Addendum 1 to the Feasibility Study for On-Property Soils and Perched Water

for the

Superlon Plastics Site Tacoma, Washington

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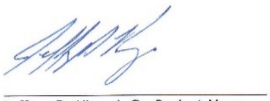
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Acronyms and Abbreviations

Acronym/Abbreviation	Description
ARARs	Applicable or Relevant and Appropriate Requirement
Chemours	The Chemours Company FC, LLC
CL	Cleanup Level
COC	Constituent of Concern
CY	Cubic Yards
DCREL	Direct Contact Remediation Level
Ecology	Washington State Department of Ecology
FS-OSP	Feasibility Study for On-Property Soils and Perched Water
MM	Million
MTCA	Model Toxics Control Act
OU	Operable Unit
PERC	Pacific Environmental and Redevelopment Corporation
PIONEER	PIONEER Technologies Corporation
PPE	Personal Protective Equipment
Property	Superlon Plastics Property
PW	Perched Water
PWREL	Perched Water Remediation Level
RAO	Remedial Action Objective
RAU	Remedial Action Unit
REL	Remediation Level
SPWREL	Soil-to-Perched Water Remediation Level
TCLP	Toxicity Characteristic Leaching Procedure
White Birch	White Birch Group LLC
XRF	X-Ray Fluorescence

1. Introduction

The Chemours Company FC, LLC (Chemours) and White Birch Group LLC (White Birch) have been conducting remedial design activities at the Superlon Plastics Property (Property) since the Washington State Department of Ecology (Ecology) selected the preferred remedial alternative for the Property in 2015.[1] The results of remedial design activities indicate that a revised alternative may be more time- and cost-effective for achieving remedial action objectives (RAOs) than the selected preferred alternative.

To demonstrate that the proposed revised alternative will be more time- and cost-effective than the selected alternative, the revised alternative was compared to the preferred alternative initially presented in the Feasibility Study for On-Property Soils and Perched Water (FS-OSP; (Pacific Environmental & Redevelopment Corporation [PERC] and PIONEER Technologies Corporation [PIONEER] 2014).

The purpose of this addendum to the FS-OSPW is to present this comparison and propose the change in the selected alternative for the Property to the revised alternative.

The proposed revised alternative includes the following:

- Treating perched water on the Property;
- Excavating and disposing of soil with constituents of concern (COC) concentrations greater than site-specific direct contact remediation levels (DCRELs) in Operable Units (OUs) 4 and 6 (see Figure 1);
- Excavating and disposing of soil with COC concentrations greater than site-specific soil-to-perched water RELs (SPWRELs) in OUs 1, 2, and 3;
- Constructing a gravel cover on the Property; and
- Applying a Deed Restriction to limit the Property to industrial land use.

1.1 Initial FS-OSP Alternatives

Five alternatives were initially evaluated in the FS-OSP. Two of the alternatives (Alternative 1 and Alternative 2) did not meet the Model Toxics Substances Control (MTCA) four threshold criteria and were eliminated from the evaluation. The three remaining alternatives were evaluated further. Alternative 5 was rejected because it was clearly cost disproportionate, Alternative 3 was selected as the preferred alternative and Alternative 4 was selected as the "alternate" preferred alternative. The contents of Alternative 3 and 4 are summarized in the following table.

[1] Ecology cleanup project manager Marv Coleman communicated the approval of the alternative in a memo to Jeff King of Pacific Environmental & Redevelopment Corporation [PERC] dated January 26, 2015.

Alternative 3	Alternative 4
▪ Install a slurry or grout wall ▪ Treat perched water ▪ Excavate and dispose of soil with COC concentrations greater than DCRELs in OUs 4 and 6 ▪ Excavate and stabilize soil with COC concentrations greater than SPWRELs in OUs 1, 2, and 3 ▪ Install a cover ▪ Apply a Deed Restriction	▪ Install a slurry or grout wall ▪ Treat perched water ▪ Excavate and dispose of soil with COC concentrations greater than DCRELs in OUs 4 and 6 ▪ Excavate and dispose of soil with COC concentrations greater than SPWRELs in OUs 1, 2, and 3 ▪ Install a cover ▪ Apply a Deed Restriction

1.2 Proposed FS-OSP Addendum Alternative

The proposed revised alternative is most similar to initial Alternative 4 from the FS-OSP; therefore, the new alternative was referred to as Alternative 4(Rev).

