Detects Number of Distinct Detects Minimum Detect Maximum Detect Variance Detects Mean Detects Median Detects Skewness Detects Mean of Logged Detects Norm	General 10 9 9 108.5 260 2714 189.6 187 -0.176 5.208	ts; for additional insight the user may want to consult a statistician Statistics Number of Distinct Observations Number of Non-Detects Number of Distinct Non-Detects Minimum Non-Detect Maximum Non-Detects Percent Non-Detects SD Detects CV Detects Kurtosis Detects SD of Logged Detects st on Detects Only	an. 10 1 1 76.5 76.5 10% 52.09 0.275 -1.317 0.295
132         133         134         135         136         137         138         139         140         141         142         143         144         145         146         147         148         149	Result (1c-w-7) Total Number of Observations Number of Detects Number of Distinct Detects Minimum Detect Maximum Detect Variance Detects Mean Detects Median Detects Skewness Detects Mean of Logged Detects Norm Shapiro Wilk Test Statistic	General           10           9           108.5           260           2714           189.6           187           -0.176           5.208	ts; for additional insight the user may want to consult a statisticia Statistics           Statistics           Number of Distinct Observations           Number of Non-Detects           Number of Distinct Non-Detects           Minimum Non-Detect           Maximum Non-Detects           SD Detects           CV Detects           SD Detects           SD of Logged Detects           st on Detects Only	an. 10 1 1 76.5 76.5 10% 52.09 0.275 -1.317 0.295
132         133         134         135         136         137         138         139         140         141         142         143         144         145         146         147         148         149         150	Result (1c-w-7) Total Number of Observations Number of Detects Number of Distinct Detects Minimum Detect Maximum Detect Variance Detects Mean Detects Median Detects Skewness Detects Median Detects Norm Shapiro Wilk Test Statistic 5% Shapiro Wilk Critical Value	General           10           9           108.5           260           2714           189.6           187           -0.176           5.208           nal GOF Tes           0.956           0.829	ts; for additional insight the user may want to consult a statistician Statistics Number of Distinct Observations Number of Non-Detects Number of Distinct Non-Detects Minimum Non-Detect Maximum Non-Detect Percent Non-Detects SD Detects SD Detects CV Detects Kurtosis Detects SD of Logged Detects st on Detects Only Shapiro Wilk GOF Test Detected Data appear Normal at 5% Significance Level	an. 10 1 1 76.5 76.5 10% 52.09 0.275 -1.317 0.295 ////////////////////////////////////
132         133         134         135         136         137         138         139         140         141         142         143         144         145         146         147         148         149         150	Result (1c-w-7) Total Number of Observations Number of Detects Number of Distinct Detects Minimum Detect Maximum Detect Variance Detects Mean Detects Median Detects Skewness Detects Mean of Logged Detects Norm Shapiro Wilk Test Statistic 5% Shapiro Wilk Critical Value Lilliefors Test Statistic	General           10           9           108.5           260           2714           189.6           187           -0.176           5.208           mal GOF Tess           0.956           0.829           0.165	ts; for additional insight the user may want to consult a statisticia Statistics           Statistics           Number of Distinct Observations           Number of Non-Detects           Number of Distinct Non-Detects           Minimum Non-Detect           Maximum Non-Detect           Percent Non-Detects           SD Detects           CV Detects           SD Detects           SD of Logged Detects           st on Detects Only           Shapiro Wilk GOF Test           Detected Data appear Normal at 5% Significance Lev           Lilliefors GOF Test	an. 10 1 1 76.5 76.5 10% 52.09 0.275 -1.317 0.295 ////////////////////////////////////
132         133         134         135         136         137         138         139         140         141         142         143         144         145         146         147         148         149         150         151	Result (1c-w-7) Total Number of Observations Number of Detects Number of Distinct Detects Minimum Detect Maximum Detect Variance Detects Mean Detects Median Detects Skewness Detects Median Detects Norm Shapiro Wilk Test Statistic 5% Shapiro Wilk Critical Value Lilliefors Test Statistic	General 10 9 9 108.5 260 2714 189.6 187 -0.176 5.208 nal GOF Tes 0.956 0.829 0.165 0.274	ts; for additional insight the user may want to consult a statisticia Statistics           Statistics           Number of Distinct Observations           Number of Non-Detects           Number of Distinct Non-Detects           Minimum Non-Detect           Maximum Non-Detect           Percent Non-Detects           SD Detects           CV Detects           SD of Logged Detects           St on Detects Only           Shapiro Wilk GOF Test           Detected Data appear Normal at 5% Significance Lev           Lilliefors GOF Test           Detected Data appear Normal at 5% Significance Lev	an. 10 1 1 76.5 76.5 10% 52.09 0.275 -1.317 0.295 ////////////////////////////////////
132         133         134         135         136         137         138         139         140         141         142         143         144         145         146         147         148         149         150         151         152         153	Result (1c-w-7) Total Number of Observations Number of Detects Number of Distinct Detects Number of Distinct Detects Maximum Detect Variance Detects Mean Detects Median Detects Skewness Detects Mean of Logged Detects Norr Shapiro Wilk Test Statistic 5% Shapiro Wilk Critical Value Lilliefors Test Statistic 5% Lilliefors Critical Value Detected Data a	General 10 9 9 108.5 260 2714 189.6 187 -0.176 5.208 mal GOF Tes 0.956 0.829 0.165 0.274 appear Norr	ts; for additional insight the user may want to consult a statisticia Statistics           Statistics           Number of Distinct Observations           Number of Non-Detects           Number of Distinct Non-Detects           Minimum Non-Detect           Maximum Non-Detect           Percent Non-Detects           SD Detects           CV Detects           SD of Logged Detects           st on Detects Only           Shapiro Wilk GOF Test           Detected Data appear Normal at 5% Significance Level           Detected Data appear Normal at 5% Significance Level	an. 10 1 1 76.5 76.5 10% 52.09 0.275 -1.317 0.295 vel
132         133         134         135         136         137         138         139         140         141         142         143         144         145         146         147         148         149         150         151         152         153         154	Result (1c-w-7) Total Number of Observations Number of Detects Number of Distinct Detects Number of Distinct Detects Maximum Detect Variance Detects Mean Detects Median Detects Skewness Detects Mean of Logged Detects Norr Shapiro Wilk Test Statistic 5% Shapiro Wilk Critical Value Lilliefors Test Statistic 5% Lilliefors Critical Value Detected Data a	General 10 9 9 108.5 260 2714 189.6 187 -0.176 5.208 nal GOF Tes 0.956 0.829 0.165 0.274 appear Norr	ts; for additional insight the user may want to consult a statisticial Statistics Number of Distinct Observations Number of Non-Detects Number of Distinct Non-Detects Minimum Non-Detect Maximum Non-Detect Percent Non-Detects SD Detects CV Detects CV Detects CV Detects SD of Logged Detects St on Detects Only Shapiro Wilk GOF Test Detected Data appear Normal at 5% Significance Level CVIIIIIEfors GOF Test Detected Data appear Normal at 5% Significance Level	an. 10 1 1 76.5 76.5 10% 52.09 0.275 -1.317 0.295 //el
132         133         134         135         136         137         138         139         140         141         142         143         144         145         146         147         148         149         150         151         152         153         154         155	Result (1c-w-7) Total Number of Observations Number of Detects Number of Distinct Detects Minimum Detect Maximum Detect Variance Detects Median Detects Median Detects Skewness Detects Mean of Logged Detects Norr Shapiro Wilk Test Statistic 5% Shapiro Wilk Critical Value Lilliefors Test Statistic 5% Lilliefors Critical Value Detected Data a Kaplan-Meier (KM) Statistics usin	General 10 9 9 108.5 260 2714 189.6 187 -0.176 5.208 mal GOF Tes 0.956 0.829 0.165 0.274 appear Norr ng Normal C 178.3	ts; for additional insight the user may want to consult a statisticial Statistics Number of Distinct Observations Number of Non-Detects Number of Distinct Non-Detects Number of Distinct Non-Detects Minimum Non-Detect Maximum Non-Detect Percent Non-Detects SD Detects CV Detects CV Detects SD of Logged Detects SD of Logged Detects St on Detects Only Shapiro Wilk GOF Test Detected Data appear Normal at 5% Significance Lev Lilliefors GOF Test Detected Data appear Normal at 5% Significance Lev nal at 5% Significance Level Critical Values and other Nonparametric UCLs	an. 10 1 1 76.5 76.5 10% 52.09 0.275 -1.317 0.295 vel vel
132         133         134         135         136         137         138         139         140         141         142         143         144         145         146         147         148         149         150         151         152         153         154         155         156	Result (1c-w-7) Total Number of Observations Number of Detects Number of Distinct Detects Number of Distinct Detects Minimum Detect Maximum Detect Variance Detects Median Detects Median Detects Skewness Detects Mean of Logged Detects Norr Shapiro Wilk Test Statistic 5% Shapiro Wilk Critical Value Lilliefors Test Statistic 5% Lilliefors Critical Value Detected Data a Kaplan-Meier (KM) Statistics usi	General 10 9 9 108.5 260 2714 189.6 187 -0.176 5.208 nal GOF Tes 0.956 0.829 0.165 0.274 appear Norr ng Normal C 178.3 57.64	ts; for additional insight the user may want to consult a statisticia  Statistics  Number of Distinct Observations Number of Non-Detects Number of Distinct Non-Detects Number of Distinct Non-Detect Maximum Non-Detect Percent Non-Detects SD Detects CV Detects CV Detects SD of Logged Detects St on Detects Only Shapiro Wilk GOF Test Detected Data appear Normal at 5% Significance Lev Lilliefors GOF Test Detected Data appear Normal at 5% Significance Lev nal at 5% Significance Level Critical Values and other Nonparametric UCLs KM Standard Error of Mean 95% KM (BCA) UCL	an. 10 1 1 76.5 76.5 10% 52.09 0.275 -1.317 0.295 -1.317 0.295 -1.317 0.295 -1.317 0.295 -1.317 0.295 -1.317 0.295 -1.317 0.295
132         133         134         135         136         137         138         139         140         141         142         143         144         145         146         147         148         149         150         151         152         153         154         155         156         157	Result (1c-w-7)  Total Number of Observations Number of Detects Number of Distinct Detects Minimum Detect Maximum Detect Variance Detects Mean Detects Median Detects Kewness Detects Mean of Logged Detects Norr Shapiro Wilk Test Statistic 5% Shapiro Wilk Critical Value Lilliefors Test Statistic 5% Lilliefors Critical Value Detected Data a Kaplan-Meier (KM) Statistics usin KM Mean KM SD	General 10 9 9 108.5 260 2714 189.6 187 -0.176 5.208 mal GOF Tes 0.956 0.829 0.165 0.274 appear Norr ng Normal C 178.3 57.64 213.7	ts; for additional insight the user may want to consult a statisticia  Statistics  Number of Distinct Observations Number of Non-Detects Number of Distinct Non-Detects Minimum Non-Detect Maximum Non-Detect Percent Non-Detects SD Detects CV Detects CV Detects CV Detects SD of Logged Detects SD of Logged Detects St on Detects Only  Shapiro Wilk GOF Test Detected Data appear Normal at 5% Significance Lev Lilliefors GOF Test Detected Data appear Normal at 5% Significance Lev al at 5% Significance Level Critical Values and other Nonparametric UCLs KM Standard Error of Mean 95% KM (BCA) UCL 95% KM (Percentile Bootstran) UCI	an. 10 1 1 76.5 76.5 10% 52.09 0.275 -1.317 0.295 -1.317
132         133         134         135         136         137         138         139         140         141         142         143         144         145         146         147         148         149         150         151         152         153         154         155         156         157         158         152	Result (1c-w-7) Total Number of Observations Number of Distinct Detects Number of Distinct Detects Minimum Detect Maximum Detect Variance Detects Mean Detects Median Detects Kewness Detects Kewness Detects Norm Shapiro Wilk Test Statistic 5% Shapiro Wilk Critical Value Lilliefors Test Statistic 5% Lilliefors Critical Value Detected Data a Kaplan-Meier (KM) Statistics usin KM Mean KM SD 95% KM (t) UCL	General         10         9         9         108.5         260         2714         189.6         187         -0.176         5.208         mal GOF Test         0.956         0.829         0.165         0.274         appear Norr         mg Normal C         178.3         57.64         213.7         210.1	ts; for additional insight the user may want to consult a statisticia  Statistics  Number of Distinct Observations Number of Non-Detects Number of Distinct Non-Detects Minimum Non-Detect Maximum Non-Detect Percent Non-Detects SD Detects CV Detects CV Detects CV Detects CV Detects SD of Logged Detects SD of Logged Detects St on Detected Data appear Normal at 5% Significance Lev Lilliefors GOF Test Detected Data appear Normal at 5% Significance Lev Itiliefors GOF Test Detected Data appear Normal at 5% Significance Lev St on Detects Only Critical Values and other Nonparametric UCLs KM Standard Error of Mean 95% KM (BCA) UCL 95% KM (Percentile Bootstrap) UCL 95% KM Bootstran t UCI	an. 10 1 1 76.5 76.5 10% 52.09 0.275 -1.317 0.295 -1.317 0.295 (rel 19.33 207.9 209.2 211.1
132         133         134         135         136         137         138         139         140         141         142         143         144         145         146         147         148         149         150         151         152         153         154         155         156         157         158         159         160	Result (1c-w-7)  Total Number of Observations Number of Distinct Detects Number of Distinct Detects Minimum Detect Maximum Detect Variance Detects Mean Detects Median Detects Kewness Detects Mean of Logged Detects Norm Shapiro Wilk Test Statistic 5% Shapiro Wilk Critical Value Lilliefors Test Statistic 5% Lilliefors Critical Value Detected Data a KM Mean KM SD 95% KM (t) UCL 95% KM (z) UCL	General 10 9 9 108.5 260 2714 189.6 187 -0.176 5.208 nal GOF Tes 0.956 0.829 0.165 0.274 appear Norr ng Normal C 178.3 57.64 213.7 210.1 236.3	ts; for additional insight the user may want to consult a statisticia  Statistics  Statistics  Number of Distinct Observations Number of Distinct Non-Detects Number of Distinct Non-Detects Minimum Non-Detect Maximum Non-Detect Percent Non-Detects SD Detects CV Detects CV Detects CV Detects SD of Logged Detects SD of Logged Detects SD of Logged Detects SD of Logged Detects CU Lilliefors GOF Test Detected Data appear Normal at 5% Significance Lev Lilliefors GOF Test Detected Data appear Normal at 5% Significance Lev Stritical Values and other Nonparametric UCLs KM Standard Error of Mean 95% KM (BCA) UCL 95% KM (Percentile Bootstrap) UCL 95% KM Bootstrap t UCL 95% KM Chebyshev UCL	an. 10 1 1 76.5 76.5 10% 52.09 0.275 -1.317 0.295 -1.317 -1.317 0.295 -1.317
132         133         134         135         136         137         138         139         140         141         142         143         144         145         146         147         148         149         150         151         152         153         154         155         156         157         158         159         160         161	Result (1c-w-7)  Total Number of Observations Number of Distinct Detects Number of Distinct Detects Minimum Detect Maximum Detect Variance Detects Mean Detects Median Detects Kewness Detects Kewness Detects Norm Shapiro Wilk Test Statistic 5% Shapiro Wilk Test Statistic 5% Shapiro Wilk Critical Value Lilliefors Test Statistic 5% Lilliefors Critical Value Detected Data a Kaplan-Meier (KM) Statistics usi KM Mean KM SD 95% KM (t) UCL 90% KM Chebyshev UCL	General         10         9         9         108.5         260         2714         189.6         187         -0.176         5.208         mal GOF Test         0.956         0.829         0.165         0.274         appear Norr         mg Normal C         178.3         57.64         213.7         210.1         236.3         299	ts; for additional insight the user may want to consult a statisticia  Statistics  Number of Distinct Observations Number of Non-Detects Number of Distinct Non-Detects Minimum Non-Detect Percent Non-Detects SD Detects CV Detects CV Detects CV Detects SD of Logged Detects SD of Logged Detects SD of Logged Detects SD of Logged Detects St on Detects Only Shapiro Wilk GOF Test Detected Data appear Normal at 5% Significance Lev Lilliefors GOF Test Detected Data appear Normal at 5% Significance Lev St on Significance Level Critical Values and other Nonparametric UCLs KM Standard Error of Mean 95% KM (BCA) UCL 95% KM (Percentile Bootstrap) UCL 95% KM Chebyshev UCL 95% KM Chebyshev UCL	an. 10 1 1 76.5 76.5 10% 52.09 0.275 -1.317 0.295 (rel (rel 19.33 207.9 209.2 211.1 262.6 370.7

	А	В	С	D	E	F	F G H I J K					
163				C	Gamma GOF	Tests on De	etected Obse	ervations On	ly			
164				A-D	Test Statistic	0.261		A	nderson-Da	rling GOF Te	est	
165				5% A-D (	Critical Value	0.721	Detecte	d data appea	ar Gamma D	istributed at 5	5% Significan	ce Level
166				K-S	Test Statistic	0.188		ŀ	Kolmogorov	Smirnov GO	F	
167				5% K-S (	Critical Value	0.279	Detecte	d data appea	ar Gamma D	istributed at 5	5% Significan	ce Level
168				Detected	l data appea	r Gamma Di	stributed at !	5% Significa	nce Level			
169												
170					Gamma	Statistics or	n Detected D	ata Only				
171					k hat (MLE)	13.79			k	star (bias cor	rected MLE)	9.265
172				The	ta hat (MLE)	13.75			Theta	star (bias cor	rected MLE)	20.47
173				1	nu hat (MLE)	248.2				nu star (bia	as corrected)	166.8
174				Me	ean (detects)	189.6						
175												
176				(	Gamma ROS	Statistics u	sing Imputed	l Non-Detec	ts			
177			GROS may	not be used	when data s	et has > 50%	6 NDs with m	any tied obs	ervations at	multiple DLs		
178		GROS may	y not be used	when kstar	of detects is a	small such a	s <1.0, espe	cially when the	ne sample si	ze is small (e	e.g., <15-20)	
179			Fo	or such situat	ions, GROS I	method may	yield incorre	ct values of l	JCLs and B	ΓVs		
180				٦	This is especi	ally true whe	en the sample	e size is sma	II.			
181		For gar	mma distribut	ed detected	data, BTVs a	nd UCLs ma	ay be comput	ed using gar	nma distribu	tion on KM e	stimates	
182					Minimum	80.42					Mean	178.7
183					Maximum	260					Median	178.5
184					SD	60.04					CV	0.336
185					k hat (MLE)	8.567			k	star (bias cor	rected MLE)	6.064
186				The	ta hat (MLE)	20.86			Theta	star (bias cor	rected MLE)	29.47
187				I	nu hat (MLE)	171.3				nu star (bia	as corrected)	121.3
188			Adjusted	Level of Sig	nificance (β)	0.0267						
189		Appr	oximate Chi	Square Valu	e (121.27, α)	96.84		A	djusted Chi	Square Value	e (121.27, β)	93.05
190		95% Gamma	a Approximat	e UCL (use v	when n>=50)	223.8		95% Ga	amma Adjus	ted UCL (use	when n<50)	232.9
191												
192				E٤	stimates of G	amma Para	meters using	, KM Estima	tes			
193					Mean (KM)	178.3					SD (KM)	57.64
194				Va	ariance (KM)	3322				SE o	f Mean (KM)	19.33
195					k hat (KM)	9.569					k star (KM)	6.765
196					nu hat (KM)	191.4					nu star (KM)	135.3
197				th	eta hat (KM)	18.63				the	eta star (KM)	26.36
198			80%	6 gamma pe	rcentile (KM)	232			909	% gamma pei	rcentile (KM)	269.8
199			95%	6 gamma pe	rcentile (KM)	304			999	% gamma pei	rcentile (KM)	375.1
200												
201					Gamm	a Kaplan-M	eier (KM) St	atistics				
202		Appr	oximate Chi	Square Valu	e (135.30, α)	109.4		A	djusted Chi	Square Value	e (135.30, β)	105.4
203	95%	6 Gamma Ap	proximate KN	/I-UCL (use v	when n>=50)	220.5		95% Gamm	a Adjusted I	KM-UCL (use	when n<50)	228.9
204												

	A	В	С	D	E	F	G	Н	<u> </u>	J	K	L
205			0		ognormal GO	F Test on D	etected Obs	ervations O	nly Observices M			
206			5	hapiro Wilk I	est Statistic	0.944	Det	anta d Data a	Snapiro w		nificana l	
207			5% 5		ritical value	0.829	Det	ected Data a	ppear Logn	COF Test	nificance L	evei
208			5		est Statistic	0.10	Det	antad Data a			nificance L	
209			5		cted Data an		mal at 5% S			onnai at 5 % Siy		ever
210				Dele		pear Logilo		Significance	Level			
211				Lo	anormal ROS	S Statistics	Usina Impute	ed Non-Dete	ects			
212				Mean in O	riginal Scale	179.6				Mean in	Log Scale	5.137
213				SD in O	riginal Scale	58.45				SD in	Log Scale	0.358
214		95% t l	JCL (assume	es normality c	of ROS data)	213.5			95%	Percentile Boot	strap UCL	207.1
215				95% BCA Bo	otstrap UCL	206.7				95% Boots	trap t UCL	211.9
217				95% H-UCI	(Log ROS)	231.5						
218					I						Į	
219			Statis	stics using K	M estimates	on Logged [	Data and As	suming Logr	normal Distr	ibution		
220				KM Me	ean (logged)	5.121				KM	Geo Mean	167.5
221				KM	SD (logged)	0.371			95%	Critical H Value	e (KM-Log)	2.055
222			KM Standa	rd Error of Me	ean (logged)	0.124				95% H-UCL	(KM -Log)	231.4
223				KM	SD (logged)	0.371			95%	Critical H Value	e (KM-Log)	2.055
224			KM Standa	rd Error of Me	ean (logged)	0.124						
225						DI (0.0						
226						DL/2 St	atistics			Tropoformod		
227			DL/2 I	Normai Moon in O	riginal Socia	174 5			DL/2 Log-	I ransformed Moon in		5.052
228					riginal Scale	68.58				Wean In		0.567
229			95% † 1		s normality)	214.2				95% H	LOG Scale	284.6
230			DI /2	is not a reco	mmended me	ethod provid	led for com	narisons and	l historical r	easons		204.0
231									motoriouri			
232					Nonparame	tric Distribu	tion Free UC	CL Statistics				
233				Detected	Data appea	r Normal Dis	stributed at {	5% Significa	nce Level			
235								-				
236						Suggested	UCL to Use					
237				95%	KM (t) UCL	213.7						
238												
239		Note: Sugge	stions regard	ling the selec	tion of a 95%	UCL are pro	ovided to hel	p the user to	select the n	nost appropriate	95% UCL	
240			F	Recommenda	tions are bas	ed upon dat	a size, data	distribution, a	and skewne	SS.		
241		These reco	mmendations	s are based u	pon the resu	Its of the sim	ulation studi	es summariz	ed in Singh	, Maichle, and L	.ee (2006).	
242	Нс	wever, simu	llations result	ts will not cov	er all Real W	orld data set	ts; for additio	onal insight th	ie user may	want to consult	a statisticia	an.
243	Deput (1e )											
244		w-o)										
245						General	Statistics					
246			Total	Number of C	bservations	10			Numbe	er of Distinct Ob	servations	6
247				Numbe	er of Detects	2				Number of No	on-Detects	8
240			N	umber of Dist	tinct Detects	2			Numb	er of Distinct No	on-Detects	4
250				Mini	mum Detect	199				Minimum N	Ion-Detect	40.5
251				Maxi	mum Detect	340				Maximum N	Ion-Detect	77
252				Varia	nce Detects	9941				Percent No	on-Detects	80%
253				М	ean Detects	269.5				S	D Detects	99.7
254				Mee	dian Detects	269.5				C	V Detects	0.37
255				Skewn	ess Detects	N/A				Kurtos	sis Detects	N/A
256				Mean of Log	ged Detects	5.561				SD of Logge	ed Detects	0.379
257												
258					Warning: D	ata set has o	only 2 Detec	ted Values.				
250			TI	his is not end	ough to comp	oute meaning	gful or reliab	le statistics	and estimat	tes.		

	А	В	С	D	E	F	G	Н		J	К	L	
260													
261													
262					Norn	nal GOF Tes	t on Detects	Only					
263					Not En	ough Data to	Perform G	OF Test					
264													
265			Kaplan-	Meier (KM) S	Statistics usi	ng Normal C	ritical Value	s and other	Nonparar	metric UCLs			
266					KM Mean	86.3				KM Standard	Error of Mean	43.32	
267					KM SD	96.87				95% ł	KM (BCA) UCL	N/A	
268				95%	KM (t) UCL	165.7			95% KN	A (Percentile E	Bootstrap) UCL	N/A	
269			,	95%	KM (z) UCL	157.6				95% KM B	ootstrap t UCL	N/A	
270				30% KM Che	byshev UCL	216.3				95% KM C	hebyshev UCL	275.1	
271			97	.5% KM Che	bysnev UCL	356.9				99% KM C	nebysnev UCL	517.4	
272						Tooto on D	tootod Obo	nuctions Or					
273				e	Not En		Porform G		шу				
274					NOLEI			JF Test					
275					Gamma	Statistics or	Detected D	ata Only					
276			k hat (MLE) 14.27 k star (bias corrected MLE)										
277				The	ta hat (MLE)	18.88			The	eta star (bias c	corrected MLE	N/A	
278				r	u hat (MLE)	57.09				nu star (	bias corrected)	N/A	
279				Me	an (detects)	269.5				(	,		
200					, ,								
201				Es	timates of G	amma Para	meters using	y KM Estima	ites				
283					Mean (KM)	86.3					SD (KM)	96.87	
284				Va	riance (KM)	9385				SE	of Mean (KM)	43.32	
285					k hat (KM)	0.794					k star (KM)	0.622	
286					nu hat (KM)	15.87					nu star (KM)	12.44	
287				th	eta hat (KM)	108.7				1	theta star (KM)	138.7	
288			80%	6 gamma per	centile (KM)	142.2			ę	90% gamma p	percentile (KM)	222.6	
289			95%	6 gamma per	centile (KM)	306.5			ę	99% gamma p	percentile (KM)	508.7	
290						I							
291					Gamm	na Kaplan-M	eier (KM) St	atistics					
292									Adjus	sted Level of S	Significance (β)	0.0267	
293		App	proximate Ch	i Square Valı	ue (12.44, α)	5.521			Adjusted	Chi Square V	'alue (12.44, β)	4.744	
294	95%	6 Gamma Ap	proximate KN	/I-UCL (use v	/hen n>=50)	194.5		95% Gamm	na Adjuste	ed KM-UCL (u	se when n<50)	226.4	
295													
296				Lo	gnormal GC	OF Test on D	etected Obs	ervations O	nly				
297					Not En	ough Data to	Perform G	OF Test					
298													
299				Lo	gnormal RO	S Statistics	Using Impute	ed Non-Dete	ects			0.000	
300				Mean in O	riginal Scale	81.25				Mea	in in Log Scale	3.826	
301		050/ +1		SD In O	riginal Scale	100			05	S 10/ Deveentile	D In Log Scale	1.056	
302		95% t l	UCL (assume		etetren LICI	142.7			95			140.6	
303						248.0				95% B	ooisirap t UCL	370.8	
304				30 /0 FI-UU		240.9							
305			Static	tics using K	V estimates	on Logged	Data and ∆o	sumina Log	normal Di	stribution			
306			Statis		an (logged)	4 072				Sanduuuli	KM Geo Meon	58 75	
307				KM		0.754			95	% Critical H V	alue (KM-Log	2 626	
308			KM Standa		ean (logged)	0.337			50	95% H-I		150.9	
309				KM	SD (logged)	0.754			95	% Critical H V	/alue (KM-Log)	2.626	
310			KM Standa	rd Error of M	ean (logged)	0.337						2.020	
311					iogged)	0.007							
312													

	А	В	С	D	E	F	G	Н	I	J	K	L	
313						DL/2 St	tatistics		DI /0	• <b>T</b> uo 11 of o 1110 o d			
314			DL/2 I	Normai		00 70			DL/2 LOg	g- I ransformed		2.005	
315					riginal Scale	82.73				Mean	in Log Scale	3.905	
316			OE0/ +1			104				5D 05%		0.074	
317			95% [[		es normality)	143			l historiaal	95%	H-Stat UCL	177	
318			DLIZ	IS NOL A LECO	mmenaea m	etrioa, provid	ued for comp	parisons and	1 historical	reasons			
319					Nonnoromo	trio Diotribu	tion Eroo LIC						
320				Data do n		iscornible Di	ietribution at	5% Signific	ancolava	<b>N</b>			
321								. 5 % Signine		71			
322						Suggested	UCL to Use						
323				95%	KM (t) UCI	165.7					KM H-UCI	150.9	
324				95% KM	1 (BCA) UCL	N/A							
325				Warn	ina: One or r	nore Recom	mended UC	L(s) not ava	ilable!				
320								_(-,-,					
327		Note: Sugge	estions regard	ling the seled	tion of a 95%	UCL are pro	ovided to he	lp the user to	select the	e most appropria	ate 95% UCL.		
320			F	Recommenda	ations are bas	sed upon dat	a size, data	distribution,	and skewn	ess.			
329		These reco	mmendation	s are based u	pon the resu	Its of the sim	ulation studi	es summariz	zed in Sing	h, Maichle, and	d Lee (2006).		
331	H	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
332		,, _,, _											
333													
334	Result (2a-	w-10)											
335													
336						General	Statistics						
337			Total	Number of C	Observations	10			Numl	ber of Distinct (	Observations	10	
338									Numt	ber of Missing (	Observations	0	
339					Minimum	151					Mean	302.9	
340					Maximum	550					Median	278.5	
341					SD	128.7				Std. E	rror of Mean	40.7	
342				Coefficien	t of Variation	0.425					Skewness	0.686	
343													
344						Normal C	GOF Test						
345			S	Shapiro Wilk	Fest Statistic	0.944			Shapiro \	Wilk GOF Test			
346			5% S	hapiro Wilk C	Critical Value	0.842		Data app	ear Norma	I at 5% Signific	ance Level		
347				Lilliefors	Fest Statistic	0.138			Lilliefo	rs GOF Test			
348			5	5% Lilliefors C	Critical Value	0.262		Data app	ear Norma	I at 5% Signific	ance Level		
349					Data appe	ar Normal at	5% Signific	ance Level					
350					<b>^</b>		nal Dist it	lan					
351			050/ 14		As	suming Norr	nai Distribut			divoted for Ola	wmaaa)		
352			90% INC		dent's t LCL	377 5		90%			(Chen 1005)	370.2	
353				90% Slu	ueni s-i UCL	377.3			95 % Aujus		(Cileii-1995)	370	
354									30 /0 IVIOO	inieu-i UCL (JO	1113011-1970)	513	
355						Gamma	GOF Teet						
356				A-D -	Test Statistic	0.186		Ande	rson-Darlir	ng Gamma GO	F Test		
357				5% A-D C	Critical Value	0.728	Detecte	d data anne:	ar Gamma	Distributed at P	5% Sjanificano	ce Level	
358				K-S	Test Statistic	0.131	2010010	Kolmor	orov-Smir	nov Gamma G	OF Test		
359				5% K-S (	Critical Value	0.267	Detecte	d data appea	ar Gamma	Distributed at 5	5% Significand	ce Level	
361				Detected	data appea	r Gamma Dis	stributed at	5% Significa	nce Level				
301													
J02													

	А	В	С	D	E	F	G	Н	I	J	K	L		
363						Gamma	Statistics							
364					k hat (MLE)	6.309			k	star (bias cor	rected MLE)	4.483		
365				The	eta hat (MLE)	48.01			Theta	ı star (bias cor	rected MLE)	67.57		
366					nu hat (MLE)	126.2				nu star (bia	as corrected)	89.66		
367			M	E Mean (bi	as corrected)	302.9				MLE Sd (bia	as corrected)	143.1		
368									Approximat	e Chi Square	Value (0.05)	68.83		
360			Adjus	ted Level of	f Significance	0.0267			- A	Adjusted Chi S	quare Value	65.66		
270														
370					As	suming Gar	nma Distribu	tion						
3/1	(	5% Annroxi	mate Gamma	UCL (use v	vhen n>=50))	394.6		95%	Adjusted Gam	ma LICL (use	when n<50)	413.6		
372				002 (000 )		001.0		00701			(incline 100)	110.0		
3/3						Lognorma	I GOF Test							
3/4			c	hanira Wilk	Tost Statistic			Sh	aniro Wilk Lo	anormal COE	Toet			
375			50/ C	hapiro Wilk	Critical Value	0.909		Data ann		J at 5% Signifi				
376			5%3			0.042								
377						0.122		Data and						
378			5	% Lilliefors	Critical value	0.262	nal at 5% Significance Level							
379					Data appear	r Lognormai	at 5% Signi	licance Le	vei					
380														
381						Lognorma	ormal Statistics							
382				Minimum of	Logged Data	5.017	17 Mean of logged Data							
383			Ν	laximum of	Logged Data	6.31	1 SD of logged Data							
384														
385					Assi	uming Logno	ormal Distrib	ution						
386					95% H-UCL	414.1	1 SD of logged Dat .ognormal Distribution 90% Chebyshev (MVUE) UC 97.5% Chebyshev (MVUE) UC 3							
387			95%	Chebyshev	(MVUE) UCL	484.1			97.5%	Chebyshev (	MVUE) UCL	562.4		
388			99%	Chebyshev	(MVUE) UCL	716.3								
389														
390					Nonparame	etric Distribu	tion Free UC	CL Statistic	s					
391				Data appea	ar to follow a	Discernible	Distribution	at 5% Sigr	nificance Leve	əl				
392														
393					Nonpa	rametric Dis	tribution Fre	e UCLs						
394				9	5% CLT UCL	369.8				95% Ja	ckknife UCL	377.5		
395			95%	Standard B	ootstrap UCL	366.6				95% Boo	tstrap-t UCL	392.8		
396			9	5% Hall's B	ootstrap UCL	390.7			95%	Percentile Bo	otstrap UCL	369.2		
397				95% BCA B	ootstrap UCL	373.5								
398			90% Ch	ebyshev(Me	ean, Sd) UCL	425			95% C	hebyshev(Me	an, Sd) UCL	480.3		
399			97.5% Ch	ebyshev(Me	ean, Sd) UCL	557			99% C	hebyshev(Me	an, Sd) UCL	707.8		
400											I			
401						Suggested	UCL to Use							
402				95% Stu	udent's-t UCL	377.5								
403						ļ	ŀ							
404		Note: Sugge	estions regard	ing the sele	ction of a 95%	6 UCL are pr	ovided to he	lp the user	to select the i	nost appropria	ate 95% UCL	•		
405			F	Recommend	ations are bas	sed upon dat	a size, data	distributior	, and skewne	SS.				
406		These reco	mmendations	are based	upon the resu	Its of the sim	nulation studi	ies summa	rized in Singh	, Maichle, and	I Lee (2006).			
407	He	owever, simu	ulations result	s will not co	ver all Real W	/orld data se	ts; for additic	onal insight	the user may	want to consu	ult a statisticia	an.		
408														
409	Result (2a-	w-40)												
410														
411						General	Statistics							
412			Total	Number of	Observations	10	0 Number of Distinct Observation							
413				Numb	er of Detects	1	Number of Non-Detect							
414			N	umber of Dis	stinct Detects	1	Number of Distinct Non-Detect							
415														
416		Warning: Or	nly one distin	ct data valu	e was detecte	ed! ProUCL	(or any othe	r software)	) should not b	e used on su	ch a data set	1		
417	lt is sugg	ested to use	alternative s	ite specific	values deteri	mined by the	e Project Tea	am to estin	nate environn	nental parame	eters (e.g., El	PC, BTV).		
418														
419				The d	lata set for va	riable Resu	lt (2a-w-40)	was not pr	ocessed!					
-														

	A	В	С	D	E	F	G	Н			J		K	L
420														
421														
422														
423	Result (2a-	·w-41)												
424														
425						General	Statistics							
426			Total	Number of (	Observations	10			Nu	umbe	r of Distine	ct Ol	bservations	10
427									Nu	ımbeı	of Missin	ng Ol	bservations	0
428					Minimum	145							Mean	577.6
429					Maximum	1130							Median	567.5
430					SD	340.3					Sto	1. Er	ror of Mean	107.6
431				Coefficien	t of Variation	0.589							Skewness	0.212
432														
433						Normal (	GOF Test							
434			S	hapiro Wilk	Test Statistic	0.949			Shapir	ro Wi	Ik GOF Te	est		
435			5% S	hapiro Wilk (	Critical Value	0.842		Data app	ear Norr	mal a	t 5% Sign	ifica	nce Level	
436				Lilliefors	Test Statistic	0.139			Lillie	efors	GOF Tes	t		
437			5	% Lilliefors (	Critical Value	0.262		Data app	ear Norr	mal a	t 5% Sign	ifica	nce Level	
438					Data appe	ar Normal at	5% Signific	ance Level						
439		Assuming Normal Distribution												
440		Assuming Normal Distribution												
441	95% Student's-t UCL 774.9 95% Adjusted CLT UCL (C													
442				95% Stu	dent's-t UCL	774.9			95% Ac	djuste	ed-CLT UC	CL (C	Chen-1995)	762.3
443									95% M	/lodifie	ed-t UCL (	(Joh	nson-1978)	776.1
444						-								
445					<b>T</b>	Gamma	GOF Test	<u> </u>						
446				A-D	l est Statistic	0.286	Dataata	Ande	rson-Da	arling	Gamma	GOF		
447				5% A-D (	Tritical Value	0.733	Detecte	d data appea	ar Gamn	ma Di	stributed a	at 59	% Significant	ce Level
448				K-5	l est Statistic	0.163	Detecto		jorov-Sr		ov Gamma			
449				5% K-S (		0.269	Detecte		ar Gamn	na Di	stributed	at 5%	% Significant	ce Level
450				Delected	i uata appea			5% Significa		vei				
451						Gamma	Statistics							
452					k bat (MLE)	2 627	Statistics			k	etar (hiae	corr	ected MLE)	1 005
453				The	ta bat (MLE)	2.027			т	hota	star (bias	corr	ected MLE)	303 1
454						52 53				neta		(hias		38 11
455			М	E Mean (bia		577.6						(bias	corrected)	418.4
456			IVI			077.0			Annroxi	imate		are \	(alue (0.05)	24 97
457			Adius	ted Level of	Significance	0.0267			прріолі		diusted Ch	ni So	uare Value	23.14
458			Aujua		Significance	0.0207					.,			20.17
459					As	sumina Gam	ma Distribu	tion						
460	-	95% Approxi	mate Gamma	UCL (use w	/hen n>=50\)	881.5		95% Ar	diusted (	Gamr	na UCL (i	Jse v	when n<50)	951.3
401				(300 M					,		((			
402						Lognorma	GOF Test							
403			S	hapiro Wilk	Test Statistic	0.921		Sha	piro Will	k Log	normal G	iOF	Test	
465			5% S	hapiro Wilk (	Critical Value	0.842		Data appea	ar Logno	ormal	at 5% Sig	gnific	ance Level	
466				Lilliefors	Test Statistic	0.16		Li	lliefors L	Logno	ormal GO	FΤe	est	
467			5	% Lilliefors (	Critical Value	0.262		Data appea	ar Logno	ormal	at 5% Sig	gnific	ance Level	
468					Data appear	· Lognormal	at 5% Signi	ficance Leve	əl					
469														
470						Lognorma	I Statistics							
471				Minimum of	Logged Data	4.977					Mean	of lo	ogged Data	6.157
472			Ν	Aaximum of	Logged Data	7.03					SD	) of lo	ogged Data	0.722
473													ļ	

	А	В	С	D	E	F	G	Н	I	J	K	L
474					Assu	uming Logno	ormal Distrit	oution				
475					95% H-UCL	1138			90%	Chebyshev (	(MVUE) UCL	1014
476			95%	Chebyshev (	MVUE) UCL	1204			97.5%	Chebyshev (	(MVUE) UCL	1469
477			99%	Chebyshev (	MVUE) UCL	1988						
478												
479					Nonparame	etric Distribu	tion Free U	CL Statistic	S			
480				Data appea	r to follow a	Discernible	Distribution	at 5% Sign	ificance Leve	el a la constante de la consta		
481												
482					Nonpa	rametric Dis	tribution Fre	e UCLs				
483				95	5% CLT UCL	754.6				95% Ja	ackknife UCL	774.9
484			95%	Standard Bo	ootstrap UCL	744.2				95% Boo	otstrap-t UCL	791.3
485			ç	95% Hall's Bo	otstrap UCL	756.9			95%	Percentile Bo	ootstrap UCL	738.6
486				95% BCA Bo	otstrap UCL	751.1						
487			90% Ch	nebyshev(Me	an, Sd) UCL	900.4			95% C	hebyshev(Me	an, Sd) UCL	1047
488			97.5% Ch	nebyshev(Me	an, Sd) UCL	1250			99% C	hebyshev(Me	an, Sd) UCL	1648
489												
490						Suggested	UCL to Use	)				
491				95% Stu	dent's-t UCL	774.9						
492												
493		Note: Sugge	stions regard	ling the selec	tion of a 95%	UCL are pr	ovided to he	Ip the user	to select the n	nost appropri	ate 95% UCL	
494				Recommenda	ations are bas	sed upon dat	a size, data	distribution	, and skewnes	SS.	(0000)	
495		I hese reco	mmendation	s are based u	ipon the resu	Its of the sim	iulation stud	lies summai	rized in Singh	, Maichle, and	d Lee (2006).	
496	H	owever, simu	liations result	IS WIII NOT COV	er all Real W	orid data se	is; for addition	onal insight	the user may	want to cons	uit a statisticia	an.
497												
498	Desult (2a											
499	Result (28	-w-4 <i>z)</i>										
500						General	Statistics					
501			Total	Number of (	Observations	10			Numbe	er of Distinct (	Observations	9
502									Numbe	er of Missing (	Observations	0
503					Minimum	100					Mean	201.6
504					Maximum	330					Median	180
506					SD	69.67				Std. E	rror of Mean	22.03
507				Coefficien	t of Variation	0.346					Skewness	0.573
508												
509						Normal (	GOF Test					
510			S	hapiro Wilk	Fest Statistic	0.935			Shapiro W	ilk GOF Test	:	
511			5% S	hapiro Wilk C	Critical Value	0.842		Data ap	pear Normal a	at 5% Signific	ance Level	
512				Lilliefors	Fest Statistic	0.198			Lilliefors	GOF Test		
513			5	5% Lilliefors C	Critical Value	0.262		Data ap	pear Normal a	at 5% Signific	ance Level	
514					Data appe	ar Normal at	5% Signifie	cance Leve	1			
515												
516					As	suming Nor	nal Distribu	tion				
517			95 <mark>% N</mark> o	ormal UCL				95	% UCLs (Adjı	usted for Ske	wness)	
518				95% Stu	dent's-t UCL	242			95% Adjust	ed-CLT UCL	(Chen-1995)	242.1
519									95% Modif	ied-t UCL (Jo	hnson-1978)	242.6
520												
521						Gamma	GOF Test		<b>_</b>			
522				A-D	est Statistic	0.331		And	erson-Darling	<b>y Gamma GC</b>		
523				5% A-D (	ritical Value	0.726	Detecte	ed data app	ear Gamma D	vistributed at {	o% Significan	ce Level
524				K-S	est Statistic	0.182		Kolmo	ogorov-Smirn	ov Gamma G		
525				5% K-S (	ritical Value	0.267	Detecte	ed data app	ear Gamma D	vistributed at {	o% Significan	ce Level
526				Detected	i data appeai	r Gamma Di	stributed at	o% Signific	ance Level			
527												

	А	В	С	D	E	F	G	Н		J	K	L	
528	Gamma Statistics												
529					k hat (MLE)	9.367	k star (bias corrected MLE)					6.624	
530				The	ta hat (MLE)	21.52	Theta star (bias corrected MLE)					30.44	
531				r	nu hat (MLE)	187.3	nu star (bias corrected)					132.5	
532			М	LE Mean (bia	as corrected)	201.6	MLE Sd (bias corrected)					78.33	
533							Approximate Chi Square Value (0.05)					106.9	
534			Adjus	sted Level of	Significance	0.0267	Adjusted Chi Square Value					102.9	
535													
536	Assuming Gamma Distribution												
537	95% Approximate Gamma UCL (use when n>=50)) 249.9 95% Adjusted Gamma UCL (use when n<50)											259.6	
538													
539													
540			5	Shapiro Wilk	lest Statistic	0.953	Shapiro Wilk Lognormal GOF Test						
541			5% S	hapiro Wilk C	Critical Value	0.842	Data appear Lognormal at 5% Significance Level						
542				Lilliefors	est Statistic	0.176	Lilliefors Lognormal GOF Test						
543	5% Lilliefors Critical Value 0.262 Data appear Lognormal at 5% Significance Level												
544	Data appear Lognormal at 5% Significance Level												
545													
546						Lognorma	I Statistics					5 050	
547	Minimum of Logged Data					4.605	Mean of logged Data				5.252		
548			1	viaximum of L	Logged Data	5.799				SD of	logged Data	0.351	
549													
550	Assuming Lognormal Distribution											000.0	
551			05%	0	95% H-UCL	257.5			90%	269.6			
552	95% Chebyshev (MVUE) UCL						97.5% Chebysnev (MVOE) UCL					342.9	
553			99%	Chebysnev (	MVUE) UCL	426.6							
554	Name are madele. Distrikted by Error 1101. Other later												
555				Data annea				at 5% Signif	icanca Leve	1			
556	Data appear to tollow a Discernible Distribution at 5% Significance Level												
557	Nonporemetria Distribution Free UCLs												
558				95		237.8		00010		95% Ja	ckknife UCL	242	
559	95% Standard Bootstran UCI					236.1	95% Bootstrap-t UC				otstran-t UCI	250	
560	95% Hall's Bootstrap UCL					243.5		95% Percentile Bootstrap UCL				238.7	
501				95% BCA Bo	otstrap UCI	240.6			0070				
562	90% Chebyshev(Mean, Sd) UCI					267.7	95% Chebyshev(Mean. Sd) UCL				297.6		
503			97.5% Cł	nebyshev(Me	an, Sd) UCL	339.2			99% Cł	nebyshev(Me	an, Sd) UCL	420.8	
504				.,	, _ , ,					.,	, ,		
505	Suaaested UCL to Use												
500	95% Student's-t UCL 242												
569							<u> </u>						
560		Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
570		Recommendations are based upon data size, data distribution, and skewness.											
570		These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
572	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											an.	
572													
5/3													
	A B C D E	F	G H I J K	L									
------------	---	---------------	--	----------									
574	Result (2a-w-9)												
575		General	Statistics										
5/6	Total Number of Observations	10	Number of Distinct Observations	9									
572	Number of Detects	9	Number of Non-Detects	1									
579	Number of Distinct Detects	8	Number of Distinct Non-Detects	1									
580	Minimum Detect	119	Minimum Non-Detect	230									
581	Maximum Detect	1040	Maximum Non-Detect	230									
582	Variance Detects	91394	Percent Non-Detects	10%									
583	Mean Detects	409	SD Detects	302.3									
584	Median Detects	225.5	CV Detects	0.739									
585	Skewness Detects	1.218	Kurtosis Detects	1.088									
586	Mean of Logged Detects	5.78	SD of Logged Detects	0.725									
587	N - m-		t en Dete de Onte										
588	Norm Chapita Wilk Test Statistic		t on Detects Unly										
589	Shapiro Wilk Test Statistic	0.820	Shapiro Wilk GOF Test										
590		0.829	Lilliefors GOE Test	CI									
591	5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level										
592	Detected Data appear	Approximat	e Normal at 5% Significance Level										
593		••											
595	Kaplan-Meier (KM) Statistics usi	ng Normal C	critical Values and other Nonparametric UCLs										
596	KM Mean	387.1	KM Standard Error of Mean	93.57									
597	KM SD	278.6	95% KM (BCA) UCL	541.6									
598	95% KM (t) UCL	558.7	95% KM (Percentile Bootstrap) UCL	536.8									
599	95% KM (z) UCL	541	95% KM Bootstrap t UCL	672.9									
600	90% KM Chebyshev UCL	667.8	95% KM Chebyshev UCL	795									
601	97.5% KM Chebyshev UCL	971.5	99% KM Chebyshev UCL	1318									
602													
603	Gamma GOF	lests on De	Anderson Derling COF Test										
604	A-D Test Statistic	0.434	Anderson-Daning GOF Test										
605	K-S Test Statistic	0.729	Kolmogorov-Smirnov GOF										
606	5% K-S Critical Value	0.282	Detected data appear Gamma Distributed at 5% Significand	e l evel									
608	Detected data appear	r Gamma Di	stributed at 5% Significance Level										
609													
610	Gamma	Statistics or	n Detected Data Only										
611	k hat (MLE)	2.291	k star (bias corrected MLE)	1.601									
612	Theta hat (MLE)	178.5	Theta star (bias corrected MLE)	255.4									
613	nu hat (MLE)	41.23	nu star (bias corrected)	28.82									
614	Mean (detects)	409											
615													
616	Gamma ROS	Statistics u											
617	GROS may not be used when data's	et nas > 50%	$_{0}$ NDS with many tied observations at multiple DLS										
618	For such situations, GBOS	method may	vield incorrect values of LICLs and BTVs										
619	This is especi	ally true whe	an the sample size is small.										
620	For gamma distributed detected data. BTVs a	Ind UCLs ma	v be computed using gamma distribution on KM estimates										
0∠1 622	Minimum	119	Mean	387.2									
623	Maximum	1040	Median	225.5									
624	SD	293.3	CV	0.757									
625	k hat (MLE)	2.309	k star (bias corrected MLE)	1.683									
626	Theta hat (MLE)	167.7	Theta star (bias corrected MLE)	230.1									
627	nu hat (MLE)	46.18	nu star (bias corrected)	33.66									
628	Adjusted Level of Significance (β)	0.0267											
629	Approximate Chi Square Value (33.66, α)	21.39	Adjusted Chi Square Value (33.66, β)	19.71									
630	95% Gamma Approximate UCL (use when n>=50)	609.2	95% Gamma Adjusted UCL (use when n<50)	661.3									
631	Falinatia da	omme Der-	motors using KM Estimator										
632		387 1		278 6									
633	Variance (KM)	77610	SE of Mean (KM)	93 57									
634	k hat (KM)	1.931	k star (KM)	1.418									
035													

	A	В	С	D	E	F	G	Н			J		K	L
636					nu hat (KM)	38.62						n	u star (KM)	28.37
637				tr	ieta hat (KM)	200.5						theta	a star (KM)	272.9
638			80%	6 gamma pe	rcentile (KM)	602.6				90%	b gamma	perc	entile (KM)	817.8
639			95%	6 gamma pe	rcentile (KM)	1028				99%	5 gamma	perc	entile (KM)	1503
640														
641					Gamm	a Kaplan-M	eier (KM) Sta	atistics					(00.07.0)	
642		App	proximate Ch	i Square Val	ue (28.37, α)	17.21			Adjuste	ed Chi	Square	Value	e (28.37, β)	15./2
643	95%	o Gamma Ap	proximate KN	/I-UCL (use v	when n>=50)	637.9		95% Gamm	na Adjus	sted K	M-UCL (	use v	when n<50)	698.5
644														
645				L(	ognormal GC			ervations O						
646			5		lest Statistic	0.937	<u> </u>		Snapi	ro wi				
647			5% 5			0.829	Dete	ected Data a	appear L	_ogno	rmal at 5	% SIQ	gnificance L	evei
648				Lilliefors		0.247	Det		LIIIIe	etors	GOF Tes	ST	···· : 6:	
649			5	% Lilliefors (	critical value	0.274	Dete	ected Data a	appear L	_ogno	rmal at 5	% Sig	gnificance L	evel
650				Dete	ected Data ap	opear Logno	rmai at 5% S	significance	Levei					
651						C Statistica	loing Imput	d Non Dot	t-					
652				Maan in C					ecis		Ma	on in		E 720
653				Niean in C	riginal Scale	388.1					ivie	ean in	i Log Scale	0.7
654		0.5% +1				292.0				050/ 0	Doroontilo			0.7
655		95%10				579 5				95 % F		Poot		641.2
656						5/6.5 711.6					95%	DUUIS	strap t OCL	041.3
657 95% H-UCL (LOG RUS) /11.6														
658			Static	tios using K	Mostimatos		Data and Asy		normal	Dietri	hution			
659			Statis			5 724			normai	Disui	Julion	КM	Geo Mean	306
660				KM		0.675				95% (	ritical H	Value		2 489
661			KM Standa		ean (logged)	0.070				5570 0	95% H		(KM -Log)	672.4
662				KM	SD (logged)	0.675			(	95% (	Critical H	Value	e (KM-Log)	2 489
663			KM Standa	rd Error of M	ean (logged)	0.228							o ( 209)	
665					(-33)									
666						DL/2 S	tatistics							
667			DL/2	Normal					DL/2	Log-T	ransform	ned		
668				Mean in C	riginal Scale	379.6				-	Me	ean in	n Log Scale	5.676
669				SD in C	riginal Scale	299.8					:	SD in	n Log Scale	0.758
670			95% t l	JCL (Assum	es normality)	553.4					ç	95% H	H-Stat UCL	756.2
671			<b>DL/2</b> i	is not a reco	mmended m	ethod, provi	ded for comp	arisons and	d histori	ical re	asons			
672														
673					Nonparame	etric Distribu	tion Free UC	L Statistics						
674			De	tected Data	appear Appr	oximate Nor	mal Distribut	ed at 5% Si	ignificar	nce Le	evel			
675														
676						Suggested	UCL to Use							
677 95% KM (t) UCL 558.7														
678														
679			When a c	lata set follo	ws an approx	imate (e.g., ı	normal) distri	bution passi	ng one	of the	GOF tes	st		
680		When app	olicable, it is s	suggested to	use a UCL b	ased upon a	distribution (	e.g., gamma	a) passii	ng bot	th GOF te	ests ir	n ProUCL	
681														
<u>68</u> 2		Note: Sugge	stions regard	ling the sele	ction of a 95%	UCL are pr	ovided to hel	p the user to	select	the m	ost appro	opriat	te 95% UCL	-
<u>68</u> 3			F	Recommenda	ations are bas	sed upon dat	a size, data o	distribution,	and ske	wnes	s.			
684		These reco	mmendations	s are based (	upon the resu	Its of the sim	ulation studi	es summariz	zed in S	Singh,	Maichle,	and l	Lee (2006).	
685	Ho	owever, simu	lations result	s will not cov	ver all Real W	orld data se	ts; for additio	nal insight th	ne user	may v	vant to co	onsul	t a statisticia	an.
686														

	А	В	С	D	E	F	G	Н		J	K	L	
687	<sub>37</sub> Result (2b-w-4)												
688													
689						General	Statistics						
690			Total	Number of C	bservations	10			Numbe	r of Distinct O	bservations	4	
601				Numbe	er of Detects	0				Number of N	Non-Detects	10	
091			N	umber of Dist	inct Detects	0			Numbe	er of Distinct N	Non-Detects	4	
692						•							
693		14/			New Datast								
694		vvar	ning: All obse	ervations are	Non-Detect	s (NDS), the	refore all sta	atistics and e	estimates sn	ouid also be			
695		Specif	ically, sample	e mean, UCL	.s, UPLs, an	d other stati	stics are als	o NDs lying	below the la	rgest detectio	on limit!		
696		The Project	Team may de	ecide to use	alternative s	ite specific v	alues to est	imate enviro	onmental par	ameters (e.g.	., EPC, BTV	).	
697													
698				The d	ata set for va	ariable Resu	lt (2b-w-4) v	vas not proc	essed!				
699													
700													
701	Result (5-w	/-14)											
701	•												
702						General	Statistics						
703			Total	Number of C	hservations	10			Numbo	r of Distinct ()	bservations	4	
/04			iudi	Number	ar of Detocto	0			Tambe	Number of N	Von-Detecto	10	
705			K I		inot Doto -t-	0			NI		Von-Delecis	10	
706			N	uniber of Dist	INCL DETECTS	U			NUMD		NUII-DETECTS	4	
707													
708		War	ning: All obse	ervations are	Non-Detect	ts (NDs), the	refore all sta	atistics and e	estimates sh	ould also be	NDs!		
709		Specif	ically, sample	e mean, UCL	.s, UPLs, an	d other stati	stics are als	o NDs lying	below the la	rgest detectio	on limit!		
710		The Project	Team may de	ecide to use	alternative s	ite specific v	alues to est	imate enviro	onmental par	ameters (e.g.	., EPC, BTV	).	
711													
712	The data set for variable Result (5-w-14) was not processed!												
713													
714													
714	Result (5-w	/-16)											
715	(	· · · <b>/</b>											
/16						General	Statistics						
717			Total	Number of C	heariana	11	otatistics		Numbo	r of Dictingt O	hearing	5	
718			TOLA	Number of C		0			Numbe	Number of N		11	
719				NUMDE	er of Detects	0					von-Detects		
720			N	umber of Dist	inct Detects	0			Numbe	er of Distinct N	Jon-Detects	5	
721													
722		War	ning: All obso	ervations are	Non-Detect	ts (NDs), the	refore all sta	atistics and e	estimates sh	ould also be	NDs!		
723		Specif	ically, sample	e mean, UCL	.s, UPLs, an	d other stati	stics are als	o NDs lying	below the la	rgest detectio	on limit!		
724		The Project	Team may de	ecide to use	alternative s	ite specific v	alues to est	imate enviro	onmental par	ameters (e.g.	., EPC, BTV	).	
725													
726				The d	ata set for va	ariable Resu	lt (5-w-16) v	vas not proc	essed!				
727													
728													
720	Result (5-w	<i>ı</i> -17)											
729		,											
/30						General	Statistics						
/31			Total	Number of C	heenvotions	10	- 1410100		Numbo	r of Distinct O	Ihservations	Λ	
732			TULAI	Number of C		10			Numbe			4	
733						0			·			10	
734			N	umber of Dist	Inct Detects	U			Numbe	er of Distinct N	von-Detects	4	
735													
736		War	ning: All obs	ervations are	Non-Detect	ts (NDs), the	refore all sta	atistics and e	estimates sh	ould also be	NDs!		
737		Specif	ically, sample	e mean, UCL	.s, UPLs, an	d other stati	stics are als	o NDs lying	below the la	rgest detectio	on limit!		
738	-	The Project	Team may de	cide to use	alternative s	ite specific v	alues to est	imate enviro	onmental par	ameters (e.g.	., EPC, BTV	).	
739													
740				The d	ata set for va	ariable Resu	lt (5-w-17) v	vas not proc	essed!				
740							. ,	•					
741													
/42													