The two major changes between the selected preferred alternative (Alternative 3) and the revised alternative (Alternative 4(Rev)) are as follows:

- Soils with COC concentrations greater than SPWRELs in OUs 1, 2, and 3 will be excavated and disposed of rather than being stabilized and reused on-site.
- Perched water will be treated in-situ with an additive rather than with the installation of a slurry/grout wall and a pump-and-treat system.

The initial Alternatives 3 and 4 and the Alternative 4 (Rev) are presented in the following table; however, only Alternatives 3 and 4(Rev) were evaluated and presented in this addendum.

Alternative 3	Alternative 4	Alternative 4(Rev)
▪ Install a slurry or grout wall ▪ Treat perched water ▪ Excavate and dispose of soil with constituent concentrations greater than DCRELs in OUs 4 and 6 ▪ Excavate and stabilize soil with COC concentrations greater than SPWRELs in OUs 1, 2, and 3 ▪ Install a cover ▪ Apply a Deed Restriction	▪ Install a slurry or grout wall ▪ Treat perched water ▪ Excavate and dispose of soil with constituent concentrations greater than DCRELs in OUs 4 and 6 ▪ Excavate and dispose of soil in COC concentrations greater than SPWRELs in OUs 1, 2, and 3 ▪ Install a cover ▪ Apply a Deed Restriction	▪ Treat perched water using an additive to treat water in-situ ▪ Excavate and dispose of soil with COC concentrations greater than DCRELs in Operable Units 4 and 6; ▪ Excavate and dispose of soil with COC concentrations greater than SPWRELs in OUs 1, 2, and 3 ▪ Install a gravel cover ▪ Apply a Deed Restriction

1.3 Document Organization

This document is organized as follows:

- Section 1: Introduction
- Section 2: Summary of New Information
- Section 3: Revised Alternative Analysis
- Section 4: Summary of Analysis
- Section 5: Conceptual Design of the New Preferred Remedial Alternative
- Section 6: References

2. Summary of New Information

During the remedial design process, additional investigations were conducted to develop the information necessary to complete the final design process. During these investigations, information was acquired that changed the understanding of the type of remediation processes that would most-effectively reduce COC concentrations to achieve RAOs. The key learnings from these investigations, the remedial design process and the way in which the revised alternative was designed to achieve RAOs are summarized in this section.

2.4 Remedial Design Process Key Learnings

2.4.1. Soil Volume Verification and XRF Demonstration

An investigation was conducted to verify the volume of soil to be excavated during remedial actions and to demonstrate that the X-Ray Fluorescence (XRF) analytical method is appropriate for use at the Property. A total of 184 soil samples were collected at 24 boring locations for this investigation and the results of the investigation were documented in a Soil Volume Verification and XRF Demonstration report (PERC/PIONEER 2017). The information from this investigation was used to determine chemical characteristics and the volume of soil that would need to be treated during remediation.

During the investigation, 810% more characteristically-hazardous soil was identified at the Property than was initially estimated during the FS-OPS&PW. In addition, the cubic yard (CY)-to-ton conversion rate was refined based on the results of the investigation. The changed conversion rate resulted in an increase in the tons of soil that need to be treated at the Property. The initial and updated soil volumes are shown in the table below.

	Cubic Yards			**Tons**			
Estimate	Total Waste	Total Hazardous Waste	Total Non-Hazardous Waste	Total Waste	Total Hazardous Waste	Total Non-Hazardous Waste	**CY-to-Ton Conversion Rate**
Initial FS-OPS&PW Volume	13,704	1,455	12,249	16,445	1,746	14,699	1.20
Updated Volume	12,000	8,567	3,433	19,800	14,136	5,664	1.65

2.4.2. Perched Water Bench-Scale and Field Pilot Studies

A new approach was identified for treating on-Property PW. The initial approach for treating perched water included installing a slurry or grout wall and using an ex-situ groundwater pump-and- treat system. However, SPWRELs will be achieved more efficiently and effectively using the new approach than the initial approach presented in the FS-OSP for the selected preferred alternative (Alternative 3). In the new approach, the additive is distributed throughout the perched zone of the Property. The additive will treat existing perched water and provide treatment capacity for future perched water. In the new approach, the treatment additive is applied directly to the perched water in each excavation; if perched water is not present, the excavation is backfilled with clean soil and treatment additive. Combining the additive with clean soil will evenly distribute the additive and create a highly-effective treatment zone for perched water on the Property now and in the future.