	A	В	С	D	E	F	G	Н		J	K	L
743	Result (5-v	v-18)										
744												
745						General	Statistics					
746			Total	Number of C	Observations	11			Numbe	er of Distinct (	Observations	5
747				Numb	er of Detects	2				Number of	Non-Detects	9
748			N	umber of Dis	tinct Detects	2			Numb	er of Distinct	Non-Detects	3
749				Min	mum Detect	166.5				Minimum	n Non-Detect	76.5
750				Max	mum Detect	198				Maximum	n Non-Detect	78
751				Varia	nce Detects	496.1				Percent	Non-Detects	81.82%
751				N	lean Detects	182.3					SD Detects	22.27
752				Ме	dian Detects	182.3					CV Detects	0.122
753				Skewr	ess Detects	N/A				Kurt	tosis Detects	N/A
754				Mean of Loc	aed Detects	5.202				SD of Loc	aged Detects	0.123
755					. <u></u>						99	
756					Warning: D	ata set has (	only 2 Deter	cted Values.				
757			т	nis is not end	ough to com	oute meanin	aful or reliat	ole statistics	and estimat	es		
758												
759												
760					Norm	nal GOF Tes	t on Detects	s Only				
/61					Not En		Perform G					
762								OI TESL				
763			Kanlan-	Mojor (KM)	Statistice usi	ng Normal C	ritical Value	e and other	Nonnarama	tric UCLe		
764	KM Mean     95.73     KM Standard Error of Mean											
765						95.75			N			17.03 N/A
766				05%		107.7			05% KM /F	90 /0 Kiv	atetran) UCL	
767				90 /		127.7			95 % KIVI (F			
768				95%	KIVI (Z) UCL	124.7				95% KM BOC		N/A
769					bysnev UCL	148.6					bysnev UCL	172.0
770			97	.5% KIN Che	bysnev UCL	205.8				99% KM Che	ebysnev UCL	2/1.1
771					0.05	<b>T</b>						
772						iOF Tests on Detected Observations Only						
773					NOT EN	ougn Data to	Perform G	OF Test				
774					0		Data at a d F	Data Oata				
775					Gamma	Statistics or	Detected L	Data Only				N1/A
776					K nat (MLE)	133.0			K	star (blas cor	rrected MLE)	N/A
777				Ine	ta hat (MLE)	1.365			Ineta	star (bias coi	rrected MLE)	N/A
778				۱ ۱	nu hat (MLE)	534.3				nu star (bia	as corrected)	N/A
779				Me	ean (detects)	182.3						
780												
781				Es	sumates of G	iamma Parai	meters using	g KM Estima	tes			
782					Mean (KM)	95.73					SD (KM)	41.34
783				Va	ariance (KM)	1/09				SE o	or Mean (KM)	17.63
784					к nat (KM)	5.363					k star (KM)	3.961
785					nu hat (KM)	118					nu star (KM)	87.14
786				th	eta hat (KM)	17.85				the	eta star (KM)	24.17
787			80%	6 gamma pei	centile (KM)	132.1			909	% gamma pe	rcentile (KM)	160.2
788			95%	6 gamma pei	centile (KM)	186			999	% gamma pe	rcentile (KM)	241.3
789												
790					Gamm	na Kaplan-M	eier (KM) St	tatistics				
791									Adjusted	d Level of Sig	nificance (β)	0.0278
792		Ар	proximate Ch	i Square Val	ue (87.14, α)	66.62			Adjusted Ch	ni Square Val	ue (87.14, β)	63.7
793	95%	6 Gamma Ap	proximate KN	/I-UCL (use v	vhen n>=50)	125.2		95% Gamm	a Adjusted k	KM-UCL (use	when n<50)	130.9
794												
795				Lo	ognormal GC	OF Test on D	etected Obs	servations O	nly			
796					Not En	ough Data to	Perform G	OF Test				
797												

	А	В	С	D	E	F	G	Н		J	K	L
798				Lo	gnormal RO	S Statistics	Using Imput	ed Non-Dete	ects			
799				Mean in O	riginal Scale	106				Mean	in Log Scale	4.598
800				SD in O	riginal Scale	42.66				SD	in Log Scale	0.37
801		95% t l	UCL (assume	es normality of	of ROS data)	129.3			959	% Percentile B	ootstrap UCL	127.5
802				95% BCA Bo	ootstrap UCL	132.1				95% Bo	otstrap t UCL	144.5
803				95% H-UC	L (Log ROS)	134.7						
804												
805			Statis	stics using K	M estimates	on Logged I	Data and As	suming Log	normal Dis	stribution		
806				KM M	ean (logged)	4.494				K	M Geo Mean	89.52
807				KM	SD (logged)	0.335			959	% Critical H Va	lue (KM-Log)	1.984
808			KM Standa	rd Error of M	ean (logged)	0.143				95% H-U	CL (KM -Log)	116.9
809				KM	SD (logged)	0.335			959	% Critical H Va	lue (KM-Log)	1.984
810			KM Standa	rd Error of M	ean (logged)	0.143						
811												
812						DL/2 S	tatistics					
813			DL/2	Normal					DL/2 Log	g-Transformed		
814				Mean in O	riginal Scale	64.55				Mean	in Log Scale	3.93
815				SD in O	riginal Scale	58.62				SD	in Log Scale	0.63
816			95% t l	JCL (Assume	es normality)	96.58				95%	6 H-Stat UCL	99.3
817			DL/2 i	is not a reco	mmended m	ethod, provi	ded for com	parisons and	d historica	l reasons		
818												
819					Nonparame	etric Distribu	tion Free UC	CL Statistics				
820				Data do n	ot follow a D	iscernible Di	istribution at	5% Signific	ance Leve	əl		
821												
822						Suggested	UCL to Use					
823				95%	6 KM (t) UCL	127.7					KM H-UCL	116.9
824				95% KN	I (BCA) UCL	N/A						
825				Warn	ing: One or i	more Recom	mended UC					
826												
827		Note: Sugge	estions regard	ling the seled	ction of a 95%	6 UCL are pr	ovided to hel	lp the user to	select the	e most appropri	ate 95% UCL	
828			F	Recommenda	ations are bas	sed upon dat	a size, data	distribution,	and skewn	iess.		
829		These reco	mmendations	s are based ι	upon the resu	Its of the sim	nulation studi	ies summariz	zed in Sing	gh, Maichle, an	d Lee (2006).	
830	He	owever, simu	ulations result	s will not cov	/er all Real W	/orld data set	ts; for additic	onal insight th	ne user ma	ay want to cons	ult a statistici	an.
831												
832	Result (5-w	/-19)										
833												
834						General	Statistics					
835			Total	Number of C	Observations	10			Num	ber of Distinct	Observations	6
836				Numb	er of Detects	1				Number of	Non-Detects	9
837			N	umber of Dis	tinct Detects	1			Nun	nber of Distinct	Non-Detects	5
838												
839		Warning: Or	nly one distin	ct data value	e was detecte	ed! ProUCL	(or any othe	r software) s	should not	be used on su	ich a data sei	tl
840	It is sugg	ested to use	alternative s	site specific	values deter	mined by the	Project Tea	am to estima	te enviror	nmental param	eters (e.g., E	PC, BTV).
841												
842				The d	lata set for va	ariable Resu	ılt (5-w-19) v	vas not proc	essed!			
843												
844												

	A B C D E	F	G H I J K	L									
845	Result (5-w-43)												
846													
847		General	Statistics										
848	I otal Number of Observations	10	Number of Distinct Observations	6									
849	Number of Detects	3	Number of Distinct Non-Detects	/									
850	Minimum Detect	88	Minimum Non-Detect	37									
851	Maximum Detect	368	Maximum Non-Detect	77									
852	Variance Detects	24850	Percent Non-Detects	70%									
000 854	Mean Detects	186.2	SD Detects	157.6									
855	Median Detects	102.5	CV Detects	0.847									
856	Skewness Detects	1.716	Kurtosis Detects	N/A									
857	Mean of Logged Detects	5.005	SD of Logged Detects	0.786									
858			· · · · · · · · · · · · · · · · · · ·										
859	Warning: D	ata set has	only 3 Detected Values.										
860	This is not enough to comp	oute meanin	gful or reliable statistics and estimates.										
861													
862													
863	Norm	al GOF Tes	t on Detects Only										
864	Shapiro Wilk Test Statistic	0.789	Shapiro Wilk GOF Test										
865	5% Shapiro Wilk Childal Value	0.767	Lilliefors GOE Test	ei									
866	5% Lilliefors Critical Value	0.309	Detected Data appear Normal at 5% Significance Lev	ام									
867	Detected Data	appear Nom	nal at 5% Significance Level										
868													
870	Kaplan-Meier (KM) Statistics usi	ng Normal C	ritical Values and other Nonparametric UCLs										
871	KM Mean	81.75	KM Standard Error of Mean	38.03									
872	KM SD	98.2	95% KM (BCA) UCL	N/A									
873	95% KM (t) UCL	151.5	95% KM (Percentile Bootstrap) UCL	N/A									
874	95% KM (z) UCL	144.3	95% KM Bootstrap t UCL	N/A									
875	90% KM Chebyshev UCL	195.8	95% KM Chebyshev UCL	247.5									
876	97.5% KM Chebyshev UCL	319.3	99% KM Chebyshev UCL	460.2									
877													
878	Gamma GOF	Tests on De	etected Observations Only										
879	NOT ENG	ougn Data to	D Perform GOF Test										
880	Gamma	Statistics or	Detected Data Only										
881	k hat (MLF)	2.41         k star (bias corrected MLE)         N/A											
882	Theta hat (MLE)	77.23	Theta star (bias corrected MLE)	N/A									
001	nu hat (MLE)	14.46	nu star (bias corrected)	N/A									
885	Mean (detects)	186.2											
886													
887	Gamma ROS	Statistics u	sing Imputed Non-Detects										
888	GROS may not be used when data set	et has > 50%	6 NDs with many tied observations at multiple DLs										
889	GROS may not be used when kstar of detects is s	small such a	s <1.0, especially when the sample size is small (e.g., <15-20)										
890	For such situations, GROS r	method may	yield incorrect values of UCLs and BTVs										
891	This is especi	ally true whe	n the sample size is small.										
892	For gamma distributed detected data, BTVs a	nd UCLs ma	by be computed using gamma distribution on KM estimates	55.00									
893	Minimum	0.01	Mean										
894		116 7		2 088									
895	k hat (MI F)	0 136	k star (hias corrected MLE)	0 162									
896	Theta hat (MLE)	411.6	Theta star (bias corrected MEE)	345.5									
800 87	nu hat (MLE)	2.714	nu star (bias corrected)	3.233									
090 800	Adjusted Level of Significance (β)	0.0267		-									
900	Approximate Chi Square Value (3.23, α)	0.445	Adjusted Chi Square Value (3.23, β)	0.307									
901	95% Gamma Approximate UCL (use when n>=50)	406.1	95% Gamma Adjusted UCL (use when n<50)	N/A									
902													
903	Estimates of G	amma Para	meters using KM Estimates										
904	Mean (KM)	81.75	SD (KM)	98.2									
905	Variance (KM)	9643	SE of Mean (KM)	38.03									
906	k hat (KM)	0.693	k star (KM)	0.552									

	А	В	С	D	E	F	G	Н			J	K	L	
907				th	nu hat (KM) eta hat (KM)	13.86 118					th	nu star (KM) ieta star (KM)	11.04 148.1	
908			80%	6 gamma per	centile (KM)	134.7				90%	6 gamma pe	ercentile (KM)	216.6	
909			95%	6 gamma per	centile (KM)	303.2				99%	6 gamma pe	ercentile (KM)	514.1	
910				<u> </u>	. ,						<u> </u>			
912					Gamm	a Kaplan-M	eier (KM) St	atistics						
913		App	proximate Ch	i Square Valı	ue (11.04, α)	4.599			Adjuste	ed Ch	i Square Va	lue (11.04, β)	3.903	
914	95%	6 Gamma Ap	proximate KM	/I-UCL (use v	vhen n>=50)	196.2		95% Gamn	na Adjus	sted K	M-UCL (use	e when n<50)	231.2	
915														
916				Lo	ognormal GC	F Test on D	etected Obs	ervations O	nly					
917			S	hapiro Wilk	Fest Statistic	0.829			Shapi	ro Wi	k GOF Tes	t		
918			5% S	hapiro Wilk C	Critical Value	0.767	Det	ected Data a	appear L	ogno	rmal at 5% S	Significance L	evel	
919				Lilliefors	Fest Statistic	0.35			Lillie	efors	GOF Test			
920			5	% Lilliefors C	Critical Value	0.425	Det	ected Data a	appear L	_ogno	rmal at 5% S	Significance L	evel	
921				Dete	cted Data ap	opear Logno	rmal at 5% S	Significance	Level					
922														
923				Lo	gnormal RO	S Statistics	Using Imput	ed Non-Dete	ects					
924				Mean in O	riginal Scale	61.63					Mean	in Log Scale	2.733	
925				SD in O	riginal Scale	113.8					SD	in Log Scale	1.795	
926		95% t l	UCL (assume	es normality o	of ROS data)	127.6				95% F	Percentile B	ootstrap UCL	125.8	
927				95% BCA Bo	otstrap UCL	152.4			95% Bootstrap t UCL					
928				95% H-UC	L (Log ROS)	1450								
929														
930			Statis	stics using K	M estimates	estimates on Logged Data and Assuming Lognormal Distribution							50.04	
931				KM M	ean (logged)	4.029				050/ /	K	M Geo Mean	56.21	
932			KM Ctonda		SD (logged)	0.729				95% (		lue (KM-Log)	2.582	
933			KINI Standa		SD (logged)	0.282				050/ (	95% H-U	L (KIVI -LOG)	137.4	
934			KM Standa		SD (logged)	0.729				95%		iue (Kivi-Log)	2.302	
935					ean (logged)	0.202								
936						DL/2 S	tatistics							
937			DL/2	Normal		5220			DL/2	Loa-T	ransformed	1		
938				Mean in O	riginal Scale	80.68					Mean	in Log Scale	3.98	
939				SD in O	riginal Scale	104.2					SD	in Log Scale	0.829	
941			95% t l	JCL (Assume	es normality)	141.1					95%	% H-Stat UCL	162.1	
942			DL/2	is not a reco	mmended m	ethod, provi	ded for com	parisons and	d histori	ical re	asons			
943														
944					Nonparame	etric Distribu	tion Free UC	L Statistics	;					
945				Detected	l Data appea	r Normal Di	stributed at §	5% Significa	nce Lev	vel				
946														
947						Suggested	UCL to Use							
948				95%	5 KM (t) UCL	151.5								
949														
950		Note: Sugge	stions regard	ling the selec	tion of a 95%	95% UCL are provided to help the user to select the most appropriate 95% UCL.								
951			F	Recommenda	ations are bas	sed upon dat	a size, data	distribution,	and ske	wnes	S.			
952		These reco	mmendations	s are based ι	ipon the resu	Its of the sim	ulation studi	es summariz	zed in S	ingh,	Maichle, an	d Lee (2006).		
953	H	owever, simu	lations result	s will not cov	ver all Real W	/orld data se	ts; for additio	nal insight t	he user	may v	vant to cons	ult a statisticia	an.	
954														
955														

A B C D E F G H								J	K	L			
956	Result (5-w	<i>ı-</i> 51)											
957													
958						General	Statistics						
959			Total	Number of C	Observations	10			Numbe	r of Distinct C	Observations	9	
960									Number	r of Missing C	Observations	0	
961					Minimum	201					Mean	788.8	
062					Maximum	1530					Median	800	
902					SD	381				Std. E	rror of Mean	120.5	
963				Coefficient	t of Variation	0.483					Skewness	0.28	
964				0001101011		0.100						0.20	
965						Normal (							
966				honiro Mille	Foot Statiatia				Chaniza Wi				
967						0.957		Data ann	Snapiro wi				
968			5% 5			0.842		Data appe	ear Normal a	t 5% Significa	ance Level		
969				Lilliefors	lest Statistic	0.159			Lilliefors	GOF Test			
970			5	% Lilliefors C	Critical Value	0.262		Data appe	ear Normal a	t 5% Significa	ance Level		
971					Data appe	ar Normal at	t 5% Signific	ance Level					
972													
973					As	suming Nor	mal Distribut	tion					
974			95% No	ormal UCL				95%	UCLs (Adju	sted for Ske	wness)		
975				95% Stu	dent's-t UCL	1010			95% Adjuste	ed-CLT UCL (	(Chen-1995)	998.3	
976									95% Modifi	ed-t UCL (Joł	nnson-1978)	1011	
977													
978						Gamma	GOF Test						
979				A-D	Fest Statistic	0.453		Ande	rson-Darling	Gamma GO	F Test		
980				5% A-D C	Critical Value	0.73	Detecte	d data appea	ar Gamma Di	stributed at 5	5% Significan	ce Level	
981				K-S T	Fest Statistic	0.23		Kolmog	orov-Smirno	ov Gamma G	OF Test		
982				5% K-S C	Critical Value	0.268	Detecte	d data appea	ar Gamma Di	stributed at 5	5% Significan	ce Level	
083				Detected	data appea	ata appear Gamma Distributed at 5% Significance Level							
984													
985						Gamma	Statistics						
986					k hat (MLE)	3.787			k	star (bias cor	rected MLE)	2.718	
087				The	ta hat (MLE)	208.3			Theta	star (bias cor	rected MLE)	290.2	
088				r	nu hat (MLE)	75.75				nu star (bia	as corrected)	54.36	
080			М	LE Mean (bia	as corrected)	788.8				MLE Sd (bia	s corrected)	478.4	
000					,				Approximate	Chi Square	Value (0.05)	38.42	
990			Adius	sted Level of	Significance	0.0267			A	, diusted Chi S	auare Value	36.1	
991			.,		- 3					<b>,</b>			
992					As	suming Garr	ma Distribu	tion					
993	(	95% Approxi	mate Gamma	UCL (use w	hen n>=50))	1116		95% Ac	liusted Gam	ma UCL (use	when n<50)	1188	
994													
995						Lognorma	I GOF Test						
996			S	haniro Wilk T	Test Statistic	0.888		Sha	niro Wilk Loc	inormal GOF	Test		
997			5% S	haniro Wilk (	ritical Value	0.842		Data annea		at 5% Signifi			
998			5700		Tost Statistic	0.042							
999			5		ritical Value	0.207		Data annea		at 5% Signifi	cance Level		
1000						0.202	ot 5% Cianif			at 5 % Signin			
1001					Data appear	Lognormal	ai o % Signii		1				
1002						Logno	Statistics						
1003				Minimum	agend D :		n Statistics			N A	logged D +	6 500	
1004				winimum of I	Logged Data	5.303				iviean of	logged Data	0.007	
1005			ſ	viaximum of l	Logged Data	1.333				SD of	logged Data	0.607	
1006					-								
1007					Assi		ormai Distrib	ution		<u> </u>	<b>N</b> 0 1	100-	
1008				<u></u>	95% H-UCL	1337			90%	Chebyshev (	MVUE) UCL	1287	
1009			95%	Chebyshev (	MVUE) UCL	1503			97.5%	Chebyshev (	MVUE) UCL	1803	
1010			99%	Chebyshev (	MVUE) UCL	2393							
1011													

	А	В	С	D	E	F	G	H		J	K	L		
1012				Date error	Nonparame		uon Free UC							
1013				Data appea	r to follow a	Discernible	Distribution a	at 5% Signifi	cance Leve					
1014					Num									
1015								OCLS		050/ 1		1010		
1016			050/	95	% CLT UCL	986.9				95% Ja	ckknife UCL	1010		
1017			95%	Standard Bo	otstrap UCL	970.7			050/	95% B00	Istrap-t UCL	1009		
1018			9	5% Hall's Bo	otstrap UCL	1048			95%	Percentile Bo	otstrap UCL	975		
1019				95% BCA Bo	otstrap UCL	955.8						1011		
1020			90% Ch	ebyshev(Me	an, Sd) UCL	1150			95% Cł	nebyshev(Mea	an, Sd) UCL	1314		
1021			97.5% Ch	ebyshev(Me	an, Sd) UCL	1541			99% Cł	nebyshev(Mea	an, Sd) UCL	1988		
1022														
1023						Suggested	UCL to Use							
1024				95% Stu	dent's-t UCL	1010								
1025														
1026		Note: Sugge	estions regard	ing the selec	tion of a 95%	b UCL are pro	ovided to help	p the user to	select the m	iost appropria	ite 95% UCL			
1027			F	Recommenda	itions are bas	sed upon dat	a size, data o	distribution, a	ind skewnes	S.				
1028		These reco	mmendations	s are based u	pon the resu	Its of the sim	ulation studie	es summariz	ed in Singh,	Maichle, and	Lee (2006).			
1029	H	owever, simu	ulations result	s will not cov	er all Real W	orld data set	ts; for additio	nal insight th	e user may	want to consu	It a statisticia	an.		
1030														
1031	Result (5-w	/-55)												
1032														
1033	General Statistics													
1034		Total Number of Observations     10     Number of Distinct Observations       Number of Detects     3     Number of Non-Detects												
1035	Number of Detects         3         Number of Distinct											7		
1036			N	umber of Dist	tinct Detects	3			Numb	er of Distinct N	Non-Detects	4		
1037				Mini	mum Detect	68				Minimum	Non-Detect	76		
1038				Maxi	mum Detect	230	Maximum Non-D					77.5		
1039				Varia	nce Detects	7682	Percent Non-Detect					70%		
1040				М	ean Detects	129.7	SD Detec					87.65		
1041				Mee	dian Detects	91					CV Detects	0.676		
1042				Skewn	ess Detects	1.599				Kurte	osis Detects	N/A		
1043				Mean of Log	ged Detects	4.723				SD of Log	ged Detects	0.636		
1044														
1045					Warning: D	ata set has	only 3 Detec	ted Values.						
1046			Tł	nis is not end	ough to comp	oute meaning	gful or reliab	le statistics a	and estimat	es.				
1047														
1048														
1049					Norm	al GOF Tes	t on Detects	Only						
1050			S	hapiro Wilk T	est Statistic	0.854			Shapiro Wi	lk GOF Test				
1051			5% S	hapiro Wilk C	critical Value	0.767	De	etected Data	appear Norr	nal at 5% Sig	nificance Lev	vel		
1052				Lilliefors T	est Statistic	0.337			Lilliefors	GOF Test				
1053			5	% Lilliefors C	ritical Value	0.425	De	etected Data	appear Norr	nal at 5% Sig	nificance Lev	vel		
1054				Det	tected Data a	appear Norm	nal at 5% Sig	nificance Le	vel					
1055														
1056			Kaplan-	Meier (KM) S	Statistics usi	ng Normal C	ritical Value	s and other I	Nonparame	tric UCLs				
1057					KM Mean	86.5			KI	A Standard E	rror of Mean	18.72		
1058					KM SD	48.32				95% KM	(BCA) UCL	N/A		
1059				95%	KM (t) UCL	120.8	0.8 95% KM (Percentile Bootstrap) UC					N/A		
1060				95%	KM (z) UCL	117.3				95% KM Boo	tstrap t UCL	N/A		
1061			ç	0% KM Che	byshev UCL	142.6				95% KM Chel	byshev UCL	168.1		
1062			97	.5% KM Che	byshev UCL	203.4				99% KM Chel	byshev UCL	272.7		
1063											I			
1064				G	amma GOF	Tests on De	etected Obse	rvations On	ly					
1065					Not End	ough Data to	Perform GC	OF Test						
1066														

	A	A B C D E F G H I J K							L			
1067					Gamma	Statistics on	Detected D	Data Only	-			N1/A
1068					k hat (MLE)	3.676			k	star (bias corr	ected MLE)	N/A
1069				The	ta hat (MLE)	35.28			Theta	star (bias corr	ected MLE)	N/A
1070				r	nu hat (MLE)	22.05				nu star (bias	s corrected)	N/A
1071				Me	ean (detects)	129.7						
1072												
1073					amma ROS	Statistics us	sing Imputed	d Non-Detec	ts			
1074		0500	GROS may	not be used	when data s	et has > 50%	NDs with m	any tied obs	ervations at	multiple DLs		
1075		GROS may	y not be used	I when kstar	of detects is s	small such as	s <1.0, espe	cially when the	ne sample si	ize is small (e.g	g., <15-20)	
1076			Fo	or such situat	ions, GROS i	method may	yield incorre	ct values of l	JCLs and B	IVS		
1077			مريمة مرازمة برام مر	 	I his is especi	ally true whe	n the sample	e size is sma	ll.		in at a a	
1078		For gai	mma distribut		data, BIVs a	nd UCLS ma	y be comput	ted using gan	nma distribu	Ition on KIVI esi	Imates	75.55
1079					Maximum	15.94					Median	/5.55
1080					Maximum	230					Median	57.88 777 0
1081					k hot (MLE)	2 524			k	ator (biog oorr		1 0/1
1082				Tho	to bot (MLE)	2.004			Thota	star (bias corr	ected MLE)	1.041
1083				i ne		50.60			meta	nu star (biar		36.21
1084			Adjusted	I evel of Sig		0.09				nu stat (Dias	s conecteu)	50.01
1085		Δη	proximate Ch	i Square Vali	ue (36.81 m)	23.93			Adjusted CH	ni Square Valu	e (36 81 R)	22.13
1086		95% Gamma	a Approximate		when $n \ge 50$	116.2		95% Ga	mma Adius		when n<50	N/A
1000		Julio Gumme		(000 V		. 1 4.2						
1088				Es	stimates of G	amma Parar	neters usind					
1089					Mean (KM)	86.5		<b>,</b>			SD (KM)	48.32
1090				Va	ariance (KM)	2335				SE of	Mean (KM)	18.72
1091					k hat (KM)	3.204					k star (KM)	2.31
1092					nu hat (KM)	64.09				n	u star (KM)	46.19
1093				th	eta hat (KM)	26.99				thet	a star (KM)	37.45
1094			80%	6 gamma per	rcentile (KM)	127.3			90	% gamma perc	entile (KM)	162.7
1095			95%	6 gamma per	rcentile (KM)	196.2			99	% gamma perc	entile (KM)	269.8
1097												
1098					Gamm	a Kaplan-M	eier (KM) St	atistics				
1099		App	proximate Ch	i Square Valı	ue (46.19, α)	31.6			Adjusted Ch	ni Square Valu	e (46.19, β)	29.51
1100	95%	% Gamma Ap	proximate KN	/I-UCL (use v	when n>=50)	126.5		95% Gamm	a Adjusted I	KM-UCL (use v	when n<50)	135.4
1101												
1102				Lo	ognormal GO	F Test on D	etected Obs	ervations O	nly			
1103			S	hapiro Wilk	Test Statistic	0.917			Shapiro W	ilk GOF Test		
1104			5% S	hapiro Wilk C	Critical Value	0.767	Det	ected Data a	ppear Logno	ormal at 5% Sig	gnificance L	evel
1105				Lilliefors	Test Statistic	0.297			Lilliefors	GOF Test		
1106			5	% Lilliefors C	Critical Value	0.425	Det	ected Data a	ppear Logno	ormal at 5% Sig	gnificance L	evel
1107				Dete	cted Data ap	opear Logno	mal at 5% S	Significance	Level			
1108												
1109				Lo	gnormal RO	S Statistics I	Jsing Imput	ed Non-Dete	cts			
1110				Mean in O	riginal Scale	82.98				Mean ir	n Log Scale	4.301
1111				SD in O	riginal Scale	53.69				SD ir	n Log Scale	0.459
1112		95% t l	UCL (assume	es normality o	of ROS data)	114.1			95%	Percentile Boo	otstrap UCL	114.9
1113	13         95% BCA Bootstrap UCL         126.5         95% Bootstrap t UCL							173.1				
1114				95% H-UC	L (Log ROS)	114.2	114.2					
1115									• = -			
1116			Statis	stics using K	M estimates	on Logged [	Data and As	suming Logr	normal Distr	ibution	<u> </u>	70.00
1117				KM M	ean (logged)	4.371				KM	Geo Mean	/9.08
1118				KM	SD (logged)	0.366			95%	Critical H Valu	e (KM-Log)	2.049
1119			KIM Standa	ra ⊨rror ot Me	ean (logged)	0.142			0501	95% H-UCl	_ (KM -Log)	108.6
1120				KM	อม (logged)	0.366			95%	Critical H Valu	e (KIVI-Log)	2.049
1121			Kivi Standai	ru ⊨rror of M	ean (logged)	0.142						
1122												

	A	В	С	D	E	F	G	Н			J		K	L	-
1123						DL/2 S	tatistics			_	_				
1124			DL/2	Normal		-			DL/2 Lo	og-Tra	ansform	ed			
1125				Mean in O	riginal Scale	65.73					Me	an in I	Log Scale	3.9	969
1126				SD in O	riginal Scale	60.45					Ś	SD in I	Log Scale	€ 0.6	6
1127			95% t l	JCL (Assume	es normality)	100.8					9	95% H	-Stat UC	- 101.8	8
1128			DL/2	is not a reco	mmended m	ethod, provi	ded for com	parisons and	d historica	al rea	sons				
1129															
1130					Nonparame	etric Distribu	tion Free UC	CL Statistics							
1131				Detected	l Data appea	r Normal Di	stributed at {	5% Significa	nce Leve	əl					
1132						-	-								
1133						Suggested	UCL to Use								
1134				95%	5 KM (t) UCL	120.8									
1135													050/110		
1136		Note: Sugge	estions regard	ling the selec	tion of a 95%	6 UCL are pr	ovided to hel	p the user to	select th	ne mos	st appro	priate	95% UC	L	
1137		<b>These 1999</b>	F		ations are bas	sea upon dat	a size, data	distribution,	and skew	ness.	a abla		(2006)		
1138				s are based t			to: for addition	es summariz		ign, ivi	aichie, a				
1139		Swever, sint	ulations result			ionu uata se		mai insigni u	le user m	lay wa		msuit	a statistic		
1140															
1141	Pocult (5-w	-56)													
1142	Tiesuli (o-M														
1143						General	Statistics								
1144			Total	Number of C	hservations	10	0101131103		Nur	nher c	of Distin	ct Obs	servation	s 10	
1145			10101			10			Nun	nber o	f Missin	na Obs	servation	s 0	
1146					Minimum	476.5						.g 0.00	Mea	1 2042	
1147					Maximum	5400							Media	1 1675	
1148					SD	1676					Sto	d. Erro	or of Mea	1 530.	1
1149				Coefficient	t of Variation	0.821					0.0		Skewnes	s 1.3	315
1150															
1152						Normal (	GOF Test								
1153			S	Shapiro Wilk	Fest Statistic	0.822			Shapiro	Wilk	GOF T	est			
1154			5% S	hapiro Wilk C	Critical Value	0.842		Data No	ot Normal	l at 5%	Signifi	cance	Level		
1155				Lilliefors	Fest Statistic	0.284			Lillief	fors G	OF Tes	t			
1156			5	5% Lilliefors C	Critical Value	0.262		Data No	ot Normal	l at 5%	Signifi	cance	Level		
1157					Data Not	Normal at 5	5% Significa	nce Level							
1158															
1159					As	suming Nori	mal Distribut	ion							
1160			95% No	ormal UCL				95%	UCLs (A	Adjust	ed for S	Skewn	iess)		
1161				95% Stu	dent's-t UCL	3014			95% Adj	justed	-CLT UC	CL (Cł	nen-1995	) 3150	
1162									95% Mo	odified	-t UCL (	(Johns	son-1978	) 3051	
1163															
1164						Gamma	GOF Test								
1165				A-D	Fest Statistic	0.364		Ande	rson-Dar	ling G	iamma (	GOF -	Test		
1166				5% A-D C	Critical Value	0.736	Detecte	d data appea	ar Gamm	a Dist	ributed	at 5%	Significa	nce Leve	el
1167				K-S T	Fest Statistic	0.186		Kolmog	jorov-Sm	hirnov	Gamma	a GOF	- Test		
1168				5% K-S C	Critical Value	0.27	Detecte	d data appea	ar Gamm	a Dist	ributed	at 5%	Significa	nce Leve	el
1169				Detected	I data appea	r Gamma Di	stributed at {	5% Significa	nce Leve	el					
1170							01-11-11								
1171							Statistics			11	nr /L!	0.0		1 4 2	0.4
1172				TL -		1.001			<b>T</b> I-	K Sta		correc		$\frac{1.3}{1.3}$	bö4
1173				Ine		1085			In	eta sta		correc		) 14/6	67
1174			F 4	r I E Maan (hi-		37.03 2042					nu stař NE SA			) 27.t	07
1175			IVI		is conected)	2042			Annrovin	IV nate (	hi Saur			1 1/30	67
1176			۸diur	sted Level of	Significance	0 0267			Αμμισχιμ			hi Sau		10.0	21
1177			Aujus		Significance	0.0207				Aujt	isteu Ul	n Squ		10.4	۷ ا
1178															

	А	В	С	D	E	F	G	Н		J	K	L
1179					A	ssuming Gam	nma Distribut	ion				
1180		95% Approx	imate Gamm	a UCL (use v	vhen n>=50	) 3389		95% Ad	ljusted Gam	ma UCL (use w	vhen n<50)	3716
1181												
1182						Lognorma	I GOF Test					
1183			S	hapiro Wilk	Fest Statisti	0.951		Sha	piro Wilk Log	gnormal GOF <sup>-</sup>	Test	
1184			5% S	hapiro Wilk C	Critical Valu	0.842		Data appea	ar Lognormal	at 5% Signific	ance Level	
1185				Lilliefors	Fest Statisti	0.145		Lil	liefors Logn	ormal GOF Te	st	
1186			5	% Lilliefors C	Critical Valu	0.262		Data appea	r Lognormal	at 5% Signific	ance Level	
1187					Data appe	r Lognormal	at 5% Signif	icance Leve				
1188												
1189						Lognorma	I Statistics					
1100				Minimum of I	_ogged Dat	6.166				Mean of lo	ogged Data	7.333
1101			1	Aaximum of I	_ogged Dat	8.594				SD of lo	ogged Data	0.805
1102												
1192					As	sumina Loand	ormal Distrib	ution				
1193					95% H-UC	4387			90%	Chebvshev (M	IVUE) UCL	3644
1194			95%	Chebyshev (	MVUF) UC	4373			97.5%	Chebyshev (M	IVUE) UCL	5386
1195			99%	Chebyshev (	MVUE) UC	7375						
1196			0070									
119/					Nonnaran	etric Distribu	tion Free UC	L Statistics				
1198				Data annes	r to follow	Discernible	Distribution	at 5% Signif	icance l eve	1		
1199						Discernible						
1200					Nonn	arametric Die	tribution Fred					
1201				QF				5 0013		95% Jac	kknife LICI	301/
1202			05%	Standard Bo	otetran UC	2914				95% Boots		4001
1203			90%			0720			05%	Boroontilo Poo		2010
1204						- 0/20			95%	Percentile 600		2919
1205			0.00/ 04	95% BCA BC		3070			0.5% 0.1	abyahay/Maa		1252
1206			90% Cr	ebysnev(ivie	an, Sd) UC	5052			95% Ci	iebysnev(ivieal		4353
1207			97.5% Cr	iebysnev(ivie	an, Sd) UC	5352			99% Ci	nebysnev(ivieal	n, Sa) UCL	/316
1208						0						
1209			05	0/ 0/		Suggested	UCL to Use					
1210			95	% Adjusted (	Jamma UC	3/16						
1211											050/1101	
1212		Note: Sugge	estions regard	ling the selec	tion of a 95	% UCL are pr	ovided to hel	p the user to	select the n	nost appropriat	e 95% UCL	
1213			F	Recommenda	ations are b	ised upon dat	a size, data o	distribution,	and skewnes	SS.		
1214		These reco	mmendation	s are based ι	pon the res	ults of the sim	ulation studi	es summariz	zed in Singh,	Maichle, and I	Lee (2006).	
1215	He	owever, simu	lations resul	s will not cov	ver all Real	Norld data se	ts; for additio	nal insight th	ne user may	want to consul	t a statisticia	an.
1216												
1217	Result (ew-	1)										
1218												
1219						General	Statistics					
1220			Total	Number of C	Deservation	s 10			Numbe	r of Distinct Ob	servations	6
1221				Numb	er of Detect	s 3				Number of N	on-Detects	7
1222			N	umber of Dis	tinct Detect	\$ 3			Numb	er of Distinct N	on-Detects	3
1223				Mini	mum Deteo	t 68.5				Minimum N	Non-Detect	37.5
1224				Maxi	mum Deteo	t 103.5				Maximum N	Non-Detect	77
1225				Varia	ince Detect	325				Percent N	on-Detects	70%
1226				N	lean Detect	88.5				ę	SD Detects	18.03
1227				Me	dian Detect	93.5				(	CV Detects	0.204
1228				Skewr	ness Detect	-1.152				Kurto	sis Detects	N/A
1229				Mean of Log	ged Detect	4.468				SD of Logg	ed Detects	0.215
1230												
1231					Warning:	Data set has	only 3 Detec	ted Values.				
1232			Т	nis is not end	ough to cor	pute meanin	gful or reliab	le statistics	and estimat	es.		
1233												
1234												

	А	В	С	D	E	F	G	Н		J	K	L
1235					Norm	al GOF Tes	t on Deteo	cts Only				
1236			S	hapiro Wilk T	est Statistic	0.942			Shapiro Wi	lk GOF Test		
1237			5% S	hapiro Wilk C	Critical Value	0.767		Detected Data	appear Norr	nal at 5% Sigr	nificance Lev	/el
1238					est Statistic	0.276		<u></u>	Lilliefors	GOF Test		
1239			5	% Lilliefors C	ritical Value	0.425	al at E0/	Detected Data	appear Norr	nal at 5% Sigi	nificance Lev	/el
1240				De		appear Norn	ial at 5% -	Significance Lo	evei			
1241			Kanlan-	Mojor (KM) 9	Statistics usi	a Normal C	ritical Val	ues and other	Nonnaramet	ric IICI e		
1242			Каріан-		KM Mean	62 1			K	A Standard Er	ror of Mean	12 87
1243					KM SD	22.99				95% KM	(BCA) LICI	N/A
1244				95%	KM (t) UCL	85.7			95% KM (F	Percentile Boo	(Bort) UCL	N/A
1245				95%	KM (z) UCL	83.28				95% KM Boot	tstrap t UCL	N/A
1240				90% KM Che	byshev UCL	100.7				95% KM Chet	byshev UCL	118.2
1247	-		97	.5% KM Che	byshev UCL	142.5			9	99% KM Cheb	byshev UCL	190.2
1249												
1250				G	amma GOF	Tests on De	etected Ob	servations Or	ly			
1251					Not End	ough Data to	Perform	GOF Test				
1252												
1253					Gamma	Statistics or	Detected	l Data Only				
1254					k hat (MLE)	33.77			k	star (bias corr	rected MLE)	N/A
1255				The	ta hat (MLE)	2.621			Theta	star (bias corr	rected MLE)	N/A
1256				r	nu hat (MLE)	202.6				nu star (bias	s corrected)	N/A
1257				Me	an (detects)	88.5						
1258							<u> </u>					
1259					amma ROS	Statistics us	sing Impu	ted Non-Detec	ts			
1260		CDO2 ma	GRUS may	not be used	when data so	et nas > 50%		many tied obs		multiple DLs	a <15.00)	
1261		GRUS IIIa	y not be used	r such situat		method may		rect values of			y., ≤15-20)	
1262				T	This is especi	ally true whe	n the sam	nle size is sma		V3		
1263		For da	mma distribu	ted detected	data. BTVs a	nd UCI s ma	v be comr	puted using gar	mma distribut	tion on KM es	timates	
1264					Minimum	38.14	,	· · · · · · · · · · · · · · · · · · ·			Mean	63.95
1205					Maximum	103.5					Median	62.65
1267					SD	21.51					CV	0.336
1267					k hat (MLE)	10.32			k	star (bias corr	ected MLE)	7.287
1269				The	ta hat (MLE)	6.2			Theta	star (bias corr	ected MLE)	8.776
1270				r	nu hat (MLE)	206.3				nu star (bias	s corrected)	145.7
1271			Adjusted	I Level of Sig	nificance (β)	0.0267						
1272		Аррі	roximate Chi	Square Value	e (145.75, α)	118.8		ŀ	Adjusted Chi	Square Value	e (145.75, β)	114.6
1273		95% Gamma	a Approximat	e UCL (use v	vhen n>=50)	78.43		95% Ga	amma Adjust	ed UCL (use	when n<50)	N/A
1274												
1275				Es	timates of G	amma Para	meters us	ing KM Estima	tes			
1276					Mean (KM)	62.1					SD (KM)	22.99
1277				Va	ariance (KM)	528.4				SE of	Mean (KM)	12.87
1278					k hat (KM)	7.298					k star (KM)	5.1/5
1279				44	nu hat (KM)	146				r	hu star (KM)	103.5
1280			000			0.01			000		a star (KIVI)	12
1281			٥U۶ مح			112 7			90%			30.04
1282			507	• yanina pel		112.7			337	o gamina pelo		172.3
1283					Gamm	a Kanlan-M	eier (KM)	Statistics				
1284		Appi	roximate Chi	Square Value	e (103.50. a)	81.03			Adjusted Chi	Square Value	(103.50. B)	77.58
1205 1296	959	6 Gamma Ap	proximate KM	л-UCL (use v	when n>=50)	79.33		95% Gamm	a Adjusted k	(M-UCL (use)	when n<50)	82.85
1200		- ·F			/	-	<u> </u>			( <b>-</b>	/	-

	A	В	С	D	E	F	G	H		J	K		L
1288					ognormal GO	F Test on D	etected Obs	ervations O	nly Objection				
1289				onapiro Wilk	rest Statistic	0.921			Shapiro V	VIIK GOF Test	: 		
1290			5% S	shapiro Wilk	Critical Value	0.767	Dete	ected Data a	ppear Log	normal at 5% S	Significar	ice Le	evel
1291				Lilliefors	Test Statistic	0.294			Lilliefor	s GOF Test			
1292			Ę	5% Lilliefors	Critical Value	0.425	Det	ected Data a	ppear Logi	normal at 5% S	Significar	ice Le	evel
1293				Det	ected Data ap	pear Logno	rmal at 5% S	Significance	Level				
1294													
1295					ognormal RO		Using Impute	ed Non-Dete	ects				4.450
1296				Mean in (	Driginal Scale	66.24				Mean	in Log S	cale	4.158
1297		050/ +1	101 (	SD in (	Driginal Scale	19.25			050	SD	in Log S	cale	0.274
1298		95% t l	JCL (assume	es normality	of RUS data)	77.4			95%		ootstrap		/6.06
1299				95% BCA B		76.96				95% B00	otstrap t	JCL	83.8
1300				95% H-UU	L (LOG RUS)	79.30							
1301			Stati		(Maatimataa	on Longod I	Data and Aa			tuik utie n			
1302			Stati				Data and As		ionnai Dis			laan	57 07
1303					lean (logged)	4.058			050			lean	2 06/
1304			KM Stondo		loon (logged)	0.379			957			Log)	2.004
1305			KIVI Stanua			0.233			05%			Log)	2.06/
1306			KM Standa		loon (logged)	0.379			907			LOG)	2.004
1307			KIVI Stariua		lean (loggeu)	0.233							
1308						2 1/10	tatietice						
1309			2 וח	Normal		DLiz S				-Transformed			
1310				Mean in (	Driginal Scale	51 43			DLIZ LOG	Mean	in Log S	cale	3 821
1311				SD in (	Driginal Scale	27.63				SD	in Log C	cale	0.502
1312			95% t		es normality)	67.44				95%	H-Stat		75.82
1313			00 /0 ( )	is not a reco	mmended m	athod provi	ded for comr	arisons and	l historical	reasons		OOL	70.02
1314						culou, provi			motorical	10030113			
1315					Nonnarame	tric Distribu	tion Free UC	Statistics					
1316				Detecte	d Data appea	r Normal Di	stributed at 5	5% Significa	nce Level				
1317				200000									
1210						Suggested	UCL to Use						
1319				959	% KM (t) UCL	85.7							
1320					()								
1322		Note: Sugge	stions regard	ding the sele	ction of a 95%	UCL are pr	ovided to hel	p the user to	select the	most appropri	ate 95%	UCL.	
1323				Recommend	ations are bas	ed upon dat	a size, data	distribution, a	and skewn	ess.			
1324		These reco	mmendation	s are based	upon the resu	Its of the sim	ulation studi	es summariz	ed in Sing	h, Maichle, and	d Lee (20	06).	
1325	Ho	owever, simu	lations resul	ts will not co	ver all Real W	orld data se	ts; for additio	nal insight th	ne user mag	y want to cons	ult a stat	isticia	ın.
1326													
1327	Result (ew-	·2a)											
1328													
1329						General	Statistics						
1330			Tota	I Number of	Observations	10			Numt	per of Distinct (	Observat	ions	7
1331				Numb	per of Detects	2				Number of	Non-Det	ects	8
1332			N	lumber of Di	stinct Detects	2			Num	ber of Distinct	Non-Det	ects	5
1333				Mir	nimum Detect	114				Minimun	n Non-De	etect	38
1334				Max	kimum Detect	237				Maximun	n Non-De	etect	78.5
1335				Vari	ance Detects	7565				Percent	Non-Det	ects	80%
1336				1	Mean Detects	175.5					SD Det	ects	86.97
1337				Me	edian Detects	175.5					CV Det	ects	0.496
1338				Skew	ness Detects	N/A				Kur	tosis Det	ects	N/A
1000				gged Detects	5.102				SD of Log	gged Det	ects	0.518	
1339	40												
1339													
1339 1340 1341					Warning: D	ata set has	only 2 Detec	ted Values.					

	А	В	С	D	E	F	G	Н			J	K		L
1343														
1344														
1345					Norn	nal GOF Tes	t on Detects	only						
1346					Not En	ough Data to	Perform G	OF Test						
1347														
1348			Kaplan-	Meier (KM) S	Statistics usi	ng Normal C	ritical Value	s and other	Nonpara	amet	ic UCLs			
1349					KM Mean	n 65.5 KM Standard Error of Mean 27.5				27.5				
1350					KM SD	61.49					95% KN	M (BCA) UC	_	N/A
1351				95%	KM (t) UCL	115.9			95% KI	М (Р	ercentile Bo	otstrap) UC	-	N/A
1352				95%	KM (z) UCL	110.7				ç	95% KM Bo	otstrap t UC	-	N/A
1353			(	90% KM Che	byshev UCL	148				9	5% KM Che	ebyshev UC	_ 1	185.4
1354			97	.5% KM Che	byshev UCL	237.2				9	9% KM Che	ebyshev UC	- 3	339.1
1355						<b>-</b>			•					
1356				G	iamma GOF	Tests on De	etected Obse	ervations On	ly					
1357					Not En	ough Data to	o Perform G	OF lest						
1358					-									
1359							Detected L	Data Only		1	t (l. :		<u>.                                    </u>	N1/A
1360				The	K hat (MLE)	7.795			ть	K S	star (blas co		)	N/A
1361				ine		22.01			111	ieta s	nu eter (bi			IN/A
1362				Mc		175.5					nu star (bi		<u>/</u>	IN/A
1363				IVIE		175.5								
1364				Fe	timates of G	amma Dara	meters using	n KM Estima	toe					
1365				Lo	Mean (KM)	65.5			100			SD (KM	0	61 49
1366				Va	riance (KM)	3781					SEC	of Mean (KM		27.5
1367					k hat (KM)	1,135					023	k star (KM	<u>/</u>	0.861
1368					nu hat (KM)	22.69						nu star (KM	<u>/</u>	17.22
1369				th	eta hat (KM)	57.73	theta star (KM)							76.09
1370			80%	6 gamma per	centile (KM)	106.6				90%	aamma pe	ercentile (KM	<u>,</u> ) .	156.5
1272			95%	6 gamma per	centile (KM)	207	90% gamma percentile (KM)						) :	325.5
1372				- 5 1-		-					5 - 1 -		/	
1373					Gamm	a Kaplan-M	eier (KM) St	atistics						
1375						•			Adju	isted	Level of Sig	gnificance (β	5)	0.0267
1376		Ар	proximate Ch	i Square Valu	με (17.22, α)	8.828			Adjusted	d Chi	Square Val	lue (17.22, β	5)	7.805
1377	959	% Gamma Ap	proximate KM	Л-UCL (use v	/hen n>=50)	127.8		95% Gamm	a Adjust	ed K	M-UCL (use	e when n<50	) -	144.5
1378														
1379				Lo	gnormal GC	F Test on D	etected Obs	ervations O	nly					
1380					Not En	ough Data to	Perform G	OF Test						
1381														
1382				Lo	gnormal RO	S Statistics	Using Impute	ed Non-Dete	ects					
1383				Mean in O	riginal Scale	43.31					Mean	in Log Scale	э	2.742
1384				SD in O	riginal Scale	75.68					SD	in Log Scale	э	1.382
1385		95% t	UCL (assume	es normality o	f ROS data)	87.18			9	5% F	Percentile Be	ootstrap UC	-	86.62
1386				95% BCA Bo	otstrap UCL	108.1					95% Bo	otstrap t UC		458.9
1387				95% H-UC	(Log ROS)	247								
1388														
1389			Statis	stics using K	M estimates	on Logged I	Data and As	suming Log	normal D	Distril	oution			
1390				KM Me	ean (logged)	3.93					K	M Geo Mea	٦	50.93
1391				KM	SD (logged)	0.608	95% Critical H Value (KM-Log			)	2.381			
1392		KM Standard Error of Mean (logg									95% H-U	CL (KM -Log	)	99.31
1393				KM	SD (logged)	0.608	95% Critical H Value (KM-Log)					)	2.381	
1394			KM Standa	rd Error of Me	ean (logged)	0.272							$\bot$	
1395														

	A B C D E	<u> </u>	
1396	DI /0 Normal	DL/2 S	Statistics
1397	DL/2 Normal	0.10	DL/2 Log- I ransformed
1398	SD in Original Scale		SD in Log Scale 0.755
1399		100.04	
1400	DI /2 is not a recommended n	ethod provi	vided for comparisons and historical reasons
1401			
1402	Nonparam	etric Distribu	ution Free UCL Statistics
1403	Data do not follow a [	Discernible D	Distribution at 5% Significance Level
1404			
1405		Suggested	d UCL to Use
1400	95% KM (Chebyshev) UCL	185.4	
1408			
1409	Note: Suggestions regarding the selection of a 95	% UCL are pr	provided to help the user to select the most appropriate 95% UCL.
1410	Recommendations are ba	sed upon dat	ata size, data distribution, and skewness.
1411	These recommendations are based upon the rest	ults of the sim	mulation studies summarized in Singh, Maichle, and Lee (2006).
1412	However, simulations results will not cover all Real V	Vorld data se	ets; for additional insight the user may want to consult a statistician.
1413			
1414	Result (gw-1)		
1415			
1416		General	I Statistics
1417	Total Number of Observations	s 10	Number of Distinct Observations 7
1418	Number of Detects	s 4	Number of Non-Detects 6
1419	Number of Distinct Detects	s 4	Number of Distinct Non-Detects 3
1420	Minimum Detect	t 80.5	Minimum Non-Detect 76.5
1421	Maximum Detect	t 165	Maximum Non-Detect 78
1422	Variance Detects	1303	Percent Non-Detects 60%
1423	Median Detects	120.9	CV Detects 0.291
1424	Skewness Detects	-0.512	Kutosis Detects -1 1/
1425	Mean of Longed Detects	4 808	SD of Logged Detects 0.316
1426		4.000	
1427	Nor	mal GOF Tes	est on Detects Only
1420	Shapiro Wilk Test Statistic	0.974	Shapiro Wilk GOF Test
1420	5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
1431	Lilliefors Test Statistic	0.198	Lilliefors GOF Test
1432	5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level
1433	Detected Data	appear Norn	rmal at 5% Significance Level
1434			
1435	Kaplan-Meier (KM) Statistics us	ing Normal C	Critical Values and other Nonparametric UCLs
1436	KM Mear	96.65	KM Standard Error of Mean 11.65
1437	KM SD	31.9	95% KM (BCA) UCL N/A
1438	95% KM (t) UCL	118	95% KM (Percentile Bootstrap) UCL N/A
1439	95% KM (z) UCL	. 115.8	95% KM Bootstrap t UCL N/A
1440	90% KM Chebyshev UCL	131.6	95% KM Chebyshev UCL 147.4
1441	97.5% KM Chebyshev UCL	169.4	99% KM Chebyshev UCL 212.6
1442			
1443	Gamma GOF		
1444	A-D Test Statistic	0.262	Anderson-Darling GUF Lest
1445			Kolmogorov Smirnov COE
1446	5% K_S Critical Value	0.230	Detected data appear Gamma Distributed at 5% Significance Lovel
1447		r Gamma Di	Distributed at 5% Significance Level
1448			Significance Level
1449			

	A B C D E						G	Н		J	K	L
1450					Gamma	Statistics or	Detected D	Data Only				0.744
1451					K hat (MLE)	14.31			к 	star (bias correc		3.744
1452				The	ta hat (MLE)	8.867			Ineta	star (bias corre	cted MLE)	33.89
1453				1	nu nat (IVILE)	114.5				nu star (blas	corrected)	29.95
1454				Me	ean (detects)	126.9						
1455						<u>.</u>						
1456			0000		amma ROS	Statistics us		a Non-Detec				
1457		0000	GRUS may	not be used	when data so	et nas > 50%		iany tied obs	ervations at	multiple DLs	(15.00)	
1458		GRUS may	y not be used	when Kstar	of detects is s	small such as	s < 1.0, espe	cially when the	ie sample s	ize is small (e.g.	., <15-20)	
1459			FU		IONS, GROS I	ally true who	yield incorre			172		
1460		For an	mma distribut	ad datacted	doto BTVc o				n. nma distribu	tion on KM octiv	matoc	
1461		i oi gai			Minimum		y be compu	led using gan			Mean	61.9/
1462					Maximum	165					Median	39.73
1463					SD	61.32					CV	0.99
1464					k hat (MLF)	0.365			k	star (bias corre	cted MLE)	0.322
1465				The	ta hat (MLE)	169.9			Theta	star (bias corre	cted MLE)	192.4
1466					nu hat (MLE)	7.292			111010	nu star (bias	corrected)	6.438
1467			Adiusted	Level of Sid	nificance (B)	0.0267						
1400		Ar	oproximate C	hi Square Va	alue (6.44, α)	1.868	<u> </u>		Adjusted C	Chi Square Valu	e (6.44, β)	1.472
1409		95% Gamma	a Approximat	e UCL (use v	vhen n>=50)	213.5		95% Ga	, amma Adjus	ted UCL (use w	hen n<50)	N/A
1470				,	,					, , , , , , , , , , , , , , , , , , ,	,	
1472				E	stimates of G	amma Parai	meters using	g KM Estima	tes			
1473					Mean (KM)	96.65					SD (KM)	31.9
1474				Va	ariance (KM)	1018				SE of N	lean (KM)	11.65
1475					k hat (KM)	9.177				k	star (KM)	6.491
1476					nu hat (KM)	183.5				nu	star (KM)	129.8
1477				th	eta hat (KM)	10.53				theta	star (KM)	14.89
1478			80%	6 gamma pe	rcentile (KM)	126.3			909	% gamma perce	entile (KM)	147.3
1479			95%	6 gamma pe	rcentile (KM)	166.3			99	% gamma perce	entile (KM)	205.9
1480												
1481					Gamm	a Kaplan-M	eier (KM) St	atistics				
1482		Appr	oximate Chi	Square Valu	e (129.82, α)	104.5		A	djusted Chi	Square Value (	129.82, β)	100.6
1483	95%	6 Gamma Ap	proximate KN	/I-UCL (use v	vhen n>=50)	120.1		95% Gamm	a Adjusted I	KM-UCL (use w	hen n<50)	124.8
1484												
1485				L	ognormal GO	F Test on D	etected Obs	servations O	nly			
1486			S	hapiro Wilk	l est Statistic	0.947			Shapiro W			
1487			5% S	napiro Wilk C	Fitical Value	0.748	Det	ected Data a	ppear Logno	ormal at 5% Sigi	nificance L	evel
1488			F	Lilliefors	est Statistic	0.211	Det	anta d Data a	Lilletors		-:6:	a val
1489			5	70 Lilleiois C	cted Data an	0.375	Del mal at 5% 9			onnar at 5 % Siyi		evei
1490				Dele	cieu Dala ap	ipear Logilo		Significance	Level			
1491					anormal RO	S Statistics I	lsing Imput	ed Non-Dete	orte			
1492				Mean in O	riginal Scale	76.82	abut			Mean in	Log Scale	4,171
1493				SD in O	riginal Scale	48.72				SD in	Log Scale	0.608
1494		95% t l	JCL (assume	s normality of	of ROS data)	105.1			95%	Percentile Boot	strap UCL	101.9
1495			(	95% BCA Bo	otstrap UCL	104.6				95% Boots	trap t UCL	119.2
1490				95% H-UC	L (Log ROS)	126.2						
1497				-	/		<u> </u>					
1499			Statis	tics using K	M estimates	on Logged [	Data and As	suming Logr	normal Distr	ibution		
1500	KM Mean (logged)									KM	Geo Mean	92.34
1501	KM SD (loge					0.288			95%	Critical H Value	(KM-Log)	1.965
1502	KM Standard Error of Mean (logg					0.105	<u> </u>			95% H-UCL	(KM -Log)	116.2
1503	KM SD (logg					0.288			95%	Critical H Value	(KM-Log)	1.965
1504		KM Standard Error of Mean (log										
1505												

	A B C D E			L
1506	DL/2 Normal	DL/2 5	DL/2 Log-Transformed	
1507	Mean in Original Scale	73 93	Mean in Log Scale	4 115
1508	SD in Original Scale	50.31	SD in Log Scale	0.623
1509	95% t UCL (Assumes normality)	103.1	95% H-Stat UCI 1	22.6
1510	DL/2 is not a recommended m	ethod. provi	ided for comparisons and historical reasons	
1511		, p		
1512	Nonparame	etric Distribu	ution Free UCL Statistics	
1513	Detected Data appea	r Normal Di	stributed at 5% Significance Level	
1515			-	
1516		Suggested	UCL to Use	
1517	95% KM (t) UCL	118		
1518			· · · · · ·	
1519	Note: Suggestions regarding the selection of a 95%	6 UCL are pr	rovided to help the user to select the most appropriate 95% UCL.	
1520	Recommendations are bas	sed upon da	ta size, data distribution, and skewness.	
1521	These recommendations are based upon the resu	Its of the sin	nulation studies summarized in Singh, Maichle, and Lee (2006).	
1522	However, simulations results will not cover all Real W	/orld data se	ets; for additional insight the user may want to consult a statistician.	
1523				
1524	Result (gw-2)			
1525				
1526	Total Number of Observations		Statistics	7
1527	lotal number of Observations	10	Number of Distinct Observations	7
1528	Number of Distinct Detects	3	Number of Distinct Non-Detects	7
1529	Minimum Detects	67.5	Minimum Non-Detect	38
1530	Maximum Detect	485	Maximum Non-Detect	80.5
1531	Variance Detects	44290	Percent Non-Detects	70%
1532	Mean Detects	260.8	SD Detects 2	210.5
1533	Median Detects	230	CV Detects	0.807
1534	Skewness Detects	0.645	Kurtosis Detects	N/A
1536	Mean of Logged Detects	5.278	SD of Logged Detects	0.996
1537				
1538	Warning: D	ata set has	only 3 Detected Values.	
1539	This is not enough to com	oute meanin	ngful or reliable statistics and estimates.	
1540				
1541				
1542	Norn	nal GOF Tes	st on Detects Only	
1543	Shapiro Wilk Test Statistic	0.984	Shapiro Wilk GOF Test	
1544	5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
1545	Lilliefors Test Statistic	0.225	Lilliefors GOF Test	
1546	5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	
1547		appear Norr		
1548	Kanlan-Maier /KM) Statistics usi	na Normal (	Critical Values and other Nonnarametric LICLs	
1549	KM Mean	113 7	KM Standard Error of Mean	53,11
1550	KM Mean	135.2	95% KM (BCA) UCI I	N/A
1551	95% KM (t) LICI	211.1	95% KM (Percentile Bootstran) UCI	N/A
1002	95% KM (z) UCL	201.1	95% KM Bootstrap t UCL	N/A
155/	90% KM Chebyshev UCL	273	95% KM Chebyshev UCL 3	45.2
1555	97.5% KM Chebyshev UCL	445.4	99% KM Chebyshev UCL 6	642.2
1556		I		
1557	Gamma GOF	Tests on De	etected Observations Only	
1558	Not En	ough Data te	o Perform GOF Test	
1559				
-				