Three vendors were used to evaluate the new approach for treating perched water. Each vendor successfully completed a laboratory bench-scale study by combining their additives (e.g., Free Flow FS-200 + FS blend or Free Flow FS-200 + FS blend) with clean fill and adding it to perched water. The effectiveness of this approach was confirmed during the pilot studies when water from four different areas of the Property was treated by combining three additives with clean backfill. After treatment, the dissolved arsenic and lead concentrations were well below the SPWRELs. The laboratory and field data for the Perched Water Bench-Scale and Field Pilot Studies are presented in Appendix A.

2.4.3. Evaluation of Landfill Disposal Cost and Applicability

A review of regional landfills was conducted to determine if a more cost- and time-effective option was available. A new landfill (the LRI landfill in Puyallup, Washington) was identified as the preferred landfill for non-hazardous waste disposal rather than the Waste Management landfill in Arlington, Oregon causing non-hazardous waste disposal costs and time to complete the disposal process to decrease significantly. This change in landfills impacted the disposal costs and time to meet RAOs evaluation, which had influenced the selection of the preferred alternative. The changes in cost and time are due to the following:

- The significantly-shorter roundtrip distance between the Property and the LRI landfill than the Property and the Waste Management landfill (i.e., 31 miles instead of 522 miles) greatly impacted the Sustainability and Time to meet RAO test in the FS-OSP.
- The 56% reduction in unit rates for the disposal of waste (from $85.11 to $37.73 per ton of waste) greatly impacted the cost criterion in the FS-OSP.

2.4.4. Key Leanings from the Pilot Study

The results of the field pilot studies provided additional information about the time necessary to complete the remediation and meet RAOs. The estimated amount of time needed to complete the remediation has increased due to the size and configuration of the property, the volume of hazardous waste, and the impacts of weather.

The Size and Configuration of the Property

The on-property portion of the Site is approximately 3.1 acres in size. On-going operations of the Superlon Plastic Company require up to 66% of property for the construction of pipe and for storage of Superlon's inventory. This leaves a smaller section of property for the processing and stockpiling of impacted soils than initially anticipated in the FS-OSP. The Pilot study evaluated these limitations and determined:

- The excavation of impacted soils must be done on a small scale. This will be done by starting and completing each excavation area (typically a 37.5 foot by 37.5 foot sections of the property) one-at-a-time.
- The remediation will have to move in a controlled manner from one excavation to the next.
- Time will be required to re-locate Superlon's inventory to areas that will not be impacted by excavation, hauling and stockpiling of impacted soils.
- Time will be required to re-locate the safety exclusion zone as it moves from one excavation area to the next.
- Stockpile size must be limited to approximately 1,000 tons for both Hazardous and Non-hazardous soils. The disposal of soils will be required regularly as the stockpiles fill to capacity.
- Due the limited space on-Property excavation and disposal cannot be conducted concurrently.
- Material stockpile space is limited. As such, delivery and acceptance of materials, especially backfill soils and treatment additive super sacks, must be received on an "as-needed" basis.

The Volume of Hazardous Soil

The volume of characteristically-hazardous soils increased by 810% (section 2.4.1; therefore, the treatment to reduce the leachability of this soil prior to its disposal as non-hazardous waste increased.

The Impacts of Weather

Conducting remediation work between December 15th and March 1st is inefficient due to the increase in perched water in the excavations, an increase in drying time, and a decrease in productivity. As such, there will be no remediation work during that time period.

3. Changes in the Assumptions used in the FS-OSP

The key learnings listed above made it necessary to update the assumptions used to develop Alternative 3 in the FS-OSP prior to the start of the evaluation of the alternatives. Making this updated normalizes the alternatives so that an "apples to apples" comparison can be made. These changes are reflected in the time and cost assumptions through the screening process and on Table 1-1. The following changes were made:

Time

- Ninety-six (96) workdays were added to the schedule to account for the increased disposal frequency.
- One hundred ninety (190) calendar days were added to the schedule to account for the reduced number of work days due to the change to a December 15th to March 1st field season.
- One hundred thirteen (113) workdays were added to the schedule to account for the increase for soil treatment.

Cost

The delay in the start date of remediation and the change in landfill significantly impacted the cost criterion scoring for the selected alternative in the FS-OSP.

The approximately 1.5 year start date delay for remediation tasks (the initial start date was estimated to be March 2016) resulted in significant change to the cost of the selected alternative and the scoring of the cost criterion. The costs presented in the initial cost estimates (see Section 8 of the FS-OSP) have increased due to inflation.

4. Revised Alternative Analysis

Alternatives 3 and 4(Rev) were analyzed using the approach used for the FS-OSP; however, only the ranking criteria impacted by the changes are discussed in text. The scores for criteria not impacted by remedial action investigations will remain as presented in the 2014 Ecology-approved FS-OSP (PERC/PIONEER 2014). The cost estimates for Alternatives 3 and 4(Rev) are presented on Table 1-1.

4.1 MTCA Ranking Criteria

The criteria used to analyze the remedial alternatives included the MTCA balancing criteria, the MTCA disproportionate cost/benefit evaluation criteria (WAC 173-340-360(3)(e)), as well as sustainability of each alternative and safety. The following criteria were used to evaluate Alternatives 3 and 4(Rev):

- Protectiveness;
- Permanence;
- Long-term effectiveness;
- Short-term effectiveness;
- Implementability;
- Consideration of public concerns;
- Sustainability;
- Safety; and
- Cost.

4.1.1. Protectiveness

The protectiveness criterion addresses Ecology's preference for selecting remedial alternatives that are protective. This criterion is focused on the degree of protection each technology provides to human health and the environment, and the time required to reduce risk and obtain cleanup standards. Alternatives 3 and 4(Rev) meet the MTCA protectiveness criterion by addressing soil and perched water constituent concentrations that are above site-specific remediation levels (RELs).[2] As such, both of the retained alternatives will improve environmental quality as compared to the current conditions. The only variability between Alternative 3 and the Alternative 4(Rev) when considering protectiveness is the time required to achieve RAOs.

The timeframe for implementing Alternative 3 and 4(Rev) is influenced by how long it takes to complete the following tasks:

- Excavating;
- Performing verification sampling and analysis;
- Dewatering soil prior to loading; and
- Loading and transporting the contaminated soil to the landfill.

[2] RELs include cleanup levels as well as MTCA remediation levels.

The most limiting factor for completing the tasks is the small work area available at the Property and the slow rate of dewatering that is needed to allow for stabilization and disposal. Soil will need to be excavated, dewatered, and processed in increments no greater than 1,000 tons.[3]

The timeframe required to achieve perched water and soil RAOs is presented below for the two alternatives. The timeframe required for perched water remediation for Alternative 3 is 0.55 years longer than for Alternative 4(Rev). The timeframe for soil is limited by the time it takes to dewater materials for treatment and/or disposal and the time required to treat the soil prior to reuse or disposal.[4]

The main differences between the two alternatives are:

- The difference in time to will take to construct a slurry/grout wall and treat the perched water (estimated at 0.75 years longer than the soil remediation phase) and the process to be used in under Alternative 4(Rev) (estimated at 0.2 years longer than the soil remediation phase).

  The difference in time it will take to excavate and dispose of soil with COC concentrations greater than the SPWREL but less than the DCREL (estimated at 3,532 tons in the FS-OSP under Alternative 4(Rev) and the time required, under Alternative 3, to dry and treat the same soil prior to stabilization and reuse (Alternative 3).

The RAOs could be achieved 147 work days (0.4 years) quicker using Alternative 4A (3.1 years) than Alternative 3 (3.5 years). Alternative 4A would require between 2.6 and 3.6 years to complete, whereas Alternative 3 would require between 2.9 and 4.0 years.

The protectiveness evaluation is presented in the following table.

[3] The disposal assumptions were the same in both alternatives; therefore, disposal assumptions were not considered in this comparison.

[4] The time required to achieve RAOs under ideal conditions without weather related delays or other similar conditions for the actual remediation phase only. These estimates should be used for comparison only with other alternatives using the same criteria; not as a definitive estimation of time.