	А	В	С	D	E	F	F G H I J K					L
1560					Gamma	Statistics or	n Detected D	Data Only				
1561					k hat (MLE)	1.899			k	star (bias corr	ected MLE)	N/A
1562				The	ta hat (MLE)	137.3			Theta	star (bias corr	ected MLE)	N/A
1563				I	nu hat (MLE)	11.4				nu star (bias	s corrected)	N/A
1564				Me	ean (detects)	260.8						
1565												
1566				(	Gamma ROS	Statistics us	sing Impute	d Non-Detec	ts			
1567			GROS may	not be used	when data s	et has > 50%	6 NDs with m	nany tied obs	ervations at	multiple DLs		
1568		GROS mag	y not be used	when kstar	of detects is s	small such a	s <1.0, espe	cially when the	ne sample s	ize is small (e.	g., <15-20)	
1569			Fo	or such situat	ions, GROS ı	method may	yield incorre	ct values of l	JCLs and B	TVs		
1570				٦	This is especi	ally true whe	en the sample	e size is sma	II.			
1571		For gai	mma distribut	ed detected	data, BTVs a	nd UCLs ma	y be compu	ted using gar	nma distribu	ution on KM est	timates	
1572					Minimum	0.01					Mean	82.96
1573					Maximum	485					Median	1.931
1574					SD	158.4					CV	1.909
1575					k hat (MLE)	0.164			k	star (bias corr	ected MLE)	0.181
1576				The	ta hat (MLE)	505.9			Theta	star (bias corr	ected MLE)	457.2
1577				1	nu hat (MLE)	3.28				nu star (bias	s corrected)	3.629
1578			Adjusted	Level of Sig	nificance (β)	0.0267						
1579		Ap	oproximate C	hi Square Va	alue (3.63, α)	0.581			Adjusted 0	Chi Square Val	ue (3.63, β)	0.409
1580		95% Gamma	a Approximat	e UCL (use v	vhen n>=50)	518.3		95% Ga	amma Adjus	ted UCL (use v	when n<50)	N/A
1581												
1582				E	stimates of G	amma Para	meters using	g KM Estima	tes			
1583					Mean (KM)	113.7					SD (KM)	135.2
1584				Va	ariance (KM)	18285				SE of	Mean (KM)	53.11
1585					k hat (KM)	0.707					k star (KM)	0.562
1586					nu hat (KM)	14.14				r	nu star (KM)	11.23
1587				th	eta hat (KM)	160.8				the	ta star (KM)	202.5
1588			80%	6 gamma pe	rcentile (KM)	187.3			90	% gamma pero	centile (KM)	300.1
1589			95%	6 gamma pe	rcentile (KM)	419			99	% gamma pero	centile (KM)	708.3
1590												
1591					Gamm	a Kaplan-M	eier (KM) St	atistics				
1592		Ар	proximate Ch	i Square Val	ue (11.23, α)	4.725			Adjusted Cl	hi Square Valu	e (11.23, β)	4.018
1593	95%	% Gamma Ap	proximate KN	/I-UCL (use v	vhen n>=50)	270.3		95% Gamm	a Adjusted	KM-UCL (use v	when n<50)	317.9
1594												
1595				Le	ognormal GO	F Test on D	etected Obs	ervations O	nly			
1596			S	hapiro Wilk	Fest Statistic	0.981			Shapiro W	ilk GOF Test		
1597			5% S	hapiro Wilk (	Critical Value	0.767	Det	ected Data a	ppear Logno	ormal at 5% Si	gnificance L	evel
1598				Lilliefors	Fest Statistic	0.23			Lilliefors	GOF Test		
1599			5	% Lilliefors (	Critical Value	0.425	Det	ected Data a	ppear Logno	ormal at 5% Si	gnificance L	evel
1600				Dete	cted Data ap	pear Logno	rmal at 5% S	Significance	Level			
1601												
1602				Lo	gnormal RO	S Statistics	Using Imput	ed Non-Dete	cts			
1603				Mean in O	riginal Scale	99.94				Mean ir	n Log Scale	3.853
1604				SD in O	riginal Scale	149.8				SD ir	n Log Scale	1.221
1605		95% t l	UCL (assume	s normality o	of ROS data)	186.8			95%	Percentile Boo	otstrap UCL	181.6
1606				95% BCA Bo	otstrap UCL	222.1				95% Boot	strap t UCL	561.4
1607	7 95% H-UCL (Log ROS) 425.6											
1608												
1609			Statis	tics using K	M estimates	on Logged I	Data and As	suming Logr	normal Distr	ribution		
1610				KM M	ean (logged)	4.302	302 KM Geo Mea					73.86
1611				KM	SD (logged)	0.814			95%	Critical H Valu	e (KM-Log)	2.737
1612			KM Standa	rd Error of M	ean (logged)	0.359	9 95% H-UCL (KM -Log)			216.3		
1613				KM	SD (logged)	0.814			95%	Critical H Valu	e (KM-Log)	2.737
1614			KM Standa	rd Error of M	ean (logged)	0.359						
1615												
•												

	A B C D E	<u> </u>		<u> </u>
1616	DI /2 Normal	DL/2 S	Statistics	
1617	DL/2 Normal Moon in Original Socia	102.4	DL/2 Log- I ransformed	4 071
1618	SD in Original Scale	103.4	Mean in Log Scale 4	+.U/ I
1619	95% tUCL (Accumes normality)	147.3		2.901
1620	DL /2 is not a recommended m	ethod provi	ided for comparisons and historical reasons	0.3
1621		eulou, piovi		
1622	Nonparam	etric Distribu	ution Free LICL Statistics	
1623	Detected Data annea	ar Normal Di	istributed at 5% Significance Level	
1624				
1625		Suaaested	I UCL to Use	
1620	95% KM (t) UCL	211.1		
1628				
1629	Note: Suggestions regarding the selection of a 95%	6 UCL are pr	rovided to help the user to select the most appropriate 95% UCL.	
1630	Recommendations are bas	sed upon dat	ata size, data distribution, and skewness.	
1631	These recommendations are based upon the resu	Its of the sim	nulation studies summarized in Singh, Maichle, and Lee (2006).	
1632	However, simulations results will not cover all Real W	Vorld data se	ets; for additional insight the user may want to consult a statistician.	
1633				
1634	Result (gw-3)			
1635				
1636		General	l Statistics	
1637	Total Number of Observations	10	Number of Distinct Observations 1	0
1638	Number of Detects	8	Number of Non-Detects 2	2
1639	Number of Distinct Detects	8	Number of Distinct Non-Detects 2	2
1640	Minimum Detect	131	Minimum Non-Detect 3	7.5
1641	Maximum Detect	1020	Maximum Non-Detect 7	7
1642	Variance Detects	103383	Percent Non-Detects 2	0%
1643	Mean Detects	424.5	SD Detects 32	1.5
1644	Median Detects	330	CV Detects	)./5/
1645	Skewness Detects	0.889	Kurtosis Detects -0.	.0938
1646	Mean of Logged Detects	5.782	SD of Logged Detects	J.796
1647	Norn	nal COE Tee	st on Detects Only	
1648	Shaniro Wilk Test Statistic		Shaniro Wilk GOF Test	
1649	5% Shapiro Wilk Critical Value	0.000	Detected Data annear Normal at 5% Significance Level	
1650	Lilliefors Test Statistic	0.257	Lilliefors GOF Test	
1651	5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level	
1652	Detected Data	appear Norr	mal at 5% Significance Level	
1654				
1655	Kaplan-Meier (KM) Statistics usi	ng Normal C	Critical Values and other Nonparametric UCLs	
1656	KM Mean	347.1	KM Standard Error of Mean 10	4.9
1657	KM SD	310.4	95% KM (BCA) UCL 52	7.6
1658	95% KM (t) UCL	539.4	95% KM (Percentile Bootstrap) UCL 51	0.3
1659	95% KM (z) UCL	519.7	95% KM Bootstrap t UCL 59	6.6
1660	90% KM Chebyshev UCL	661.9	95% KM Chebyshev UCL 80	4.5
1661	97.5% KM Chebyshev UCL	1002	99% KM Chebyshev UCL 139	91
1662			· · ·	
1663	Gamma GOF	Tests on De	etected Observations Only	
1664	A-D Test Statistic	0.531	Anderson-Darling GOF Test	
1665	5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Le	evel
1666	K-S Test Statistic	0.258	Kolmogorov-Smirnov GOF	
1667	5% K-S Critical Value	0.297	Detected data appear Gamma Distributed at 5% Significance Le	evel
1668	Detected data appea	r Gamma Di	istributed at 5% Significance Level	
1669				

	A	В	C D E F G H I J K						L		
1670					Gamma	Statistics or	Detected D	Data Only			
1671					k hat (MLE)	2.012			k	star (bias corrected MLE	) 1.341
1672				The	ta hat (MLE)	211			Theta	star (bias corrected MLE	.) 316.6
1673				I	nu hat (MLE)	32.19				nu star (bias corrected	) 21.45
1674				Me	ean (detects)	424.5					
1675											
1676				(	Gamma ROS	Statistics us	sing Impute	d Non-Detec	ts		
1677			GROS may	not be used	when data s	et has > 50%	NDs with m	any tied obs	ervations at	multiple DLs	
1678		GROS ma	y not be used	I when kstar	of detects is s	small such as	s <1.0, espe	cially when the	ne sample s	ize is small (e.g., <15-20	
1679			Fo	or such situat	ions, GROS ı	method may	yield incorre	ect values of l	JCLs and B	TVs	
1680				1	This is especi	ally true whe	n the sample	e size is sma	II.		
1681		For gai	mma distribut	ed detected	data, BTVs a	nd UCLs ma	y be compu	ted using gan	nma distribu	ition on KM estimates	
1682					Minimum	0.01				Mea	n 339.6
1683					Maximum	1020				Media	n 180
1684					SD	335.3				C	/ 0.987
1685					k hat (MLE)	0.321			k	star (bias corrected MLE	) 0.292
1686				The	ta hat (MLE)	1057			Theta	star (bias corrected MLE	) 1165
1687				1	nu hat (MLE)	6.424				nu star (bias corrected	) 5.83
1688		-	Adjusted	Level of Sig	niticance (β)	0.0267			A 11		
1689		Ar	oproximate C	ni Square Va	alue (5.83, α)	1.554		0501 5	Adjusted (	in Square Value (5.83, f	b) 1.204
1690		95% Gamma	a Approximat	e UCL (use v	when n>=50)	1274		95% Ga	amma Adjus	ted UCL (use when n<50	) 1645
1691				-		D					
1692				E	Mean (KM)	amma Parai	neters using	g KM Estima	tes	SD (K)	) 210.4
1693				N/		06221				SD (KN	) 310.4
1694				V	k bot (KM)	1 251					) 104.9
1695					nu bat (KM)	25.01				nu star (KN	) 18.84
1696				th	eta hat (KM)	277 5				theta star (KM	) 368.4
1697			80%	6 gamma pe	rcentile (KM)	561.2			90	% gamma percentile (KM	) 811
1698			95%		rcentile (KM)	1062		) 1647			
1099				- <u>5</u>							,
1700					Gamm	a Kaplan-M	eier (KM) St	atistics			
1701		Apr	proximate Ch	i Square Val	ue (18.84, α)	10	<b>、</b>		Adjusted Cl	ni Square Value (18.84, (	8.904
1702	95%	6 Gamma Ap	proximate KN	/I-UCL (use v	when n>=50)	653.9		95% Gamm	a Adjusted	KM-UCL (use when n<50	) 734.6
1704											
1705				Le	ognormal GO	F Test on D	etected Obs	ervations O	nly		
1706			S	hapiro Wilk	Test Statistic	0.88			Shapiro W	ilk GOF Test	
1707			5% S	hapiro Wilk (	Critical Value	0.818	Det	ected Data a	ppear Logn	ormal at 5% Significance	Level
1708				Lilliefors	Test Statistic	0.228			Lilliefors	GOF Test	
1709			5	% Lilliefors (	Critical Value	0.283	Det	ected Data a	ppear Logn	ormal at 5% Significance	Level
<u>17</u> 10				Dete	cted Data ap	pear Logno	rmal at 5% S	Significance	Level		
1711											
1712				Lo	gnormal RO	S Statistics	Using Imput	ed Non-Dete	ects		
1713				Mean in O	riginal Scale	349.3				Mean in Log Scal	e 5.402
1714				SD in O	riginal Scale	324.9				SD in Log Scal	e 1.065
1715		95% t l	UCL (assume	es normality of	of ROS data)	537.6			95%	Percentile Bootstrap UC	L 509.4
1716				95% BCA Bo	ootstrap UCL	552.9				95% Bootstrap t UC	L 598.8
1717	95% H-UCL (Log ROS) 1236										
1718											
1719			Statis	stics using K	M estimates	on Logged [	Data and As	suming Logr	normal Distr	ibution	
1720				KM M	ean (logged)	5.351				KM Geo Mea	n 210.8
1721			141.5	KM	SD (logged)	1.09	9 95% Critical H Value (KM-Lu				) 3.291
1722	KM Standard Error of Mean (logge					0.369				95% H-UCL (KM -Log	) 1263
1723	KM SD (logg					1.09			95%	Critical H Value (KM-Log	) 3.291
1724			KM Standa	rd Error of M	ean (logged)	0.369					
1725											

	A	В	С	D	E	F	G	H		J	K	L		
1726						DL/2 S	tatistics							
1727			DL/2 I	Normal Maan in O		245.2			DL/2 Lo	g-Transforme	1 - in Lon Coole	E 204		
1728				Mean In O	riginal Scale	345.3				Iviear	1 In Log Scale	5.284		
1729			05% +1			529.1				3L 05		2125		
1730			95% LC	is not a reco		ethod provi	ded for com	narisons an	d historica		% H-Stat UCL	2155		
1731			DLIZ											
1/32					Nonparam	etric Distribu	ition Free UC	CL Statistics						
1/33				Detected	Data appea	ar Normal Di	stributed at {	5% Significa	, ance Leve					
1734										•				
1726						Suggested	UCL to Use							
1737				95%	KM (t) UCL	539.4								
1738														
1739		Note: Sugge	stions regard	ling the selec	tion of a 959	% UCL are pr	ovided to he	p the user t	o select the	e most appropi	riate 95% UCL			
1740			F	Recommenda	tions are ba	sed upon da	ta size, data	distribution,	and skewn	ness.				
1741		These reco	mmendations	s are based u	pon the resi	ults of the sin	nulation studi	es summar	zed in Sing	gh, Maichle, ar	nd Lee (2006).			
1742	Ho	owever, simu	lations result	s will not cov	er all Real V	Vorld data se	ts; for additic	onal insight t	he user ma	ay want to con	sult a statisticia	an.		
1743														
1744	Result (gw-	4)												
1745														
1746						General	Statistics							
1747			Total	Number of C	bservations	10			Num	ber of Distinct	Observations	7		
1748				Numbe	er of Detects	4				Number o	f Non-Detects	6		
1749			N	umber of Dis	tinct Detects	4			Nur	nber of Distinc	t Non-Detects	3		
1750				IVIINI	mum Detect	80				Maximu	m Non-Detect	38		
1751				Iviaxi	mum Detect	692.2				Doroon	m Non-Detect	// 60%		
1752				Valla	ean Detects	112				Percen	SD Detects	26.14		
1753				Me	dian Detects	112					CV Detects	0 233		
1/54				Skewr	ess Detects	-0.282		CV Delect						
1755				Mean of Log	aed Detects	4 697				SD of Lo	aged Detects	0.244		
1750					9	1					33			
1757					Norr	nal GOF Tes	st on Detects	Only						
1759			S	hapiro Wilk T	est Statistic	0.992		-	Shapiro	Wilk GOF Tes	st			
1760			5% S	hapiro Wilk C	Critical Value	0.748	D	etected Data	a appear N	lormal at 5% S	ignificance Lev	/el		
1761				Lilliefors 7	Fest Statistic	0.163			Lilliefo	ors GOF Test				
1762			5	% Lilliefors C	Critical Value	0.375	D	etected Data	a appear N	lormal at 5% S	ignificance Lev	/el		
1763				De	tected Data	appear Norr	nal at 5% Sig	gnificance l	.evel					
1764														
1765			Kaplan-	Meier (KM) S	Statistics us	ing Normal C	Critical Value	s and othe	<sup>.</sup> Nonparar	netric UCLs				
1766					KM Mean	67.6				KM Standard	Error of Mean	14.23		
1767					KM SD	38.98				95% K	M (BCA) UCL	N/A		
1768				95%	KM (t) UCL	93.69			95% KN	1 (Percentile B	ootstrap) UCL	N/A		
1769				95%	KM (z) UCL	91.01				95% KM Bo	otstrap t UCL	N/A		
1770			2	HOW KM Che	byshev UCL	110.3				95% KM Ch	ebyshev UCL	129.6		
1771			97	.5% KM Che	byshev UCL	156.5				99% KM Ch	ebyshev UCL	209.2		
1772					amma 005	Tooto on P	atacted Ob-	nutions O	nhz					
1773							elected UDS(	ervations O	Andorser	Darling COE 1	[oct			
1774				-D Ω 5% Δ₋D Ω	ritical Value	0.219	Detecto	d data anno	ar Gamma		5% Significan			
1775				K-6 1	Test Statistic	0.007	Delecte	a aata appe	Kolmogor					
1//6				5% K-S C	Critical Value	0.394	Detecte	d data anne	ar Gamma	Distributed at	5% Significan	ce Level		
1770				Detected	data annea	r Gamma Di	stributed at !	5% Signific	ance Leve					
1770				20.00.00	appoo					-				
1//9														

	А	В	С	D	E	F	G	Н		J	K	L
1780					Gamma	Statistics or	Detected D	Data Only				<b>-</b> 070
1781					k hat (MLE)	23.25			k	star (bias corre	cted MLE)	5.979
1782				The	ta hat (MLE)	4.81/			Iheta	star (bias corre	cted MLE)	18.73
1783				1	nu hat (MLE)	186				nu star (bias	corrected)	47.84
1784				Me	ean (detects)	112						
1785												
1786				(	Gamma ROS	Statistics us	sing Impute	d Non-Detec	ts			
1787			GROS may	not be used	when data s	et has > 50%	NDs with m	nany tied obs	ervations at	multiple DLs		
1788		GROS ma	iy not be used	I when kstar	of detects is s	small such a	s <1.0, espe	cially when the	ne sample s	ize is small (e.g	., <15-20)	
1789			Fo	or such situat	ions, GROS I	method may	yield incorre	ct values of	JCLs and B	TVs		
1790					his is especi	ally true whe	n the sample	e size is sma	II.			
1791		For ga	mma distribut	ed detected	data, BTVs a	nd UCLs ma	ly be comput	ted using gar	nma distribu	ition on KM esti	mates	
1792					Minimum	4.667					Mean	62.33
1793					Maximum	141					Median	48.03
1794					SD	47.21						0.757
1795				<b>T</b> L -	K hat (MLE)	1.463			K Thata	star (blas corre		1.091
1796				The		42.0			Ineta	star (blas corre		57.14 21.02
1797			۸ diviate -			29.20				nu star (DIAS	conected)	21.8Z
1798		۸ م				12.0207			Adjusted C	ni Squaro Voluc	(21 82 0)	10.07
1799		Ар 95% Сотт	a Approximate		when $n > -50$	111 5		05% 04			(21.02, p)	N/A
1800		95 % Gamm			MIEITI/~-50)	111.5		95 % Ga	amina Aujus		nen n<50)	- IN/A
1801				F	timates of G	amma Para	meters usin	n KM Estima	tes			
1802					Mean (KM)	67.6			.00		SD (KM)	38.98
1803				Va	ariance (KM)	1519				SE of M	Mean (KM)	14 23
1804					k hat (KM)	3 008					(star (KM)	2 172
1805					nu hat (KM)	60.16				nı	ustar (KM)	43.44
1806				th	eta hat (KM)	22.47				theta	a star (KM)	31.12
1807			80%	6 gamma pe	rcentile (KM)	100.2			90'	% gamma perce	entile (KM)	129
1808			95%	6 gamma pe	rcentile (KM)	156.2			99	% gamma perce	entile (KM)	216.5
1010				- <u>5</u>							()	
1811					Gamm	a Kaplan-M	eier (KM) St	atistics				
1812		Ар	proximate Ch	i Square Val	ue (43.44, α)	29.33			Adjusted Cl	ni Square Value	(43.44, β)	27.33
1813	959	% Gamma Ap	proximate KM	/I-UCL (use v	when n>=50)	100.1		95% Gamm	a Adjusted	KM-UCL (use w	/hen n<50)	107.5
1814												
1815				Le	ognormal GC	F Test on D	etected Obs	ervations O	nly			
1816			S	hapiro Wilk	Test Statistic	0.976			Shapiro W	ilk GOF Test		
1817			5% S	hapiro Wilk (	Critical Value	0.748	Det	ected Data a	ppear Logn	ormal at 5% Sig	nificance L	evel
1818				Lilliefors	Test Statistic	0.182			Lilliefors	GOF Test		
1819			5	% Lilliefors (	Critical Value	0.375	Det	ected Data a	ppear Logno	ormal at 5% Sig	nificance L	evel
1820				Dete	cted Data ap	pear Logno	rmal at 5% S	Significance	Level			
1821												
1822				Lo	gnormal RO	S Statistics	Using Imput	ed Non-Dete	ects			
1823				Mean in O	riginal Scale	73.62				Mean in	Log Scale	4.192
1824				SD in O	riginal Scale	36.99				SD in	Log Scale	0.48
1825		95% t	UCL (assume	es normality	of ROS data)	95.06			95%	Percentile Boot	tstrap UCL	93.03
1826				95% BCA Bo	ootstrap UCL	94.69				95% Boots	trap t UCL	102.6
1827	95% H-UCL (Log R					105.5						
1828												
1829			Statis	stics using K	M estimates	on Logged I	Data and As	suming Log	normal Distr	ribution		
1830				KM M	ean (logged)	4.061				KM	Geo Mean	58.05
1831			1010	KM	SD (logged)	0.536			95%	Critical H Value	e (KM-Log)	2.271
1832			KM Standa	rd ⊢rror of M	ean (logged)	0.196				95% H-UCL	(KM -Log)	100.5
1833				KM	SD (logged)	0.536			95%	Critical H Value	e (KM-Log)	2.2/1
1834			KM Standa	ra ⊢rror of M	ean (logged)	0.196						
1835												

	A B C D E	<u> </u>	G H I	J K	L			
1836	DI /2 Normal	DL/2 S	atistics	formed				
1837	DL/2 Norman	65.99	DL/2 Log-Tran		3 007			
1838	SD in Original Scale	42.99		SD in Log Scale	0.655			
1839	95% t LICL (Assumes normality)	42.00		95% H_Stat LICI	115.2			
1840	DI /2 is not a recommended m	ethod provi	ed for comparisons and historical reaso		113.2			
1841								
1842	Nonparam	etric Distribu	on Free UCL Statistics					
1843	Detected Data appea	ar Normal Di	tributed at 5% Significance Level					
1044								
1040		Suggested	JCL to Use					
1847	95% KM (t) UCL	93.69						
1848								
1849	Note: Suggestions regarding the selection of a 95%	6 UCL are pr	vided to help the user to select the most	appropriate 95% UCL.				
1850	Recommendations are ba	sed upon dat	size, data distribution, and skewness.					
1851	These recommendations are based upon the resu	Its of the sim	Ilation studies summarized in Singh, Mai	chle, and Lee (2006).				
1852	However, simulations results will not cover all Real V	Vorld data se	; for additional insight the user may wan	t to consult a statisticia	n.			
1853								
1854	Result (mw-4)							
1855								
1856		General	Statistics					
1857	Total Number of Observations	10	Number of	Distinct Observations	10			
1858	Number of Detects	9	Nu	mber of Non-Detects	1			
1859	Number of Distinct Detects	9	Number of	Distinct Non-Detects	1			
1860	Minimum Detect	300		Minimum Non-Detect	76.5			
1861	Maximum Detect	600		Aaximum Non-Detect	76.5			
1862	Variance Detects	8551		Percent Non-Detects	10%			
1863	Mean Detects	393	SD Detects					
1864	Median Detects	390		CV Detects	0.235			
1865	Skewiness Detects	5 052		Runosis Delects	0.217			
1866	Mean of Logged Detects	5.952		D of Logged Delects	0.217			
1867	Norr	nal GOF Tes	on Detects Only					
1868	Shapiro Wilk Test Statistic	0.861	Shapiro Wilk G	OF Test				
1009	5% Shapiro Wilk Critical Value	0.829	Detected Data appear Normal a	at 5% Significance Lev	el			
1070	Lilliefors Test Statistic	0.225	Lilliefors GO	F Test				
1872	5% Lilliefors Critical Value	0.274	Detected Data appear Normal	at 5% Significance Lev	el			
1873	Detected Data	appear Norr	al at 5% Significance Level					
1874								
1875	Kaplan-Meier (KM) Statistics usi	ng Normal C	itical Values and other Nonparametric I	JCLs				
1876	KM Mean	361.4	KM St	andard Error of Mean	42.24			
1877	KM SD	125.9		95% KM (BCA) UCL	424.6			
1 <u>8</u> 78	95% KM (t) UCL	438.8	95% KM (Perce	entile Bootstrap) UCL	423.4			
1879	95% KM (z) UCL	430.8	95%	KM Bootstrap t UCL	429.6			
1880	90% KM Chebyshev UCL	488.1	95%	KM Chebyshev UCL	545.5			
1881	97.5% KM Chebyshev UCL	625.1	99%	KM Chebyshev UCL	781.6			
1882								
1883	Gamma GOF	Tests on De	ected Observations Only					
1884	A-D Test Statistic	0.39	Anderson-Darling	GOF Test				
1885	5% A-D Critical Value	0.721	Detected data appear Gamma Distrib	outed at 5% Significanc	e Level			
1886	K-S Test Statistic	0.187	Kolmogorov-Smi	rnov GOF				
1887	5% K-S Critical Value	0.279	Detected data appear Gamma Distrib	outed at 5% Significand	e Level			
1888	Detected data appea	r Gamma Di	tributed at 5% Significance Level					
1889								

	А	В	С	D	E	F	G	Н		J	K	L
1890					Gamma	Statistics on	Detected D	Data Only	<u> </u>			15.0.1
1891					k hat (MLE)	22.9			k	star (bias correc	cted MLE)	15.34
1892				The	ta hat (MLE)	17.16			Iheta	star (bias correc	cted MLE)	25.62
1893				۱ ۸	nu hat (MLE)	412.2				nu star (blas o	corrected)	276.1
1894				Me	ean (detects)	393						
1895						<u>.</u>						
1896			0000		amma ROS			I NON-Detec	<b>IS</b>			
1897		CROSma	GRUS may	not be used	when data so	et nas > 50%	$\sim 10$ occo	any tied obs			<15 20)	
1898		GRUS IIIa	y not be used	r such situat	ione GROS	method may	vield incorre				, <15-20)	
1899					This is especi	ally true whe	n the sample	e size is sma		1 V 3		
1900		For gar	mma distribut	ed detected	data, BTVs a	nd UCI s ma	v be comput	ted using gar	nma distribu	tion on KM estir	nates	
1901					Minimum	198.6	, 20 00pu	ieu ueilig gui			Mean	373.6
1902					Maximum	600					Median	370
1903					SD	106.7					CV	0.286
1904					k hat (MLE)	13.56			k	star (bias correc	cted MLE)	9.561
1905				The	ta hat (MLE)	27.54			Theta	star (bias correc	cted MLE)	39.07
1907				1	nu hat (MLE)	271.3				nu star (bias o	corrected)	191.2
1908			Adjusted	Level of Sig	nificance (β)	0.0267						
1909		Appr	roximate Chi	Square Value	e (191.22, α)	160.2		Ą	djusted Chi	Square Value (	191.22, β)	155.3
1910		95% Gamma	a Approximat	e UCL (use v	vhen n>=50)	445.8		95% Ga	amma Adjus	ted UCL (use wi	hen n<50)	460
1911												
1912				E٤	stimates of G	amma Parar	neters using	g KM Estima	tes			
1913					Mean (KM)	361.4					SD (KM)	125.9
1914				Va	ariance (KM)	15856				SE of N	lean (KM)	42.24
1915					k hat (KM)	8.235				k	star (KM)	5.831
1916					nu hat (KM)	164.7				nu	star (KM)	116.6
1917				th	eta hat (KM)	43.88				theta	star (KM)	61.97
1918			80%	6 gamma pei	rcentile (KM)	477.6			909	% gamma perce	entile (KM)	561.5
1919			95%	6 gamma per	rcentile (KM)	637.4			99	% gamma perce	entile (KM)	796.8
1920					0	a Kanlan M		-				
1921		Appr	ovimato Chi	Squaro Valu			eler (KM) St	atistics	diustod Chi	Square Value (	116 62 B)	88.08
1922	95%		nrovimate KN		e(110.02, u)	92.09 454 7		95% Gamm	a Adjusted I		hen n < 50	473.6
1923								5570 Camin				473.0
1924				L	ognormal GO	F Test on D	etected Obs	ervations O	nlv			
1925			S	hapiro Wilk	Fest Statistic	0.915			Shapiro W	ilk GOF Test		
1920			5% S	hapiro Wilk C	Critical Value	0.829	Det	ected Data a	ppear Logno	ormal at 5% Sigr	nificance Le	evel
1928				Lilliefors	Fest Statistic	0.184			Lilliefors	GOF Test		
1929			5	% Lilliefors C	Critical Value	0.274	Det	ected Data a	ppear Logn	ormal at 5% Sigr	nificance Le	evel
1930				Dete	cted Data ap	pear Logno	mal at 5% S	Significance	Level			
1931												
1932				Lo	gnormal RO	S Statistics I	Jsing Imput	ed Non-Dete	cts			
1933				Mean in O	riginal Scale	376.5				Mean in	Log Scale	5.899
1934				SD in O	riginal Scale	101.7				SD in	Log Scale	0.263
1935		95% t l	UCL (assume	s normality	of ROS data)	435.4			95%	Percentile Boots	strap UCL	428.2
1936				95% BCA Bo	ootstrap UCL	436.2				95% Bootst	trap t UCL	452.6
1937				95% H-UC	L (Log ROS)	447.8						
1938												
1939			Statis	stics using K	M estimates	on Logged [	vata and As	suming Logr	normal Distr	IDUTION		007.4
1940				KM M	ean (logged)	5.79			0501	KM (	Jeo Mean	327.1
1941			KM Ctored	KM		0.522			95%		(KIVI-LOG)	2.251
1942			Kivi Standa		ean (logged)	0.1/5			050/	95% H-UCL		2 254.4
1943			KM Standa		טט (iugged)	0.022			95%	Ghucai 🖬 Value	(raivi-log)	2.201
1944					ean (iogged)	0.175						
1945												