Medium	Alternative 3	Alternative 4(Rev)
Perched Water	A slurry/grout wall will be constructed along the perimeter of the Property and a pump-and-treat system will process the estimated 850,000 gallons of perched water two times. Approximately 0.75 years (assuming the treatment of perched water can performed concurrently with soil remediation) is required for this component of the alternative.	Perched water treatment can be performed concurrently with soil remediation and will only require additional time to mix the additive into the excavation. The estimated total additional time for treatment is 0.2 years.
Soil	In order to evenly mix the additive, the soil must be dried to <30% moisture content, which could take up to 3 months. Soil treatment could be performed concurrently with soil processing result. The drying time would add an additional 7 months to the remediation schedule. The space and drying limitations would apply to both alternatives, but the amount of drying required for stabilization is more than for off-site disposal.	The time required for excavation is offset by the time required for the disposal of waste. The disposal of 3,532 additional tons of waste is required in Alternative 4(Rev), compared to Alternative 3, which, when using the haul rate of 650 tons per day, equals an additional 5.4 haul days. The change in landfills resulted in the ability to have a higher moisture content in soil prior to disposal. In the initial FS-OPS&PW, the moisture content of the soil could not exceed 25%. Disposal at the LRI landfill requires the soil to pass "the paint filter test," which requires the soil be dried for a shorter period of time. In addition, more trips to the landfill can be accomplished because the haul distance is shorter.

4.1.2. Permanence

The permanence evaluation criterion addresses Ecology's preference for selecting remedial alternatives that utilize treatment technologies that permanently and significantly reduce toxicity, mobility, and volume of the constituents in Property soils. This evaluation also focuses on the ability of remedial alternatives to reduce the total volume of impacted soils, and irreversibly reduce mobility and toxicity of the constituents. Both alternatives are protective and will address soil COC concentrations greater than RELs.

Toxicity Reduction

The toxicity reduction evaluation was based on the ability of the alternative to destroy or convert the Property constituents to less toxic forms. Lead and arsenic in Property soils are elemental constituents; thus, the constituents cannot be destroyed, per se. However, lead and arsenic can exist in the environment as organic and inorganic complexes, which can have reduced bioavailability in living systems. In risk terms, a reduction in bioavailability is comparable to a reduction in toxicity (i.e., the dose is proportional to the reduction in the constituent's bioavailability).

Both Alternative 3 and 4(Rev) decrease arsenic and lead concentrations. Alternatives 3 and 4(Rev) decrease perched water dissolved arsenic and lead concentrations to below the RELs. Alternative 4(Rev) would result in much lower arsenic and lead concentrations in soil than Alternative 3, which

would minimize the potential to impact future perched water. Neither alternative is intended to reduce the toxicity of lead or arsenic in soil. However, Alternative 4(Rev) will transfer all impacted soil off-site to a controlled landfill, thus reducing the toxicity of lead or arsenic in soil on the Property.

The toxicity reduction evaluation is presented in the following table.

Medium	Alternative 3	Alternative 4(Rev)
Perched Water	Arsenic and lead will be removed via a pump-and-treat system and disposed of off-site. However, perched water at the Property is discontinuous and would likely be difficult to treat all perched water on the Property with a pump-and-treat system.	Free Flow FF-200 + FS will be added to the perched water zone throughout the Property. The treatment is based on the sorption of arsenic and lead on ferric hydroxide, which is followed by the iron compound precipitating out of water and binding to particulates in the soil. The increased arsenic concentration in soil resulting from treating the perched water with 37.6 mg/L of arsenic went from 1.8 mg/kg to 9.1 mg/kg (see Free Flow Report in Appendix A). The increase in the lead concentration in soil due to treating perched water went from 2.5 mg/kg to 2.53 mg/kg. These concentrations are much lower than what would occur for Alternative 3 because the backfill soil for Alternative 4(Rev) is clean backfill.
Soil	Soil stabilization and soil re-use will likely result in the decreased bioavailability of lead, and possibly arsenic, in soil (PERC/PIONEER 2014). MT2 Company performed a study with lead-based paint treated with Ecobond® (the same material that was used in the Superlon soil treatability study) using a United State Environmental Protection Agency in-vitro bioaccessibility test, and found that there was a 50% to 75% reduction in relative lead bioavailability. Thus, in at least a qualitative sense, a reduction in lead bioavailability in soils treated with this same reagent can be expected.	All impacted soil will be transferred off-site to a controlled landfill, thus reducing the toxicity of lead or arsenic in soil on the Property.