	A B C D E		
1946	DI /2 Normal	DL/2 S	Statistics
1947	DL/2 Norman Moon in Original Scale	357.5	Moon in Log Scolo 5 721
1948		142.1	SD in Log Scale 0.755
1949		142.1	
1950	95% t OCL (Assumes normality)	439.9	
1951	DL/2 is not a recommended in	etnoa, provi	
1952	Noncorr	atula Diatulhu	
1953			Jution Free OCL Statistics
1954		ar Normai Di	
1955		Suggested	
1956			
1957	95% KM (I) UCL	430.0	
1958	Note: Suggestions reporting the selection of a 059		revided to help the uper to colorit the most entropyiete 0.5% LICI
1959	Note: Suggestions regarding the selection of a 95%	6 UCL are pr	Storided to help the user to select the most appropriate 95% UCL.
1960	Recommendations are based upon the reco	sed upon da	ata size, data distribution, and skewness.
1961	I hese recommendations are based upon the rest	lits of the sin	mulation studies summarized in Singh, Malchie, and Lee (2006).
1962	However, simulations results will not cover all Real v	vorid data se	ets; for additional insight the user may want to consult a statistician.
1963			
1964	Result (p2-7s)		
1965		Ganaral	al Statistics
1966	Total Number of Observations		Number of Distinct Observations 9
1967	Number of Detects	7	Number of Non Detects 3
1968	Number of Distinct Detects	7	Number of Distinct Non-Detects 2
1969	Minimum Detect	123	Minimum Non-Detect 76 5
1970	Maximum Detect	320	Maximum Non-Detect 78
1971	Variance Detect	6485	Percent Non-Detects 30%
1972	Mean Detects	201.6	SD Detects 80.53
1973	Median Detects	151	CV Detects 0.30
1974	Skewness Detects	0.54	Kurtosis Detects -1.96
1975	Mean of Logged Detects	5 230	SD of Logged Detects 0.303
1976	Mean of Logged Delects	0.200	
19//	Norr	nal GOF Tes	ast on Detects Only
1978	Shapiro Wilk Test Statistic		Shapiro Wilk GOF Test
1979	5% Shapiro Wilk Critical Value	0.803	Detected Data appear Normal at 5% Significance Level
1980	Lilliefors Test Statistic	0.307	Lilliefors GOE Test
1981	5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level
1982	Detected Data appea	r Approximat	ate Normal at 5% Significance Level
1983		, approximation	
1984	Kaplan-Meier (KM) Statistics us	ng Normal (	Critical Values and other Nonnarametric UCI s
1985	KM Mean	164.1	KM Standard Error of Mean 28.94
1007	KM Moun	84.73	95% KM (BCA) UCI 211.4
1987	95% KM (t) UCI	217.2	95% KM (Percentile Bootstran) UCI 209.2
1988	95% KM (7) UCI	211.7	95% KM Bootstrap t UCI 223 4
1909	90% KM Chebvshev UCL	250.9	95% KM Chebyshev UCL 290.3
1990	97.5% KM Chebyshev UCI	344.8	99% KM Chebyshev UCL 452 1
1997			
1002	Gamma GOF	Tests on De	Detected Observations Only
1004	A-D Test Statistic	0.659	Anderson-Darling GOF Test
1005	5% A-D Critical Value	0.709	Detected data appear Gamma Distributed at 5% Significance Level
1006	K-S Test Statistic	0.31	Kolmoaorov-Smirnov GOF
1007	5% K-S Critical Value	0.312	Detected data appear Gamma Distributed at 5% Significance Level
1000	Detected data appea	r Gamma Di	Distributed at 5% Significance Level
1998			
1999			

	А	В	С	D	E	F	G	Н		J K	L
2000					Gamma	Statistics or	Detected D	Data Only			
2001					k hat (MLE)	7.615			k	star (bias corrected MLE)	4.447
2002				The	ta hat (MLE)	26.48			Theta	star (bias corrected MLE)	45.35
2003				ı	nu hat (MLE)	106.6				nu star (bias corrected)	62.25
2004				Me	ean (detects)	201.6					
2005											
2006				C	Gamma ROS	Statistics us	sing Impute	d Non-Detec	ts		
2007			GROS may	not be used	when data s	et has > 50%	NDs with m	nany tied obs	ervations at	multiple DLs	
2008		GROS may	y not be used	l when kstar	of detects is a	small such as	s <1.0, espe	cially when the	ne sample si	ize is small (e.g., <15-20)	
2009			Fc	or such situat	ions, GROS ı	method may	yield incorre	ect values of l	JCLs and B	TVs	
2010				٦	his is especi	ally true whe	n the sample	e size is sma	II.		
2011		For gar	mma distribut	ed detected	data, BTVs a	nd UCLs ma	y be comput	ted using gar	nma distribu	tion on KM estimates	
2012					Minimum	14.55				Mean	151.5
2013					Maximum	320				Median	141.3
2014					SD	104.5				CV	0.69
2015					k hat (MLE)	1.661			k	star (bias corrected MLE)	1.229
2016				The	ta hat (MLE)	91.23			Theta	star (bias corrected MLE)	123.3
2017				ı	nu hat (MLE)	33.21				nu star (bias corrected)	24.58
2018			Adjusted	Level of Sig	nificance (β)	0.0267					
2019		App	proximate Ch	i Square Val	ue (24.58, α)	14.29			Adjusted Ch	ni Square Value (24.58, β)	12.95
2020		95% Gamma	a Approximat	e UCL (use v	vhen n>=50)	260.6		95% Ga	amma Adjus	ted UCL (use when n<50)	287.7
2021											
2022				Es	timates of G	amma Parai	neters using	g KM Estima	tes		
2023					Mean (KM)	164.1				SD (KM)	84.73
2024				Va	ariance (KM)	7179				SE of Mean (KM)	28.94
2025					k hat (KM)	3.751				k star (KM)	2.692
2026					nu hat (KM)	75.02				nu star (KM)	53.84
2027				th	eta hat (KM)	43.75				theta star (KM)	60.95
2028			80%	6 gamma pei	centile (KM)	237.1			909	% gamma percentile (KM)	298.1
2029			95%	6 gamma pei	centile (KM)	355.4			999	% gamma percentile (KM)	480.3
2030											
2031					Gamm	a Kaplan-M	eier (KM) St	atistics			
2032		App	proximate Ch	i Square Val	ue (53.84, α)	37.99			Adjusted Ch	ni Square Value (53.84, β)	35.68
2033	95%	6 Gamma Ap	proximate KN	/I-UCL (use v	vhen n>=50)	232.6		95% Gamm	a Adjusted I	KM-UCL (use when n<50)	247.6
2034											
2035				Lo	ognormal GO	F Test on D	etected Obs	servations O	nly		
2036			S	hapiro Wilk	Fest Statistic	0.847			Shapiro W	ilk GOF Test	
2037			5% S	hapiro Wilk C	Critical Value	0.803	Det	ected Data a	ppear Logno	ormal at 5% Significance L	evel
2038				Lilliefors	Fest Statistic	0.286			Lilliefors	GOF Test	
2039			5	% Lilliefors C	Critical Value	0.304	Det	ected Data a	ppear Logno	ormal at 5% Significance L	evel
2040				Dete	cted Data ap	pear Logno	rmal at 5% S	Significance	Level		
2041											
2042				Lo	gnormal RO	S Statistics	Jsing Imput	ed Non-Dete	cts		
2043				Mean in O	riginal Scale	162.7				Mean in Log Scale	4.948
2044				SD in O	riginal Scale	90.96				SD in Log Scale	0.572
2045		95% t l	UCL (assume	es normality of	of ROS data)	215.4			95%	Percentile Bootstrap UCL	208.1
2046				95% BCA Bo	otstrap UCL	212.7				95% Bootstrap t UCL	226.8
2047				95% H-UC	L (Log ROS)	258.6					
2048											
2049			Statis	stics using K	M estimates	on Logged [	Data and As	suming Logr	normal Distr	ibution	
2050				KM M	ean (logged)	4.969				KM Geo Mean	143.8
2051				KM	SD (logged)	0.513			95%	Critical H Value (KM-Log)	2.239
2052			KM Standa	rd Error of M	ean (logged)	0.175				95% H-UCL (KM -Log)	240.7
2053				KM	SD (logged)	0.513			95%	Critical H Value (KM-Log)	2.239
2054			KM Standa	rd Error of M	ean (logged)	0.175					
2055											

	А	В	С	D	E	F	G	Н	I		J	K		L
2056				<u> </u>		DL/2 S	tatistics				_			
2057			DL/2	Normal					DL/2 Lo	og-Transfo	ormed		_	
2058				Mean in O	riginal Scale	152.7					Mean ir	n Log Scal	е	4.763
2059				SD in O	riginal Scale	102.6					SD ir	n Log Scal	е	0.832
2060			95% t l	JCL (Assume	es normality)	212.2					95%	H-Stat UC	L 3	356.5
2061			DL/2 i	is not a reco	mmended m	ethod, provi	ded for comp	parisons and	l historica	al reasons	3			
2062														
2063					Nonparame	etric Distribu	tion Free UC	CL Statistics						
2064			De	tected Data	appear Appr	oximate Nor	mal Distribu	ted at 5% Si	gnificanc	e Level				
2065														
2066						Suggested	UCL to Use							
2067				95%	5 KM (t) UCL	217.2								
2068														
2069			When a c	data set follow	vs an approx	imate (e.g., r	normal) distri	bution passi	ng one of	the GOF	test			
2070		When app	olicable, it is s	suggested to	use a UCL b	ased upon a	distribution (	e.g., gamma	a) passing	both GO	F tests i	n ProUCL		
2071														
2072		Note: Sugge	stions regard	ling the seled	tion of a 95%	6 UCL are pr	ovided to hel	p the user to	select the	e most ap	propriat	te 95% UC	CL.	
2073			F	Recommenda	tions are bas	sed upon dat	a size, data	distribution, a	and skewr	ness.				
2074		These reco	mmendations	s are based ι	pon the resu	Its of the sim	ulation studi	es summariz	zed in Sing	gh, Maich	le, and	Lee (2006	).	
2075	Ho	owever, simu	lations result	ts will not cov	er all Real W	/orld data set	s; for additio	nal insight th	ne user ma	ay want to	o consu	lt a statisti	cian.	
2076														
2077	Result (pz-	8)												
2078						-	-							
2079						General	Statistics						-	
2080			Total	Number of C	bservations	10			Num	nber of Dis	stinct O	bservation	S	5
2081				Numb	er of Detects	0				Num	ber of N	lon-Detect	s	10
2082			N	umber of Dis	tinct Detects	0			Nur	mber of D	istinct N	Ion-Detect	S	5
2083		14/			New Date of									
2084		war	ning: All obs	ervations are	Non-Detect	s (NDS), the	refore all sta	atistics and e	estimates	snould a	ISO DE I			
2085		Specif	ically, sample	e mean, UCI	.s, UPLs, an	a other stati	stics are also	o NDS lying	below the				10	
2086		ne Project	ream may de	ecide to use	alternative s	ite specific v	alues to est	imate enviro	nmental	paramete	rs (e.g.	, ЕРС, ВТ	v).	
2087				The	data set for	variable Des	ult (nz_8) wa	e not proce	eeodl					
2088							un (pz-0) wa		53EU!					
2089														
2090	Result (s1-a	ad)												
2091		,												
2092						General	Statistics							
2093			Total	Number of C	bservations	10			Num	nber of Dis	stinct O	bservation	s	4
2094				Numb	er of Detects	1				Num	ber of N	Ion-Detect	s	9
2090			N	umber of Dis	tinct Detects	1			Nur	mber of D	istinct N	Ion-Detect	s	4
2097														
2098		Warning: Or	nly one distin	ct data value	was detect	ed! ProUCL	(or any othe	r software) s	hould not	t be used	on suc	h a data s	et!	
2099	It is sugg	ested to use	alternative s	site specific	alues deter	mined by the	Project Tea	m to estima	te enviro	nmental p	paramet	ters (e.g.,	EPC	, BTV).
2100														
2101				The	data set for v	ariable Res	ult (s1-ad) w	as not proce	essed!					
2102														
2103														

	А		В	С	D	E	F	G	Н		J	K	L			
2104	Result (s <sup>-</sup>	1-au)														
2105																
2106							General	Statistics								
2107				Total	Number of C	bservations	10			Numbe	r of Distinct (	Observations	4			
2108					Numbe	er of Detects	0				Number of	Non-Detects	10			
2109				N	umber of Dis	inct Detects	0			Numb	er of Distinct	Non-Detects	4			
2110					-											
2111			War	ning: All obse	ervations are	Non-Detect	ts (NDs), the	refore all sta	atistics and e	estimates sh	ould also be	NDs!				
2112			Specif	cally, sample	e mean, UCl	.s, UPLs, an	d other stati	stics are als	o NDs lying	below the la	rgest detecti	on limit!				
2113		The	Project -	Feam may de	cide to use	alternative s	ite specific v	alues to est	imate enviro	nmental par	ameters (e.ç	J., EPC, BTV	).			
2114								<b>b</b> ( <b>d</b> )								
2115																
2116																
2117	Decembra (cr	4 11														
2118	Result (s	Number of Non-Detects         0         Number of Non-Detects           Number of Distinct Detects         0         Number of Distinct Non-Detects           Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!         Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!           The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV           The data set for variable Result (s1-au) was not processed!           itt (s1-bd)           General Statistics           Number of Distinct Detects           Number of Distinct Non-Detects           Number of Distinct Detects           Number of Distinct Non-Detects           Number of Distinct data value was detected! ProUCL (or any other software) should not be used on such a data se           s suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., E           The data set for variable Result (s1-bd) was not processed!           Itt (s1-bu)           General Statistics														
2119																
2120				T	Number		General	Statistics		Niccoste	n of Distingt		0			
2121				Iotal	Number of C	bservations	10			NUMDE	Number of	Joservations	0			
2122				NI.		er of Detects	1			Nicceala	Number of	Non-Detects	9			
2123				INU	Imper of DIS	Inct Detects	I			NUMD	er of Distinct	Non-Detects	5			
2124		We.		hi ana diatin		waa dataat		(or only othe		hould not h		ah a data aat				
2125	lt in our	vva	ming: Or	liy one distin				Or any othe	r sonware) s		e used on su	ch a data set				
2126	it is sug	geste	e to use	alternative s	tte specific v	alues deteri	minea by the	Project Tea	am to estima	te environm	ental param	eters (e.g., E	РС, ВТУ).			
2127					The		oriable Dee	ult (o1 bd) w	no not proof	aaadi						
2128					THE			uit (ST-DU) W		556U!						
2129		warming: An observations are Non-Detects (NUPs), interefore all statistics and estimates should also be NDSI         Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!         The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BT         The data set for variable Result (s1-au) was not processed!         Image: team of the statistics         General Statistics         Total Number of Observations         10       Number of Distinct Observations         Number of Distinct Detects       1         Number of Distinct Detects       1         Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data s         suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g.,         The data set for variable Result (s1-bd) was not processed!         it (s1-bu)       General Statistics         Total Number of Observations       10         Number of Distinct Detects       0         Number of Distinct Det														
2130	Recult (e'	1_bu)														
2131	i tesuit (s	1-Du)														
2132							General	Statistics								
2133				Total	Number of (	bservations	10			Numbe	r of Distinct (	Observations	5			
2134					Number	er of Detects	0				Number of	Non-Detects	10			
2135				N	umber of Dis	inct Detects	0			Numb	er of Distinct	Non-Detects	5			
2130							-						-			
2137			War	ning: All obse	ervations are	Non-Detect	ts (NDs), the	refore all sta	atistics and e	estimates sh	ould also be	NDs!				
2130			Specif	cally, sample	e mean, UCI	.s, UPLs, an	d other stati	stics are als	o NDs lying	below the la	rgest detecti	ion limit!				
2139		The	Project	Feam may de	cide to use	alternative s	ite specific v	alues to est	imate enviro	nmental par	ameters (e.g	J., EPC, BTV	).			
2140			•	•			•			•			·			
2142					The	lata set for v	variable Res	ult (s1-bu) w	as not proce	essed!						
2143																
2144																
2145	Result (s	2-ad)														
2146																
2147							General	Statistics								
2148				Total	Number of C	bservations	10			Numbe	r of Distinct (	Observations	6			
2149					Numbe	er of Detects	0				Number of	Non-Detects	10			
2150				N	umber of Dis	inct Detects	0			Numb	er of Distinct	Non-Detects	6			
2151																
2152			War	ning: All obse	ervations are	Non-Detect	ts (NDs), the	refore all sta	atistics and e	estimates sh	ould also be	NDs!				
2153			Specif	cally, sample	e mean, UCI	.s, UPLs, an	d other stati	stics are als	o NDs lying	below the la	rgest detecti	on limit!				
2154		The	Project	Feam may de	cide to use	alternative s	ite specific v	alues to est	imate enviro	nmental par	ameters (e.ç	J., EPC, BTV	).			
2155																
2156					The	lata set for v	ariable Resi	ult (s <mark>2-ad) w</mark>	as not proce	essed!						
2157												· · · · · · · · · · · · · · · · · · ·				
2158																

	A		В		С		)		E	F	(	G		H			J		K		L
2159	Result	(s2-aı	I)																		
2160																					
2161										General	Statist	tics									
2162					Tota	l Numb	er of C	)bserv	ations	10					Nur	mber	r of Distin	ct Ob	servatior	าร	6
2163						1	Numbe	er of D	etects	0							Number	r of No	on-Detec	ts	10
2164					Ν	lumber	of Dist	tinct D	etects	0					Nu	ımbe	er of Distin	nct No	on-Detec	ts	6
2165																					
2166			Wai	rning:	All obs	ervatio	ns are	Non-	Detect	ts (NDs), the	erefore	all sta	tistic	s and e	stimates	s sho	ould also	be N	Ds!		
2100			Speci	ifically	, sampl	e mear	n. UCL	.s. UF	Ls. an	d other stat	istics a	re also	) NDs	s lying b	elow th	e lar	gest dete	ectior	ı limit!		
2107		Th	e Proiect	Team	n mav de	ecide to	o use a	altern	ative s	ite specific	values	to esti	mate	enviror	mental	para	ameters	(e.a	EPC. BT	<b>V</b> ).	
2108			<b>,</b>		, <b>,</b> .											<b>F</b>		(3-,		- /-	
2169							The c	lata s	et for v	ariable Res	ult (s2-	-au) w	as no	t proces	sedi						
2170												<u>uu) II</u>									
2171																					
21/2	Result	(e2_hc	0																		
2173	Nesult	(32-00	<i>י</i> )																		
2174										Conorol	Statiat	loo									
2175					Tata	l Numb	or of C	been	otiona		Statist				NI	mhor	of Diatin	ot Oh	oonvotior		4
2176					TOLA			bserv		10					INUI	mber	Number			is to	4
2177									elecis	0					NL					is 	10
2178					IN	umber	of DISI		etects	0					NU	Impe	er of Distil		on-Detect	IS	4
2179																		<u> </u>			
2180			wa	rning:	All ODS	ervatio	ns are	NON-		ts (NDS), the		all sta	TISTIC	s and e	stimates	s sno			DS!		
2181			Speci		, sampi	e mear	n, UCL	.s, U⊦	'Ls, an	d other stat	istics a	re also		iying b	elow th	e lar	gest dete				
2182		In	e Project	leam	n may d	ecide to	o use a	altern	ative s	ite specific	values	to est	mate	enviror	nmental	para	ameters	(e.g.,	EPC, BI	V).	
2183														-							
2184							I he c	lata s	et for v	ariable Res	sult (s2-	-bd) w	as no	t proces	ssed!						
2185																					
2186			<u>,</u>																		
2187	Result	(SZ-DL	1)																		
2188										0	0										
2189					<b></b>					General	Statist	ICS					( )				10
2190					lota	INUMB	er of C	bserv	ations	10					Nur	mber	of Distin	ct Ob	servation	IS	10
2191						ſ	Numbe	er of D	etects	9							Number	of No	on-Detect	ts	1
2192					N	umber	of Dist	linct D	etects	9					Nu	imbe	er of Distin	nct No	on-Detect	ts	1
2193							Mini	mum	Detect	/8.5							Minim	1um N	Jon-Dete	ct	/6.5
2194							Maxi	mum _	Detect	1640							Maxim	1um N	Ion-Dete	ct	/6.5
2195							Varia	nce D	etects	214/68							Perce	ent No	on-Detect	ts	10%
2196							M	ean D	etects	470.6									3D Detect	ts	463.4
2197							Med	dian D	etects	370								<u> </u>	V Detect	ts	0.985
2198							Skewn	iess D	etects	2.402							ł	<urtos< th=""><th>sis Detect</th><th>ts</th><th>6.51/</th></urtos<>	sis Detect	ts	6.51/
2199						Mean	of Log	ged D	etects	5.821							SD of	Logge	ed Detect	ts	0.866
2200																					
2201									Norm	nal GOF Te	st on D	etects	Only								
2202					S	Shapiro	Wilk T	est S	tatistic	0.703					Shapiro	o Wil	k GOF T	est			
2203					5% S	hapiro	Wilk C	ritical	Value	0.829		[	Detec	ted Data	a Not No	orma	l at 5% S	ignific	cance Le	vel	
2204						Lillie	efors T	est S	tatistic	0.321					Lillief	fors	GOF Tes	st			
2205					5	5% Lillie	efors C	ritical	Value	0.274		[	Detec	ted Data	a Not No	orma	l at 5% S	ignific	cance Le	vel	
2206							D	etect	ed Data	a Not Norm	al at 5%	6 Sign	ifican	ce Leve	el						
2207																					
2208					Kaplan-	-Meier (	(KM) S	Statist	ics usi	ng Normal (	Critical	Value	s and	other N	lonpara	met	ric UCLs				
2209								KM	Mean	431.2						ΚN	1 Standar	rd Erro	or of Mea	n	144.6
2210								ł	KM SD	431							95%	KM (	BCA) UC	Ľ	705.2
2211							95%	5 KM (	t) UCL	696.2					95% K	M (P	ercentile	Boot	strap) UC	Ľ	684.4
2212							95%	KM (z	z) UCL	669						9	95% KM	Boots	strap t UC	Ľ	984.4
2213					1	90% KN	M Che	byshe	v UCL	864.9						ç	95% KM (	Cheby	/shev UC	Ľ	1061
2214					97	7.5% KN	M Che	byshe	v UCL	1334						ç	9% KM (	Cheby	/shev UC	Ľ	1870
2215																					
2216							G	amm	a GOF	Tests on D	etectec	d Obse	ervatio	ons Onl	у						
2217							A-D T	est S	tatistic	0.458				Ar	nderson	-Dar	ling GOF	- Test	t		
2218						5%	A-D C	ritical	Value	0.733	D	etecte	d data	appea	r Gamm	a Di	stributed	at 5%	Significa	ance	e Level
2219							K-S T	est S	tatistic	0.21				K	olmogo	orov-S	Smirnov	GOF			
2220	1					5%	K-S C	ritical	Value	0.284	D	etecte	d data	appear	r Gamm	a Di	stributed	at 5%	Significa	ance	Level

	А	В	С	D	E	F	G	Н	I	J	K	L
2221				Detected	data appea	r Gamma Dis	stributed at 5	5% Significa	nce Level			
2222					_	o						
2223					Gamma	Statistics or	Detected D	ata Only				1 1 7 0
2224				<b>—</b>	K hat (MLE)	1.647			K	star (bias cor	rected MLE)	1.1/2
2225				Ihet	a hat (MLE)	285.7			Iheta	star (bias cor	rected MLE)	401.5
2226				n	u hat (MLE)	29.65				nu star (bia	as corrected)	21.1
2227				Me	an (detects)	470.6						
2228						Statiation u	ning Imputed	Non Dotos	**			
2229			GROS may	not he used	when data s	rat has > 50%		any tied obs	envations at	multinle DI s		
2230		GROS may	v not be used	when kstar	of detects is	small such as	s < 10 espec	cially when t	he sample si	ze is small (e	a <15-20)	
2231			Fc	or such situati	ons. GROS	method may	vield incorre	ct values of	UCLs and B	TVs	g., 10 20)	
2232				Т	his is especi	ally true whe	n the sample	e size is sma				
2233		For gar	nma distribut	ed detected o	lata. BTVs a	Ind UCLs ma	v be comput	ed using gar	mma distribu	tion on KM es	stimates	
2234					Minimum	0.01	,				Mean	423.6
2235					Maximum	1640					Median	337.8
2230					SD	461.6					CV	1.09
2237					k hat (MLE)	0.5			k	star (bias cor	rected MLE)	0.417
2230				Thet	a hat (MLE)	847.2			Theta	star (bias cor	rected MLE)	1017
2233				n	u hat (MLE)	9.999				nu star (bia	as corrected)	8.333
2240			Adjusted	Level of Sig	nificance (β)	0.0267						
2242		Ap	proximate C	hi Square Va	lue (8.33, α)	2.929			Adjusted C	chi Square Va	alue (8.33, β)	2.401
2243		95% Gamma	a Approximat	e UCL (use w	/hen n>=50)	1205		95% Ga	amma Adjust	ted UCL (use	when n<50)	1470
2244												
2245				Es	timates of G	amma Parai	meters using	I KM Estima	ites			
2246					Mean (KM)	431.2					SD (KM)	431
2247				Va	riance (KM)	185794				SE o	f Mean (KM)	144.6
2248					k hat (KM)	1.001					k star (KM)	0.767
2249					nu hat (KM)	20.02					nu star (KM)	15.34
2250				the	eta hat (KM)	430.9				the	eta star (KM)	562
2251			80%	6 gamma per	centile (KM)	706.2			909	% gamma per	rcentile (KM)	1059
2252			95%	6 gamma per	centile (KM)	1420			999	% gamma per	rcentile (KM)	2275
2253												
2254					Gamm	a Kaplan-M	eier (KM) Sta	atistics				
2255		App	proximate Ch	i Square Valu	ie (15.34, α)	7.501			Adjusted Ch	ni Square Valı	ue (15.34, β)	6.571
2256	95%	6 Gamma Ap	proximate KN	/I-UCL (use w	/hen n>=50)	882		95% Gamm	na Adjusted k	KM-UCL (use	when n<50)	1007
2257												
2258					gnormal GC	PF Test on D	etected Obs	ervations O				
2259			S	hapiro Wilk I	est Statistic	0.944	<b>.</b> .		Shapiro Wi			
2260			5% S	hapiro Wilk C	ritical Value	0.829	Dete	ected Data a	appear Logno	ormal at 5% S	Significance L	evel
2261			E		est Statistic	0.224	Detr	atad Data a	Lilletors			
2262			5	% Lilliefors C	ntical value	0.274	Dete			ormai at 5% 5	Significance L	evei
2263				Dete	cieu Data ap	phear roguo	iniai at 5% S	synncance	revei			
2264				1.0	normal PO	S Statiation	leina Imput	d Non-Dota	octe			
2265				Mean in Or		427 8	Sang mpute		5013	Mean	in Log Scale	5 61/
2266					iginal Scale	457 4					in Log Scale	1 0/5
2267		95% + 1	ICI (assume	s normality o	f ROS data)	693			95%	Percentile Ro		676.8
2268		357011		95% RCA Ro		771 5			3570	95% Roc	otstran t LICI	971 2
2269				95% H-UCI	(Log ROS)	1442				5070 DOC		<i>v,L</i>
2270				0000000	(							L
2271												

	А	В	С	D	E	F	G	Н		J	K	L
2272			Statis	stics using KI	M estimates	on Logged	Data and As	suming Log	normal Distri	bution		
2273				KM Me	ean (logged)	5.672				K	V Geo Mean	290.7
2274				KM	SD (logged)	0.893			95% (	Critical H Val	ue (KM-Log)	2.888
2275			KM Standa	rd Error of Me	ean (logged)	0.3				95% H-UC	CL (KM -Log)	1023
2276				KM	SD (logged)	0.893			95% (	Critical H Val	ue (KM-Log)	2.888
2277			KM Standa	rd Error of Me	ean (logged)	0.3						
2278												
2279						DL/2 S	tatistics					
2280			DL/2	Normal					DL/2 Log-T	ransformed	<u> </u>	
2281				Mean in O	riginal Scale	427.4				Mean	in Log Scale	5.603
2282				SD in O	riginal Scale	457.8				SD	in Log Scale	1.068
2283			95% t l	JCL (Assume	es normality)	692.8				95%	, H-Stat UCL	1521
2284			DL/2	is not a recor	mmended m	ethod, provi	ded for comp	parisons and	i historical re	easons		
2285					N							
2286				Detected	Nonparame							
2287				Detected	Data appea	r Gamma Di	stributed at :	5% Significa	ince Levei			
2288						Suggested						
2289			05% K	M Adjusted (	Somma LICI				05% CPC	S Adjusted (	Commo LICI	1470
2290			95 /0 K	IN Aujusteu C		1007			35 % GRC	o Aujusteu v		1470
2291		Note: Sugge	estions regard	ling the selec	tion of a 95%		ovided to hel	n the user to	solect the m	ost appropri	ate 95% LICI	
2292		Note: Ougge	F	Recommends	tions are has		a size data (	distribution :	and skewnes	s		
2293		These reco	mmendation	s are based u	non the resu	Its of the sim	ulation studi	es summariz	red in Singh	Maichle and	1 Lee (2006).	
2294	Н	owever, simi	ulations result	ts will not cov	er all Real W	/orld data se	ts: for additio	nal insight th	ne user may v	want to cons	ult a statisticia	an.
2295												
2290	Result (s3-	ad)										
2237	<b>`</b>											
2290						General	Statistics					
2300			Total	Number of C	bservations	10			Numbe	r of Distinct (	Observations	6
2301				Numbe	er of Detects	0				Number of	Non-Detects	10
2302			N	umber of Dist	tinct Detects	0			Numbe	er of Distinct	Non-Detects	6
2303							1				I	
2304		War	ning: All obs	ervations are	Non-Detect	s (NDs), the	refore all sta	atistics and e	estimates sh	ould also be	NDs!	
2305		Specif	ically, sample	e mean, UCL	.s, UPLs, an	d other stati	stics are also	o NDs lying	below the la	rgest detecti	on limit!	
2306	٦	The Project	Team may de	ecide to use	alternative s	ite specific <b>v</b>	alues to esti	imate enviro	nmental par	ameters (e.ç	J., EPC, BTV	).
2307												
2308				The c	lata set for v	ariable Res	ult (s3-ad) w	as not proce	essed!			
2309												
2310												
2311	Result (s3-a	au)										
2312												
2313						General	Statistics					
2314			Total	Number of C	bservations	10			Numbe	r of Distinct (	)bservations	5
2315				Numbe	er of Detects	1				Number of	Non-Detects	9
2316			N	umber of Dist	linct Detects	1			Numbe	er of Distinct	Non-Detects	4
2317							(an arrest)					
2318	<b>It in</b> error	warning: Or	ny one distin	ct data value	was detecte		(or any other	r sontware) s	cn a data set			
2319	IT IS SUGG	ested to use	alternative s	site specific v	values deteri	nined by the	e Project Tea	im to estima	ers (e.g., El	-с, вту).		
2320				<b></b>		orioble De-						
2321					iata set for v	ariadie Kes	uit (SJ-au) W	as not proce	95SEQ!			
2322												

	A	В		С		D		E		F	(	G	H				J			K		L
2323	Desult ( 0 )	<b>b</b> .d\																				
2324	Result (s3-l	bd)																				
2325									G	onoral	Static	tice										
2326				To	tal Nu	mber of	Ohse	rvations	10			ucs			Nu	imhe	r of Disti	nct O	hson	ations		6
2327				10		Numl	ber of	Detects		,					Nu	mbe	Numbe	er of N	Jon-D	)etects	,	9
2328					Num	ber of Di	stinct	Detects	s 1						N	umbe	er of Dist	tinct N	lon-D	)etects	,	5
2329																						
2330	,	Warning	: Only	one dist	tinct c	lata valu	le wa	s detec	ted! Pr	roUCL	(or an	y othe	r softwa	are) sh	ould n	ot be	used o	n suc	h a d	lata se	et!	
2331	It is sugg	ested to	use a	Iternativ	e site	specific	value	es dete	mined	l by the	e Proje	ect Tea	im to es	stimat	e envir	onmo	ental pa	ramet	ters (	(e.g., E	EPC	, BTV).
2333																	-					
2334						The	data	set for	variab	le Res	ult (s3	-bd) w	as not j	proces	sed!							
2335																						
2336																						
2337	Result (s3-l	bu)																				
2338																						
2339									G	eneral	Statis	tics										
2340				To	tal Nu	mber of	Obse	rvations	s 10	)					Nu	imbe	r of Disti	nct O	bserv	ations	5	4
2341						Numl	ber of	Detects	s 0								Numbe	er of N	lon-D	)etects	5	10
2342					Num	per of Di	stinct	Detects	s 0						N	umbe	er of Dist	tinct N	lon-D	Detects	6	4
2343																						
2344		<u> </u>	Warnir	ng: All ol	oserva	ations a	re No	n-Detec	ts (ND	Ds), the	erefore	all sta	tistics	and e	stimate	es sh	ould als	o be l	NDs!			
2345		Sp	ecifica	ally, sam	ple m	ean, UC	CLS, U	JPLs, a	nd othe	er stati	istics a	are also	o NDs I	ying b	elow th	ne la	rgest de	tectio	on lim	nit!	^	
2346	1	The Proje	ect Te	am may	decio	le to use	e alter	native	site sp	ecific	values	to esti	imate e	nviror	menta	l par	ameters	; (e.g.	, EP(	C, BT\	/).	
2347						The	data	oot for	voriob	la Daa		<b>b</b> u) w										
2348						The	data	set for	variad	ie kes	uit (SS	-Du) W	as not	proces	sea							
2349																						
2350	Result (s3-	cd)																				
2351	1100011 (00 1	54)																				
2352									G	eneral	Statis	tics										
2353				To	tal Nu	mber of	Obse	rvations	s 10	)					Nu	mbe	r of Disti	nct O	bserv	/ations	;	5
2354						Numl	ber of	Detects	5 1								Numbe	er of N	lon-D	etects	;	9
2356					Num	ber of Di	stinct	Detects	s 1						N	umbe	er of Dist	inct N	lon-D	etects	;	4
2357																						
2358	,	Warning	: Only	one dist	tinct c	lata valu	le wa	s detec	ted! Pr	roUCL	(or an	y othe	r softwa	are) sł	ould n	ot be	e used o	n suc	h a d	lata se	et!	
2359	It is sugg	ested to	use a	Iternativ	e site	specific	: value	es dete	rmined	l by the	e Proje	ect Tea	im to e	stimat	e envir	onm	ental pa	ramet	ters (	(e.g., E	PC	, BTV).
2360																						
2361						The	data	set for	variab	le Res	ult (s3	-cd) wa	as not j	proces	sed!							
2362																						
2363																						
2364	Result (\$3-0	cu)																				
2365									6	onoral	Statio	tion										
2366				To	tal Nu	mber of	Ohso	nyations	- 10		Statis	ucs			Nu	mho	r of Disti	nct O	hean	ations		6
2367				10		Num	ber of	Detecto		,					inu	mbe					,	8
2368					Num	ber of Di	stinct	Detects	2						Ni	umbe	er of Dist	tinct N	Jon-D	)etects	,	4
2309 2270						Mi	nimun	n Detec	t 107	7.5	1						Mini	mum	Non-	Detect	t	31
23/0						Ma	ximun	n Detec	t 195	5.5							Maxi	mum	Non-	Detect	t	78
23/1 2272						Var	iance	Detects	387	2	1						Perc	cent N	lon-D	etects	;	80%
2372							Mean	Detects	151	1.5									SD D	Detects	;	62.23
2374						M	edian	Detects	s 151	1.5									CV D	etects	;	0.411
2375	1					Skew	ness	Detects	6 N//	A								Kurto	osis D	Detects	; 1	N/A
2376					Me	an of Lo	gged	Detects	<b>5</b> 4.	.977	1						SD o	f Logo	ged D	)etects	;	0.423
2377											4											
2378							Wa	rning: I	Data s	et has	only 2	Detec	ted Val	ues.							_	
2379					This	is not er	nough	to com	pute n	neanin	igful oi	r reliab	le stati	stics a	nd est	imate	es.					
2380																						
2381																						
2382								Nor	mal GO	OF Tes	st on D	etects	Only									
2383								Not Er	nough	Data t	o Perf	orm G	OF Tes	t								
2384																						

	А	В	С	D	E	F	G	Н		J	K	L
2385			Kaplan-	Meier (KM) S	Statistics usi	ng Normal C	ritical Value	s and other	Nonparame	tric UCLs		
2386					KM Mean	55.1			K	M Standard E	rror of Mean	23.28
2387					KM SD	52.06				95% KN	A (BCA) UCL	N/A
2388				95%	5 KM (t) UCL	97.78			95% KM (F	Percentile Bo	otstrap) UCL	N/A
2389				95%	KM (z) UCL	93.4				95% KM Boo	otstrap t UCL	N/A
2390				90% KM Che	byshev UCL	124.9				95% KM Che	byshev UCL	156.6
2391			97	.5% KM Che	byshev UCL	200.5				99% KM Che	ebyshev UCL	286.8
2392						Tasta an Da						
2393						Tests on De		Prvations On	шу			
2394					NOLEN	bugn Data to	o Periorini Go	JF Test				
2395					Gamma	Statistics or		ata Only				
2396					k hat (MLE)	11 51			k	star (hias co	rrected MLE)	N/A
2397				Tho	ta hat (MLE)	13.16			Theta	star (bias co		
2398				ric	u hat (MLE)	46.05			meta	nu star (biz	as corrected)	N/A
2399				Me	an (detects)	151.5						
2400						10110						
2401				Es	timates of G	amma Para	meters using	IKM Estima	tes			
2402					Mean (KM)	55.1					SD (KM)	52.06
2403				Va	ariance (KM)	2710				SE c	of Mean (KM)	23.28
2404					k hat (KM)	1.12					k star (KM)	0.851
2405					nu hat (KM)	22.4					nu star (KM)	17.01
2400				th	eta hat (KM)	49.19				the	eta star (KM)	64.77
2408			80%	% gamma per	centile (KM)	89.72			909	% gamma pe	rcentile (KM)	132
2409			95%	% gamma per	centile (KM)	174.8			99	% gamma pe	rcentile (KM)	275.5
2410												
2411					Gamm	a Kaplan-M	eier (KM) Sta	atistics				
2412									Adjuste	d Level of Sig	nificance (β)	0.0267
2413		Ap	proximate Ch	i Square Valı	ue (17.01, α)	8.683			Adjusted Ch	ni Square Val	ue (17.01, β)	7.67
2414	95%	6 Gamma Ap	proximate KM	N-UCL (use v	vhen n>=50)	108		95% Gamm	na Adjusted I	KM-UCL (use	when n<50)	122.2
2415												
2416				Lo	ognormal GC	F Test on D	etected Obs	ervations O	nly			
2417					Not En	ough Data to	Perform G	OF Test				
2418												
2419				Lo	gnormal RO	S Statistics	Using Impute	ed Non-Dete	ects			
2420				Mean in O	riginal Scale	42.53				Mean	in Log Scale	3.039
2421				SD in O	riginal Scale	61.63				SD	in Log Scale	1.179
2422		95% t	UCL (assume	es normality o	of ROS data)	78.26			95%	Percentile Bo	ootstrap UCL	76.96
2423				95% BCA Bo	otstrap UCL	86.95				95% Boo	otstrap t UCL	246.8
2424				95% H-UC	L (Log ROS)	164.6						
2425							<u></u>	<u> </u>				
2426			Statis	stics using K	M estimates	on Logged I	Data and As	suming Logi	normal Distr	ibution		10.5
2427				KM M	ean (logged)	3.742				K	M Geo Mean	42.2
2428				KM	SD (logged)	0.631			95%	Critical H Val	ue (KM-Log)	2.418
2429			KM Standa	rd ⊨rror of Me	ean (logged)	0.282			0501	95% H-U(		85.68
2430				KM	SD (logged)	0.631			95%	Critical H Va	ue (KM-Log)	2.418
2431			KM Standa	rd ⊨rror of M	ean (logged)	0.282						
2432												

	А	В	С	D	E	F	G	Н	I	J	K	L
2433			BI /2 *	law'		DL/2 S	tatistics		DI /0 1	a Tacard		
2434			DL/2		viain -1.0	F0 75			DL/2 Lo	g-I ransformed		0.001
2435				Mean in O	riginal Scale	58.75				Mean	in Log Scale	3.824
2436			059/ +1	SD In O	riginal Scale	53.58				SD		0.685
2437			95% [[		es normality)	89.81			d biotorioo	95%	H-Stat UCL	102.6
2438			DL/21	s not a reco	mmenaea m	etnoa, provi	aea tor com	parisons and	a historica	al reasons		
2439					Nonnorom	tria Diatribu	tion Free LI					
2440				Data do n	nonparame	iscernible D	istribution at	5% Signific	ance Leve	ما		
2441				Data uo II				1 5% Signing				
2442						Suggested	UCL to Use					
2443				95%	KM (t) UCI	97 78					KM H-UCI	85.68
2444				95% KM		N/A						
2445				Warn	ina: One or I	more Recorr	mended UC	L(s) not ava	ailable!			
2440					•			()				
2447		Note: Sugge	stions regard	ing the selec	tion of a 95%	6 UCL are pr	ovided to he	Ip the user to	select the	e most appropria	ate 95% UCL	
2449			F	Recommenda	tions are bas	sed upon dat	a size, data	distribution,	and skewr	ness.		
2450		These reco	mmendations	s are based u	pon the resu	Its of the sim	ulation stud	ies summari:	zed in Sing	gh, Maichle, and	Lee (2006).	
2451	Н	owever, simu	lations result	s will not cov	er all Real W	/orld data se	ts; for additio	onal insight t	he user ma	ay want to consi	ult a statisticia	an.
2452												
2453	Result (s4-	∙ad)										
2454												
2455						General	Statistics					
2456			Total	Number of C	bservations	10			Num	nber of Distinct C	Observations	4
2457				Numb	er of Detects	0				Number of	Non-Detects	10
2458			N	umber of Dis	tinct Detects	0			Nur	nber of Distinct	Non-Detects	4
2459										<u> </u>		
2460		War	ning: All obse	ervations are	Non-Detect	ts (NDs), the	erefore all st	atistics and	estimates	should also be	NDS!	
2461	·······	Specin	Ically, sample	e mean, UCI	.s, UPLS, an	d other stati	stics are als	imoto opvir	Delow the	e largest detecti		<u>,                                     </u>
2462			ream may us			ite specific v				parameters (e.y	,, EFC, DIV	).
2463				The	data set for v	ariable Res	ult (s4-ad) w	as not proc	essed!			
2464												
2405												
2467	Result (s4-	au)										
2468												
2469						General	Statistics					
2470			Total	Number of C	bservations	10			Num	nber of Distinct C	Observations	4
2471				Numb	er of Detects	1				Number of	Non-Detects	9
2472			N	umber of Dis	tinct Detects	1			Nur	mber of Distinct	Non-Detects	3
2473												
2474		Warning: Or	nly one distin	ct data value	e was detect	ed! ProUCL	(or any othe	r software) s	should not	t be used on su	ch a data set	
2475	It is sugg	ested to use	alternative s	site specific v	alues deter	mined by the	Project Tea	am to estima	ate enviror	nmental parame	∍ters (e.g., E	PC, BTV).
2476				The	lata oot for :	ariable Dec	ult (e4 ou) ··	as not pro-	peecdl			
2477				ine	iala sel 101 V		uii (54-80) N	as not proc	599601			
2478												
2479	Result /s/	.bd)										
2480		54)										
2481						General	Statistics					
2482 2192			Total	Number of C	bservations	10			Num	nber of Distinct C	Observations	5
2403 2481				Numb	er of Detects	0				Number of	Non-Detects	10
2485			N	umber of Dis	tinct Detects	0			Nur	mber of Distinct	Non-Detects	5
2486						I	I					I
2487		War	ning: All obse	ervations are	Non-Detect	ts (NDs), the	erefore all st	atistics and	estimates	should also be	NDs!	
2488		Specif	ically, sample	e mean, UCI	.s, UPLs, an	d other stati	stics are als	o NDs lying	below the	e largest detecti	on limit!	
2489		The Project	Team may de	cide to use	alternative s	ite specific v	alues to est	timate enviro	onmental p	parameters (e.g	I., EPC, BTV	).
2490												
2491				The	lata set for v	ariable Res	ult (s4-bd) w	as not proc	essed!			
			-									

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| Result (s4 | -bu)     |   |                                  |   
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  | ervations  | s 10  
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  | Detects  | s 3   
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  |   | Numbe  | er of N   | √on-  | Detect   | ls  | 7   |
|            |          |   | N                                | umb   
   | er of Dis      | stinct   
  | Detects  | s 3   
  |  |   
  |  |  | Num  
  | ıbe   | r of Dist  | tinct N   | √on-  | Detect   | ts  | 4   |
|            |          |   |                                  |   
   | Min            | imur   
  | n Detec  | t 75.5  
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  |  |  | | | | | |
  |   | Mini   | mum   | Non   | 1-Detec  | ct  | 41  |
|            |          |   |                                  |   
   | Max            | imur   
  | n Detec  | t 701   
  |  |   
  |  |  | | | | | |
  |   | Maxi   | mum   | Non   | 1-Deter  | ct  | 77  |
|            |          |   |                                  |   
   | Varia          | ance   
  | Detects  | 116575  
  |  |   
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  |   | Perc   | cent N  | √on-  | Detect   | ts  | 70%   |
|            |          |   |                                  |   
   | N              | lean   
  | Detects  | 309.2   
  |  |   
  |  |  | | | | | |
  |   |  | :   | SD  | Detect   | ts  | 341.4   |
|            |          |   |                                  |   
   | Me             | dian   
  | Detects  | s 151   
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  |   |  |   | CV  | Detect   | ts  | 1.104   |
|            |          |   |                                  |   
   | Skewr          | ness   
  | Detects  | s 1.637   
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  |   |  | Kurto   | osis  | Detect   | ts  | N/A   |
|            |          |   |                                  | Mea   
   | an of Log      | gged   
  | Detects  | 5.298   
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  |   | SD of  | f Logg  | ged   | Detect   | ts  | 1.14  |
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  | arning:  | Data set has  
  | only 3 D   | )etec   
  | ted Value  | <del>)</del> S.  |  
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  | n to com   | ipute meanir  
  | ngful or r   | eliab   
  | le statistic   | cs and   | d estima   
  | ate   | s.   |   |   |  |   |   |
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  | Nor  | mal GOF Te  
  | st on De   | tects   
  | Only   |  |  
  |   |  |   |   |  |   |   |
|            |          |   | S                                | Shap  
   | ro Wilk        | Test   
  | Statisti   | 0.839   
  |  |   
  |  | SI   | hapiro V   
  | Will  | k GOF "  | Test  |   |  |   |   |
|            |          |   | 5% S                             | hapi  
   | ro Wilk (      | Critic   
  | al Value   | e 0.767   
  |  | De  
  | etected Da   | ata ap   | pear No  
  | orm   | al at 5%   | 6 Sigr  | nifica  | ance L   | eve   | I   |
|            |          |   |                                  | L   
   | illiefors      | Test   
  | Statisti   | 0.345   
  |  |   
  |  |  | Lilliefor  
  | rs (  | GOF Te   | st  |   |  |   |   |
|            |          |   | 5                                | 5% L  
   | lliefors (     | Critic   
  | al Value   | 0.425   
  |  | De  
  | etected Da   | ata ap   | pear No  
  | orm   | al at 5%   | 6 Sigr  | nifica  | ance L   | eve   | I   |
|            |          |   |                                  |   
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  | ed Data  | appear Nor  
  | mal at 59  | % Sig   
  | nificance  | e Leve   | el 🛛   
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|            |          |   | Kaplan-                          | Mei   
   | ər (KM) 🤅      | Stati  
  | stics us   | ing Normal (  
  | Critical V   | alue:   
  | s and othe   | er No  | nparam   
  | netr  | ic UCL   | s   |   |  | -   |   |
|            |          |   |                                  |   
   |                | K  
  | M Mear   | n 131.8   
  |  |   
  |  |  | I  
  | ΚM  | Standa   | ard Er  | ror   | of Mea   | 'n  | 75.22   |
|            |          |   |                                  |   
   |                |  
  | KM SE  | 192.4   
  |  |   
  |  |  | | | | | |
  |   | 95%  | % KM  | (BC   | CU (A  | ;L  | N/A   |
|            |          |   |                                  |   
   | 95%            | 6 KN   
  | 1 (t) UCI  | 269.7   
  |  |   
  |  | 9  | 5% KM  
  | (Pe   | ercentile  | e Boot  | otstra  | ap) UC   | ;L  | N/A   |
|            |          |   |                                  |   
   | 95%            | KM   
  | (z) UCI  | 255.5   
  |  |   
  |  |  |  
  | 9   | 5% KM  | Boot  | tstra   | ip t UC  | ;L  | N/A   |
|            |          |   | (                                | 90%   
   | KM Che         | ebysł  
  | nev UCI  | 357.4   
  |  |   
  |  |  |  
  | 9   | 5% KM  | Cheb  | oysh  | iev UC   | ;L  | 459.7   |
|            |          |   | 97                               | ′.5%  
   | KM Che         | ebysł  
  | nev UCI  | 601.5   
  |  |   
  |  |  | | | | | |
  | 9   | 9% KM  | Cheb  | oysh  | iev UC   | ;L  | 880.2   |
|            |          |   |                                  |   
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  | ma GO  | = Tests on D  
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  | rvations (   | Only   | | | | | |
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  | Not E  | nough Data t  
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  | OF Test  |  | | | | | |
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  | Gamma  | a Statistics o  
  | n Detect   | ted D   
  | ata Only   |  | | | | | |
  |   |  |   |   |  |   |   |
|            |          |   |                                  |   
   |                | k ha   
  | at (MLE  | ) 1.288   
  |  |   
  |  |  | | | | | |
  | k s   | tar (bias  | s corre   | recte   | ed MLE   | =)  | N/A   |
|            |          |   |                                  |   
   | The            | eta ha   
  | at (MLE  | ) 240   
  |  |   
  |  |  | Thet   
  | ta s  | tar (bias  | s corre   | recte   | ed MLE   | Ξ)  | N/A   |
|            |          |   |                                  |   
   | I              | nu ha  
  | at (MLE  | ) 7.729   
  |  |   
  |  |  | | | | | |
  |   | nu sta   | r (bias   | s co  | rrected  | (t  | N/A   |
|            |          |   |                                  |   
   | Me             | ean (  
  | detects  | ) 309.2   
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   | (              | Gam  
  | ma RO  | S Statistics u  
  | ising Imp  | puted   
  | Non-Det  | tects  |  
  |   |  |   |   |  |   |   |
|            |          | GR  | OS may                           | / not   
   | be used        | l whe  
  | en data  | set has > 50°   
  | % NDs w  | ith m   
  | any tied ol  | bserv  | ations a   
  | at n  | nultiple   | DLs   |   |  |   |   |
|            | GROS ma  | ay not  | be used                          | d wh  
   | en kstar       | of de  
  | etects is  | small such a  
  | as <1.0, e   | espec   
  | ially wher   | n the s  | sample   
  | siz   | e is sma   | all (e.   | g., <   | <15-20   | )   |   |
|            |          |   | Fc                               | or su   
   | ch situat      | tions  
  | , GROS   | method may  
  | yield ind  | correc  
  | ct values o  | of UC  | Ls and I   
  | BT  | √s   |   |   |  |   |   |
| 1          |          |   |                                  |   
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  | is espe  | cially true wh  
  | en the sa  | ample   
  | size is sn   | mall.  |  
  |   |  |   |   |  |   |   |
|            | For ga   | imma  | distribut                        | ted c   
   | letected       | data   
  | , BTVs   | and UCLs m  
  | ay be coi  | mpute   
  | ed using g   | gamm   | a distrib  
  | buti  | on on K  | (M est  | tima  | ites   |   |   |
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  | /linimun   | n 0.01  
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  |   |  |   |   | Меа  | in  | 92.76   |
|            |          |   |                                  |   
   |                | Μ  
  | laximun  | n 701   
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  |   |  |   |   | Media  | in  | 0.01  |
|            |          |   |                                  |   
   |                |  
  | SE   | 219.6   
  |  |   
  |  |  | | | | | |
  |   |  |   |   | C  | v   | 2.367   |
|            |          |   |                                  |   
   |                | k ha   
  | at (MLE  | ) 0.128   
  |  |   
  |  |  | | | | | |
  | k s   | tar (bias  | s corre   | recte   | ed MLE   | Ξ)  | 0.156   |
|            |          |   |                                  |   
   | The            | eta ha   
  | at (MLE  | ) 727.1   
  |  |   
  |  |  | Thet   
  | ta s  | tar (bias  | s corr  | recte   | ed MLE   | =)  | 594.7   |
|            |          |   |                                  |   
   |                | nu ha  
  | at (MLE  | ) 2.552   
  |  |   
  |  |  |  
  |   | nu sta   | r (bias   | s co  | rrected  | (t  | 3.119   |
|            |          |   | Adjusted                         | d Lev   
   | el of Sic      | gnific   
  | ance (β  | ) 0.0267  
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  |  |  |  
  |   |  |   |   |  | +   |   |
|            | A        | pprox   | cimate C                         | hi S  
   | quare Va       | alue   
  | <br>(3.12, α   | ) 0.409   
  |  |   
  |  | A  | djusted  
  | l Ch  | i Squar  | re Val  | lue (   | 3.12, (  | 3)  | 0.281   |
|            | 95% Gamm | ia Apr  | oroximat                         | te U(   
   | CL (use )      | wher   
  | n n>=50  | ) 708   
  |  |   
  | 95%  | Gamr   | ma Adju  
  | uste  | ed UCL   | (use v  | whe   | n n<5(   | ))  | N/A   |
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  | ates of (  | Gamma Para  
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  | KM Estin   | mates  | ;  
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|            |          |   |                                  |   
   |                | Me   
  | an (KM   | ) 131.8   
  |  | -0  
  |  |  |  
  |   |  |   | 5   | SD (KN   | <i>I</i> )  | 192.4   |
|            |          | A       B         Result (s4-bu)       Image: Comparison of the second of the sec | A       В         Result (s4-bu) | A       B       C         Result (s4-bu)       Total         Total       N         N       N         N       S         S <t< td=""><td>Result (s4-bu)</td><td>A     B     C     D       Result (s4-bu)     Total Number of Dis       Number of Dis       Number of Dis       Max       Varia       Shapiro Wilk       GROS may not be used when kstar       For gamma distributed detected       Shapiro used       For gamma distributed de</td><td>A       B       C       D       I         Result (s4-bu)       Total Number of Obse       Number of Distinct         Mumber of Distinct       Minimur       Maximur         Variance       Mean       Median         Skewness       Mean of Logged       Watanow         Mean of Logged       Watanow       Watanow         Shapiro Wilk Test       5% Shapiro Wilk Critic       Lilliefors Test         Shapiro Wilk Critic       Lilliefors Critic       Detect         Kaplan-Meier (KM) Stati       K       N         95% KM       95% KM       95% KM         95% KM       95% KM       95% KM         95% KM       95% KM       95% KM         95% KM       90% KM Chebysl       97.5% KM Chebysl         97.5% KM Chebysl       97.5% KM Chebysl       97.5% KM Chebysl         97.5% KM Chebysl       97.5% KM Chebysl       97.5% KM         97.5% KM Chebysl       97.5% KM Chebysl       97.5% KM         97.5% For gamma distributed detected data       Mean (data of data of d</td><td>A       B       C       D       L         Result (s4-bu)       Total Number of Observations         Number of Distinct Detects       Number of Distinct Detects         Number of Distinct Detects       Maximum Detect         Maximum Detect       Median Detects         Median Detects       Median Detects         Median Detects       Median Detects         Mean of Logged Detects       Mean of Logged Detects         Skewness Detects       Skewness Detects         Shapiro Wilk Test Statistic       S% Shapiro Wilk Critical Value         Lilliefors Test Statistic       5% Shapiro Wilk Critical Value         Lilliefors Test Statistic       5% Lilliefors Critical Value         Skaplan-Meier (KM) Statistics us       KM Mear         Kaplan-Meier (KM) Statistics us       KM SC         95% KM (1) UCL       90% KM Chebyshev UCL         95% KM (2) UCL       90% KM Chebyshev UCL         90% KM Chebyshev UCL       90% KM Chebyshev UCL         90% KM Chebyshev UCL       90% KM Chebyshev UCL         90% KM Chebyshev UCL       90% KM Chebyshev UCL         90% KM Chebyshev UCL       90% KM Chebyshev UCL         90% KM Chebyshev UCL       90% KM Chebyshev UCL         90% KM Chebyshev UCL       90% KM Chebyshev UCL         <t< td=""><td>A         B         C         D         E         F           Result (s4-bu)         Image: Solution of Conservations of Co</td><td>A         B         C         D         E         F         G           Result (s4-bu)         Total Number of District Detects         3         Image: Statistic District Detects         3         Image: Statistic District Detects         3         Image: Statistic District Detects         3         Image: Statistic District Diste Distret District Distrint District District Diste District Di</td><td>A         B         C         D         E         F         G           Result (s4-bu)</td><td>A         B         C         D         E         P         G         P           Result (e4-bu)         C        
C         C</td><td>A         B         C         D         E         F         G         F           Result (a4-bu)         General Statistics         10         11<!--</td--><td>A         B         C         D         E         P         G         R         I           Result (a4-bu)         General Statistics         10         Number of Distorts         3         Num         Number of Distorts         3         Num         Num of Logged Detects         55         S</td><td>Result (e4-bu)         Result (e4-bu)         General Statistics         Total Number of Descr. Detects         Number of Descr. Detects         Number of Descr. Detects         Number of Descr. Detects         Number of Descr. Detects         Mainum Descr.         Yeariance Detects         Mean Detects         Mean Detects         Mean Detects         Skewness Detects</td><td>A         B         C         D         E         P         G         A         I         J         J           Result (s4-bu)           Number of Dist           Number of Dist           Number of Dist           Manne of Dist           Manne of Dist           Manne of Dist           Waning: Data set has only 3 Detected Values.           This is not encopit to compute memorip?           Waning: Data set has only 3 Detected Values.           This is not encopit to compute memorip?           Detected Data appear Normal at 5%           Detected Data appear Norm</td><td>A         B         C         D         E         F         G         R         L         <thl< th=""> <thl< th=""> <thl< th=""> <thl< th=""></thl<></thl<></thl<></thl<></td><td>Result (u4-ba)         C         Number of Datin C         Numbe</td><td>A       B       C</td><td>A       B       C       B       C       B       C       B       C       B       C       B       C       B       C       B       C       B       C       B       C       B       B       C       B       B       C       B</td></td></t<></td></t<> | Result (s4-bu) | A     B     C     D       Result (s4-bu)     Total Number of Dis       Number of Dis       Number of Dis       Max       Varia       Shapiro Wilk       GROS may not be used when kstar       For gamma distributed detected       Shapiro used       For gamma distributed de | A       B       C       D       I         Result (s4-bu)       Total Number of Obse       Number of Distinct         Mumber of Distinct       Minimur       Maximur         Variance       Mean       Median         Skewness       Mean of Logged       Watanow         Mean of Logged       Watanow       Watanow         Shapiro Wilk Test       5% Shapiro Wilk Critic       Lilliefors Test         Shapiro Wilk Critic       Lilliefors Critic       Detect         Kaplan-Meier (KM) Stati       K       N         95% KM       95% KM       95% KM         95% KM       95% KM       95% KM         95% KM       95% KM       95% KM         95% KM       90% KM Chebysl       97.5% KM Chebysl         97.5% KM Chebysl       97.5% KM Chebysl       97.5% KM Chebysl         97.5% KM Chebysl       97.5% KM Chebysl       97.5% KM         97.5% KM Chebysl       97.5% KM Chebysl       97.5% KM         97.5% For gamma distributed detected data       Mean (data of data of d | A       B       C       D       L         Result (s4-bu)       Total Number of Observations         Number of Distinct Detects       Number of Distinct Detects         Number of Distinct Detects       Maximum Detect         Maximum Detect       Median Detects         Median Detects       Median Detects         Median Detects       Median Detects         Mean of Logged Detects       Mean of Logged Detects         Skewness Detects      
Skewness Detects         Shapiro Wilk Test Statistic       S% Shapiro Wilk Critical Value         Lilliefors Test Statistic       5% Shapiro Wilk Critical Value         Lilliefors Test Statistic       5% Lilliefors Critical Value         Skaplan-Meier (KM) Statistics us       KM Mear         Kaplan-Meier (KM) Statistics us       KM SC         95% KM (1) UCL       90% KM Chebyshev UCL         95% KM (2) UCL       90% KM Chebyshev UCL         90% KM Chebyshev UCL       90% KM Chebyshev UCL         90% KM Chebyshev UCL       90% KM Chebyshev UCL         90% KM Chebyshev UCL       90% KM Chebyshev UCL         90% KM Chebyshev UCL       90% KM Chebyshev UCL         90% KM Chebyshev UCL       90% KM Chebyshev UCL         90% KM Chebyshev UCL       90% KM Chebyshev UCL <t< td=""><td>A         B         C         D         E         F           Result (s4-bu)         Image: Solution of Conservations of Co</td><td>A         B         C         D         E         F         G           Result (s4-bu)         Total Number of District Detects         3         Image: Statistic District Detects         3         Image: Statistic District Detects         3         Image: Statistic District Detects         3         Image: Statistic District Diste Distret District Distrint District District Diste District Di</td><td>A         B         C         D         E         F         G           Result (s4-bu)</td><td>A         B         C         D         E         P         G         P           Result (e4-bu)         C</td><td>A         B         C         D         E         F         G         F           Result (a4-bu)         General Statistics         10         11<!--</td--><td>A         B         C         D         E         P         G         R         I           Result (a4-bu)         General Statistics         10         Number of Distorts         3         Num         Number of Distorts         3         Num         Num of Logged Detects         55         S</td><td>Result (e4-bu)         Result (e4-bu)         General Statistics         Total Number of Descr. Detects         Number of Descr. Detects         Number of Descr. Detects         Number of Descr. Detects         Number of Descr. Detects         Mainum Descr.         Yeariance Detects         Mean Detects         Mean Detects         Mean Detects         Skewness Detects</td><td>A         B         C         D         E         P         G         A         I         J         J           Result (s4-bu)           Number of Dist           Number of Dist           Number of Dist           Manne of Dist           Manne of Dist           Manne of Dist           Waning: Data set has only 3 Detected Values.           This is not encopit to compute memorip?           Waning: Data set has only 3 Detected Values.           This is not encopit to compute memorip?           Detected Data appear Normal at 5%           Detected Data appear Norm</td><td>A         B         C         D         E         F         G         R         L  
      L         <thl< th=""> <thl< th=""> <thl< th=""> <thl< th=""></thl<></thl<></thl<></thl<></td><td>Result (u4-ba)         C         Number of Datin C         Numbe</td><td>A       B       C</td><td>A       B       C       B       C       B       C       B       C       B       C       B       C       B       C       B       C       B       C       B       C       B       B       C       B       B       C       B</td></td></t<> | A         B         C         D         E         F           Result (s4-bu)         Image: Solution of Conservations of Co | A         B         C         D         E         F         G           Result (s4-bu)         Total Number of District Detects         3         Image: Statistic District Detects         3         Image: Statistic District Detects         3         Image: Statistic District Detects         3         Image: Statistic District Diste Distret District Distrint District District Diste District Di | A         B         C         D         E         F         G           Result (s4-bu) | A         B         C         D         E         P         G         P           Result (e4-bu)         C | A         B         C         D         E         F         G         F           Result (a4-bu)         General Statistics         10         11 </td <td>A         B         C         D         E         P         G         R         I   
       Result (a4-bu)         General Statistics         10         Number of Distorts         3         Num         Number of Distorts         3         Num         Num of Logged Detects         55         S</td> <td>Result (e4-bu)         Result (e4-bu)         General Statistics         Total Number of Descr. Detects         Number of Descr. Detects         Number of Descr. Detects         Number of Descr. Detects         Number of Descr. Detects         Mainum Descr.         Yeariance Detects         Mean Detects         Mean Detects         Mean Detects         Skewness Detects</td> <td>A         B         C         D         E         P         G         A         I         J         J           Result (s4-bu)           Number of Dist           Number of Dist           Number of Dist           Manne of Dist           Manne of Dist           Manne of Dist           Waning: Data set has only 3 Detected Values.           This is not encopit to compute memorip?           Waning: Data set has only 3 Detected Values.           This is not encopit to compute memorip?           Detected Data appear Normal at 5%           Detected Data appear Norm</td> <td>A         B         C         D         E         F         G         R         L         <thl< th=""> <thl< th=""> <thl< th=""> <thl< th=""></thl<></thl<></thl<></thl<></td> <td>Result (u4-ba)         C         Number of Datin C         Numbe</td> <td>A       B       C</td> <td>A       B       C       B       C       B       C       B       C       B       C       B       C       B       C       B       C       B       C       B       C       B       B       C       B       B       C       B</td> | A         B         C         D         E         P         G         R         I           Result (a4-bu)         General Statistics         10         Number of Distorts         3         Num         Number of Distorts         3         Num         Num of Logged Detects         55         S | Result (e4-bu)         Result (e4-bu)         General Statistics         Total Number of Descr. Detects         Number of Descr. Detects         Number of Descr. Detects         Number of Descr. Detects         Number of Descr. Detects         Mainum Descr.         Yeariance Detects         Mean Detects         Mean Detects         Mean Detects         Skewness Detects | A         B         C         D         E         P         G         A         I         J         J           Result (s4-bu)           Number of Dist           Number of Dist           Number of Dist           Manne of Dist           Manne of Dist           Manne of Dist           Waning: Data set has only 3 Detected Values.           This is not encopit to compute memorip?           Waning: Data set has only 3 Detected Values.           This is not encopit to compute memorip?           Detected Data appear Normal at 5%           Detected Data appear Norm | A         B         C         D         E         F         G         R         L        
L         L <thl< th=""> <thl< th=""> <thl< th=""> <thl< th=""></thl<></thl<></thl<></thl<> | Result (u4-ba)         C         Number of Datin C         Numbe | A       B       C | A       B       C       B       C       B       C       B       C       B       C       B       C       B       C       B       C       B       C       B       C       B       B       C       B       B       C       B |
	A B C D E	F	G H I J K	L										
2554	Variance (KM)	37001	SE of Mean (KM)	75.22										
2555	k hat (KM)	0.469	k star (KM)	0.395										
2556	nu hat (KM)	9.389	nu star (KM)	7.906										
2557	theta hat (KM)	280.7	theta star (KM)	333.4										
2558	80% gamma percentile (KM)	212.4	90% gamma percentile (KM)	373.1										
2550	95% gamma percentile (KM)	549.9	99% gamma percentile (KM)	995										
2009	<b>.</b> ,		<b>.</b> ,											
2560	Gamm	na Kanlan-M	eier (KM) Statistics											
2561	Approvimate Chi Square Value (7.91, q)	2 681	Adjusted Chi Square Value (7.91. 8)	2 182										
2562	Approximate Chi Square Value (7.51, 4)	2.001	Adjusted Chil Square Value (7.31, p)	477.6										
2563		300.7	95% Gamma Aujusted KM-OCL (use when 11<50)	477.0										
2564														
2565														
2566	Shapiro Wilk Test Statistic	0.955	Snapiro Wilk GOF Test											
2567	5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Lev											
2568	LIIIIeTORS LEST STATISTIC U.204 LIIIIeTORS GUF Lest													
2569	5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Le	evel										
2570	Detected Data ap	opear Logno	rmal at 5% Significance Level											
2571														
2572	Lognormal RO	S Statistics	Using Imputed Non-Detects											
2573	Mean in Original Scale	113.3	Mean in Log Scale	3.809										
2574	SD in Original Scale	210.8	SD in Log Scale	1.295										
2575	95% t UCL (assumes normality of ROS data)	235.5	95% Percentile Bootstrap UCL	236.8										
2576	95% BCA Bootstrap UCL	295.6	95% Bootstrap t UCL	820.4										
2570	95% H-UCL (Log ROS)	523.6												
2511														
2010	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution													
2579	KM Mean (longed)	4 372	KM Geo Mean	79 21										
2580	KM SD (logged)	0.832	95% Critical H Value (KM-Log)	2 769										
2581	KM Standard Error of Moan (logged)	0.002		2.705										
2582	KM SD (logged)     0.92													
2583		0.832	95% Critical H Value (KNI-Log)	2.769										
2584	KM Standard Error of Mean (logged)	0.37												
2585	35													
2586		DL/2 S	tatistics											
2587	DL/2 Normal		DL/2 Log-Transformed											
2588	Mean in Original Scale	117.8	Mean in Log Scale	4.079										
2589	SD in Original Scale	208.3	SD in Log Scale	1.017										
2590	95% t UCL (Assumes normality)	238.5	95% H-Stat UCL	287										
2591	DL/2 is not a recommended m	ethod, provi	ded for comparisons and historical reasons											
2592														
2593	Nonparame	etric Distribu	tion Free UCL Statistics											
2594	Detected Data appea	ar Normal Di	stributed at 5% Significance Level											
2595														
2506		Suggested	UCL to Use											
2500	95% KM (t) UCL	269.7												
2097														
2598	Note: Suggestions regarding the selection of a 95%	6 UCL are pr	ovided to help the user to select the most appropriate 95% LICL											
2599	Recommendations are be		a size data distribution and skewness											
2600	These recommendations are based upon the recu	lts of the sim	ulation studies summarized in Singh Maichle, and Leo (2006)											
2601	However, simulations results will not enviro all Dest		ter for additional incidet the upper many want to account a statistical	n										
2602	nowever, simulations results will not cover all Real W	vonu data se	is, for auditional insight the user may want to consult a statisticia											
2603														
2604	resuit (s4-ca)													
2605														
2606		General	Statistics											
2607	Total Number of Observations	10	Number of Distinct Observations	5										
2608	Number of Detects	0	Number of Non-Detects	10										
2609	Number of Distinct Detects	0	Number of Distinct Non-Detects	5										
2610														
2611	Warning: All observations are Non-Detect	ts (NDs), the	refore all statistics and estimates should also be NDs!											
2612	Specifically, sample mean, UCLs, UPLs, an	d other stati	stics are also NDs lying below the largest detection limit!											
2613	The Project Team may decide to use alternative s	ite specific v	values to estimate environmental parameters (e.g., EPC, BTV)											
2614														
2615	The data set for v	ariable Res	ult (s4-cd) was not processed!											
_UIU														

	A	В	С	D	E	F	G	Н		J	K	L		
2616														
2617														
2618	Result (s4-	cu)												
2619														
2620						General	Statistics							
2621			Tota	Number of C	bservations	10			Numb	er of Distinct (	Observations	9		
2622				Numbe	er of Detects	6				Number of	Non-Detects	4		
2623			N	umber of Dis	tinct Detects	6			Numb	er of Distinct	Non-Detects	3		
2624				Mini	mum Detect	100				Minimum	n Non-Detect	37		
2625				Maxi	mum Detect	510				Maximum	n Non-Detect	77		
2626				Varia	ince Detects	25943				Percent	Non-Detects	40%		
2627				М	ean Detects	225.5					SD Detects	161.1		
2628				Me	dian Detects	157.8					CV Detects	0.714		
2629				Skewr	less Detects	1.395				Kurl	tosis Detects	1.179		
2630				Mean of Log	ged Detects	5.231				SD of Log	ged Detects	0.648		
2631														
2632	2 Normal GOF Test on Detects Only													
2633	Shapiro Wilk Test Statistic 0.825 Shapiro Wilk GOF Test													
2634	4 5% Shapiro Wilk Critical Value 0.788 Detected Data appear Normal at 5% Significance Level									/ei				
2635	5 Lilliefors I est Statistic 0.278 Lilliefors GOF Test													
2636			5	5% Lillietors C	ritical value	0.325			appear No	mai at 5% Sig	gnificance Lev	/ei		
2637	Detected Data appear Normal at 5% Significance Level													
2638			Kanlan	Mojor (KM) 9	Statistics usi	ng Normal (	ritical Value	s and other	Nonnaram	tria UCL a				
2639			каріан-		KM Moon				Rollbaralle	M Standard F	rror of Moon	50 70		
2640					KM SD	146.6								
2641				95%		243.2		95% KM (Percentile Rootstron) UCL						
2642				95%		233.6		95% KM Bootstrap ( UC)						
2643				90% KM Che	hvshev UCI	302.5				371 5				
2644			97	5% KM Che	hyshev UCI	467.3		99% KM Chebyshev UCL						
2645						107.0					5,0107 002			
2646					amma GOF	Tests on De	etected Obse	ervations Or	nlv					
2647				A-D T	Fest Statistic	0.418		Α	nderson-Da	arling GOF Te	est			
2648				5% A-D C	Critical Value	0.702	Detecte	d data appea	ar Gamma I	)istributed at {	5% Significan	ce Level		
2650				K-S 1	Fest Statistic	0.231			Kolmogorov	-Smirnov GC	)F			
2050				5% K-S C	Critical Value	0.335	Detecte	d data appea	ar Gamma E	) istributed at §	5% Significan	ce Level		
2652				Detected	data appea	r Gamma Di	stributed at	5% Significa	nce Level					
2653								•						
2654					Gamma	Statistics or	n Detected D	ata Only						
2655					k hat (MLE)	2.828		-	k	star (bias co	rrected MLE)	1.525		
2656				The	ta hat (MLE)	79.74	Theta star (bias corrected MLE)							
2657				r	nu hat (MLE)	33.94	nu star (bias corrected)							
2658				Me	an (detects)	225.5								
2659														

	А	В	С	D	E	F	G	Н			J	K	L	
2660		Gamma ROS Statistics using Imputed Non-Detects												
2661			GROS may	not be used	when data s	et has > 50%	5 NDs with m	any tied o	bserva	itions at	multiple DLs			
2662		GROS may	y not be used	l when kstar	of detects is s	small such a	s <1.0, espec	cially when	n the s	ample si	ze is small (e	e.g., <15-20)		
2663			Fc	or such situat	ions, GROS ı	method may	yield incorrect	ct values of	of UCL	s and B	TVs			
2664				Т	This is especi	ally true whe	n the sample	e size is sr	nall.					
2665		For gar	mma distribut	ed detected	data, BTVs a	nd UCLs ma	y be compute	ed using g	gamma	distribu	tion on KM e	stimates		
2666	Minimum 0.01											Mean	135.3	
2667					Maximum	510						Median	103.8	
2668					SD	167.2						CV	1.236	
2669					k hat (MLE)	0.203				k	star (bias coi	rrected MLE)	0.209	
2670				The	ta hat (MLE)	665.6				Theta	star (bias co	rrected MLE)	647.5	
2671				r	nu hat (MLE)	4.066					nu star (bia	as corrected)	4.179	
2672			Adjusted	Level of Sig	nificance (β)	0.0267								
2673		Ap	oproximate C	hi Square Va	alue (4.18, α)	0.794			Ac	ljusted C	chi Square Va	alue (4.18, β)	0.576	
2674		95% Gamma	a Approximat	e UCL (use v	vhen n>=50)	712.4		95%	Gamm	a Adjus	ted UCL (use	when n<50)	982.5	
2675														
2676	576 Estimates of Gamma Parameters using KM Estimates													
2677					Mean (KM)	150.1						SD (KM)	146.6	
2678				Va	ariance (KM)	21499					SE d	of Mean (KM)	50.79	
2679					k hat (KM)	1.048						k star (KM)	0.8	
2680					nu hat (KM)	20.96						nu star (KM)	16	
2681				th	eta hat (KM)	143.2					the	eta star (KM)	187.6	
2682	80% gamma percentile (KM) 245.3									909	% gamma pe	rcentile (KM)	365	
2683					999	% gamma pe	rcentile (KM)	774.8						
2684	4													
2685		Gamma Kaplan-Meier (KM) Statistics												
2686		Арр	proximate Ch	ue (16.00, α)	7.965			Adj	usted Ch	ni Square Val	ue (16.00, β)	7.002		
2687	95%	6 Gamma Ap	proximate KN	/I-UCL (use v	vhen n>=50)	301.6		95% Gan	nma A	djusted k	KM-UCL (use	when n<50)	343.1	
2688	38													
2689				Lo	ognormal GO	F Test on D	etected Obs	ervations	Only					
2690			S	hapiro Wilk T	Fest Statistic	0.906			Sh	apiro W	ilk GOF Test			
2691			5% S	hapiro Wilk C	Critical Value	0.788	Dete	evel						
2692				Lilliefors 7	Fest Statistic	0.191	Lilliefors GOF Test							
2693			5	% Lilliefors C	Critical Value	0.325	Dete	ected Data	a appe	ar Logno	ormal at 5% S	Significance L	evel	
2694				Dete	cted Data ap	pear Logno	rmal at 5% S	ignificanc	ce Lev	el				
2695														
2696				Lo	gnormal RO	S Statistics	Using Impute	ed Non-De	etects					
2697				Mean in O	riginal Scale	148.1		Mean in Log Scal						
2698				SD in O	riginal Scale	156.2		SD in Log Scale						
2699		95% t l	JCL (assume	es normality c	of ROS data)	238.7		232						
2700				95% BCA Bo	otstrap UCL	251.9		342.3						
2701				95% H-UC	L (Log ROS)	488.4							L	
2702														
2703			Statis	stics using K	M estimates	on Logged I	Data and Ass	suming Lo	ognorn	nal Distr	ibution		07.00	
2704				KM Me	ean (logged)	4.583					K	M Geo Mean	97.82	
2705				KM	SD (logged)	0.916				95%	Critical H Val	ue (KM-Log)	2.935	
2706			KM Standa	rd Error of Me	ean (logged)	0.317					95% H-UC	L (KM -Log)	364.9	
2707				KM	SD (logged)	0.916	95% Critical H Value (KM-Log)							
2708			KM Standa	rd Error of Me	ean (logged)	0.317	0.317							
2709						<b></b>								
2710						DL/2 S	tatistics			<u></u>				
2711			DL/2	Normal		446 -			DL	/2 Log-1	ransformed		( = c =	
2712				Mean in O	riginal Scale	148.7					Mean	In Log Scale	4.525	
2713				SD in O	riginal Scale	155.8					SD	In Log Scale	1.053	
2714			95% t l	JCL (Assume	es normality)	239					95%	H-Stat UCL	496.3	
2715			<b>DL/2</b> i	is not a reco	mmended m	ethod, provi	ded for comp	arisons a	nd his	torical r	easons			
2716														

	А		В	С	D	E	F	G	Н	l	J	K	L
2717						Nonparame	tric Distribu	tion Free UC	L Statisti	cs			
2718					Detected	Data appea	r Normal Di	stributed at 5	5% Signifi	cance Level			
2719													
2720							Suggested	UCL to Use					
2721					95%	KM (t) UCL	243.2						L
2722													
2723		NC	te: Sugge	stions regard	ling the selec	tion of a 95%	OCL are pr	ovided to hel	p the use	to select the n	nost appropriat	te 95% UCL.	·
2724		т		F	Recommenda	tions are bas	sed upon dat	ta size, data (	distributio	n, and skewnes	SS.	L = = (0000)	
2725			hese reco	mmendation	s are based u	pon the resu	Its of the sin	nulation studie	es summa	arized in Singh	Maichle, and	Lee (2006).	
2726		How	ever, sımı	ilations result	s will not cov	er all Real W	orld data se	ts; for additio	nal insigh	t the user may	want to consul	It a statisticia	an.
2727													
2728	Decult (u		<u>,                                    </u>										
2729	Result (w	/g-ev	)										
2730	1 General Statistics												
2731	Total Number of Observations 10 Number of Distinct Observations 9												9
2732	I OTAI NUMBER OF ODSERVATIONS 10 Number of Distinct Observations												9
2733						Minimum	300			Numbe		Moon	742
2734						Maximum	970					Median	742
2735							178 /				Std Er	ror of Mean	755 56 / 1
2736					Coefficient	of Variation	0.24				Olu. LI	Skownoss	
2737					Coemclent		0.24					OKEWIIE33	-0.307
2738	8 Normal GOE Test												
2739	Normal GOF Test												
2740				5% S	hapiro Wilk C	ritical Value	0.842		Data a	onear Normal a	at 5% Significa	nce Level	
2741	5% Snapiro wilk Unucal Value 0.842 Data appear Normal at 5% Significance Level   Lilliefors Test Statistic 0.207 Lilliefors COE Test												
2742	Limetors rest statistic 0.207 Limetors GOF Test   5% Littlefors Critical Value 0.262 Data appear Normal at 5% Significance Lovel												
2743	Data appear Normal at 5% Significance Level												
2744													
2745	Assuming Normal Distribution												
2740				95% No	ormal UCL				9	5% UCLs (Adji	usted for Skew	vness)	
2747					95% Stu	dent's-t UCL	845.4			95% Adjust	ed-CLT UCL ((	Chen-1995)	817.5
2740										95% Modif	ied-t UCL (Joh	, nson-1978)	842.7
2749													
2751							Gamma	GOF Test					
2752					A-D T	est Statistic	0.552		An	derson-Darling	gamma GOF	- Test	
2753					5% A-D C	ritical Value	0.725	Detected	d data ap	bear Gamma D	istributed at 59	% Significan	ce Level
2754					K-S T	est Statistic	0.242		Kolm	ogorov-Smirn	ov Gamma GC	OF Test	
2755					5% K-S C	ritical Value	0.266	Detected	d data ap	pear Gamma D	istributed at 59	% Significan	ce Level
2756					Detected	data appear	Gamma Di	stributed at 5	5% Signif	cance Level			
2757													
2758							Gamma	Statistics					
2759						k hat (MLE)	15.95			k	star (bias corr	ected MLE)	11.23
2760					The	a hat (MLE)	46.51			Theta	star (bias corr	ected MLE)	66.05
2761					n	u hat (MLE)	319				nu star (bias	s corrected)	224.7
2762				М	LE Mean (bia	s corrected)	742				MLE Sd (bias	s corrected)	221.4
2763										Approximat	e Chi Square V	/alue (0.05)	191
2764				Adjus	sted Level of	Significance	0.0267			A	djusted Chi Sc	juare Value	185.6
2765													
2766						Ass	suming Gan	nma Distribut	ion				
2767		959	% Approxi	mate Gamma	UCL (use w	hen n>=50))	872.9		95%	Adjusted Gam	ma UCL (use v	when n<50)	898.3
2768													
2769							Lognorma	I GOF Test					
2770				S	hapiro Wilk T	est Statistic	0.861		S	hapiro Wilk Lo	gnormal GOF	Test	
2771				5% S	hapiro Wilk C	ritical Value	0.842		Data app	ear Lognorma	I at 5% Signific	ance Level	
2772					Lilliefors T	est Statistic	0.262			Lilliefors Logn	ormal GOF Te	est	
2773				5	% Lilliefors C	ritical Value	0.262		Data N	ot Lognormal a	at 5% Significa	nce Level	
2774					Data a	ppear Appro	ximate Logr	normal at 5%	Significa	nce Level			
2775													

	Α	В	С	D	E	F	G	Н		I		J	K	L	
2776 2777	Lognormal Statistics   7 Minimum of Logged Data 5.966 Mean of logged Data   Maximum of Logged Data 6.877 SD of logged Data													6.578	
2778			ſ	Maximum of L	ogged Data	6.877						SD of	logged Data	0.28	
2779					Assi	umina Loana	ormal Distrib	ution							
2780					95% H-UCL	897.1		ution			90%	Chebyshev (	MVUE) UCL	943.3	
2782			95%	Chebyshev (	MVUE) UCL	1033				97	.5%	Chebyshev (	, MVUE) UCL	1158	
2783			99%	Chebyshev (	MVUE) UCL	1404									
2784													I		
2785					Nonparame	etric Distribu	tion Free UC	CL Statis	stics						
2786	Data appear to follow a Discernible Distribution at 5% Significance Level														
2787	Nonparametric Distribution Free UCLs														
2788												845.4			
2789			95%	Standard Bo	otstrap UCL	832.3						95% Boo	tstrap-t UCL	829.1	
2790				95% Hall's Bo	otstrap UCL	819.4				ç	95% F	Percentile Bo	otstrap UCL	824	
2792				95% BCA Bo	otstrap UCL	818									
2793			90% Cł	nebyshev(Me	an, Sd) UCL	911.2				95	% Ch	ebyshev(Me	an, Sd) UCL	987.9	
2794			97.5% Cł	nebyshev(Me	an, Sd) UCL	1094				99	% Ch	ebyshev(Me	an, Sd) UCL	1303	
2795															
2796						Suggested	UCL to Use							[	
2797				95% Stu	dent's-t UCL	845.4								L	
2798															
2799	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.													•	
2800	These recommendations are based upon data size, data distribution, and skewness. These recommendations are based upon the results of the simulation studies summarized in Singh. Maichle, and Lee (2006)														
2802	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.														
2803	3														
2804	4 Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be														
2805	j reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.														
2806	3														
2807	17 No Result (wa-wy)														
2809		-													
2810						General	Statistics								
2811			Tota	I Number of C	bservations	10	Number of Distinct Observation							10	
2812							Number of Missing Observatio							0	
2813					Minimum	190		Mear							
2814					Maximum	610		Std. Error of Mean							
2815				Coefficient	of Variation	0.417						510. E	Skewness	40.3	
2816				Cocilicici		0.417							OKCWIIC33	1.070	
2017						Normal	GOF Test								
2819			S	Shapiro Wilk T	est Statistic	0.823				Shapir	o Wi	k GOF Test			
2820			5% S	hapiro Wilk C	critical Value	0.842		Data	a No	t Norma	al at 5	% Significan	ce Level		
2821				Lilliefors T	est Statistic	0.239				Lillie	fors	GOF Test			
2822			5	5% Lilliefors C	critical Value	0.262		Data	appe	ear Norr	nal at	5% Significa	ance Level		
2823				Data	appear App	roximate No	ormal at 5% S	Significa	nce	Level					
2824					^^	ourning Nor	mal Diatribut	ion							
2825			95% N	ormal UCI	AS	อนเททญ เงิงก			95%	UCI e /	Adiu	sted for Ske	wness)		
2826			00,014	95% Stu	dent's-t UCL	379.2			0070	95% Ac	liuste	d-CLT UCL (	(Chen-1995)	394.4	
∠021 2828										95% M	lodifie	ed-t UCL (Joh	nson-1978)	382.8	
2829						I	1								
2830						Gamma	GOF Test								
2831				A-D 1	est Statistic	0.47		A	nder	rson-Da	rling	Gamma GO	F Test		
2832				5% A-D C	critical Value	0.727	Detecte	d data aj	ppea	ar Gamn	na Di	stributed at 5	% Significan	ce Level	
2833				K-S 1	est Statistic	0.225		Kol	mog	orov-Sr	nirno	v Gamma G	OF Test		
2834				5% K-S C	critical Value	0.267	Detecte	d data a	ppea	ar Gamn	na Di	stributed at 5	% Significan	ce Level	
2835				Detected	data appear	r Gamma Di	stributed at !	5% Sign	ifica	nce Lev	/el				

	A	В	С	D	E	F	G	Н		J	K	L	
2836							<u></u>						
2837						Gamma	Statistics						
2838					k hat (MLE)	7.881			ł	star (bias co	rrected MLE)	5.584	
2839				The	ta hat (MLE)	38.74			Theta	a star (bias co	rrected MLE)	54.69	
2840				r	nu hat (MLE)	157.6		111.7					
2841			М	LE Mean (bia	is corrected)	305.4				MLE Sd (bia	as corrected)	129.2	
2842									Approximation	te Chi Square	Value (0.05)	88.28	
2843			Adjus	sted Level of	Significance	0.0267			ŀ	Adjusted Chi S	Square Value	84.67	
2844	1												
2845	5 Assuming Gamma Distribution												
2846		95% Approxi	mate Gamma	a UCL (use w	hen n>=50))	386.3		95% Ad	djusted Gan	nma UCL (use	when n<50)	402.7	
2847	7												
2848	Lognormal GOF Test												
2849			S	Shapiro Wilk	est Statistic	0.915		Sha	piro Wilk Lo	gnormal GOI	- Test		
2850			5% S	hapiro Wilk C	Critical Value	0.842		Data appea	ar Lognorma	al at 5% Signif	icance Level		
2851				Lilliefors	Fest Statistic	0.204		Li	lliefors Logi	normal GOF 1	est		
2852			5	5% Lilliefors C	Critical Value	0.262		Data appea	ar Lognorma	al at 5% Signif	icance Level		
2853					Data appear	<sup>-</sup> Lognormal	at 5% Signif	icance Leve	el				
2854	4												
2855	5 Lognormal Statistics												
2856				Minimum of I	ogged Data	5.247				Mean of	logged Data	5.657	
2857			I	Maximum of I	ogged Data	6.413		0.364					
2858	<u>.                                    </u>												
2859	Assuming Lognormal Distribution												
2860					95% H-UCL	391.9		409.6					
2861			95%	Chebyshev (	MVUE) UCL	457.5		97.5% Chebyshev (MVUE) UCL					
2862			99%	Chebyshev (	MVUE) UCL	654.8							
2863													
2864					Nonparame	etric Distribu	tion Free UC	CL Statistics					
2865				Data appea	r to follow a	Discernible	Distribution	at 5% Signif	icance Lev	əl			
2866													
2867					Nonpa	rametric Dis	tribution Fre	e UCLs					
2868				95	% CLT UCL	371.6		95% Jackknife UCI					
2869			95%	Standard Bo	otstrap UCL	368.6			441.5				
2870			ç	95% Hall's Bo	otstrap UCL	477.7		ootstrap UCL	371.1				
2871				95% BCA Bo	otstrap UCL	388							
2872			90% Cł	nebyshev(Me	an, Sd) UCL	426.2		481					
2873			97.5% Cł	nebyshev(Me	an, Sd) UCL	557			99% C	hebyshev(Me	an, Sd) UCL	706.3	
2874													
2875						Suggested	UCL to Use					r	
2876				95% Stu	dent's-t UCL	379.2							
2877													
2878			When a o	data set follov	vs an approx	imate (e.g., I	normal) distri	bution passi	ng one of th	e GOF test			
2879		When app	plicable, it is s	suggested to	use a UCL b	ased upon a	distribution (	e.g., gamma	a) passing b	oth GOF tests	in ProUCL		
2880													
2881		Note: Sugge	estions regard	ling the selec	tion of a 95%	UCL are pr	ovided to he	p the user to	select the	most appropri	ate 95% UCL		
2882			F	Recommenda	ations are bas	sed upon dat	a sıze, data	distribution,	and skewne	SS.			
2883		I hese reco	mmendation	s are based ι	ipon the resu	its of the sim	nulation studi	es summariz	zed in Singh	i, Maichle, and	ג Lee (2006).		
2884	Н	owever, simu	ulations resul	ts will not cov	er all Real W	orld data se	ts; for additic	onal insight th	ne user may	want to cons	ult a statisticia	an.	
2885													

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