Mobility Reduction

Mobility reduction is based on the alternative's ability to permanently prevent constituents from being transported in the environment. The potential exposure pathways considered in the FS-OSP were direct contact and impacts to groundwater. Both remedial alternatives involve excavation and disposal of soil with COC concentrations greater than DCRELs, and would permanently reduce the potential for direct contact exposure in the excavation area by removing the source of constituents.

The mobility reduction evaluation is presented in the following table.

Medium	Alternative 3	Alternative 4(Rev)
Perched Water	Both alternatives will cause the dissolved COCs to bind with a selected media.	
	The pump-and-treat system will filter the perched water to capture the COCs, which would be disposed of off-site.	COCs will bind to the clean backfill in a non-leachable state during the treatment process, thereby becoming unavailable in perched water. The resulting COC concentrations that bind to the clean backfill would not exceed permissible limits (i.e., 588 mg/kg of arsenic). While a relatively small amount of COCs will be deposited on the clean backfill soil, the mobility of the constituents will be reduced as part of the treatment process, making Alternative 4(Rev) equal to Alternative 3 in reducing mobility, though in a less secure environment.
Soil	Both alternatives include off-Property disposal at a controlled landfill. There, the mobility of the constituents would be controlled long-term by liner and cap containment.	
	A relatively smaller volume of soil is disposed of at an off-Property landfill in Alternative 3 than in Alternative 4(Rev); however, Alternative 3 directly reduces the mobility of the constituents as part of the stabilization process, making it equal to Alternative 4(Rev) in reducing mobility, though in a less secure environment.	The greatest volume of soil is disposed of with Alternative 4(Rev), and would have the greatest reduction in on-Property mobility resulting from off-site disposal.

Total Volume Reduction

Fewer COCs will be removed (total volume reduction) using the Alternative 3 than using Alternative 4(Rev). Additionally, 3,532 tons of impacted soil will be stabilized and reused under Alternative 3, whereas, the COCs will be disposed of off-Site under Alternative 4(Rev).

The total volume reduction evaluation is presented in the following table.

Medium	Alternative 3	Alternative 4(Rev)
Perched Water	The COCs collected as part of the perched water treatment process under Alternative 3 would be collected and disposed of in a secure environment.	A relatively small amount of COCs are deposited on the clean-backfill soil as a result of the perched water treatment.
Soil	On-Property soil with concentrations greater than the DCREL will be excavated and transported to an engineered landfill.	The greatest amount of soil will be removed from the Property and placed in an engineered landfill using Alternative 4(Rev). Approximately 69% of the soil will be disposed of using Alternative 4(Rev), and as a result, on-Property volume reduction would be greatest under this alternative.

4.1.3. Long-term Effectiveness

The long-term effectiveness criterion addresses potential impacts after the cleanup action has been completed. The primary focus of this comparison is to weigh the controls that may be necessary to manage the treatment residuals or untreated soil. This comparison is performed two ways: (1) by assessing the magnitude of the residual risk, and (2) by assessing the adequacy of the individual controls to manage the treatment residuals or untreated soil.

Residual risk or controls that may be associated with the off-Property landfill remedial alternatives are not considered for long-term effectiveness. The evaluation of "certainty of success" was omitted from this evaluation, since the components of the two alternatives will need to result in concentrations less than RAOs before demobilization can occur. The cleanup of the Property will be performed over a period of time during which "success" can be measured with a high degree of certainty for each process.

Magnitude of Residual On-Property Risk

The relative magnitude of residual on-Property risk was evaluated for each alternative. Both remedial alternatives will have low residual risk, since each will leave only acceptable COCs below RELs on-Property; however, the alternatives differ in the levels of residual risk. Excavation of soil with concentrations greater than RELs means that the Property meets the RELs and RELs are based on acceptable levels of risk.

Both of the alternatives are considered permanent solutions. Off-Property landfill facility controls are acceptable based on environmental audits. Furthermore, bench-scale testing successfully bound perched water COCs to the soil. COC concentrations in perched water would be below site-specific RELs using both alternatives.

The magnitude of residual on-Property risk evaluation is presented in the following table.

Medium	Alternative 3	Alternative 4(Rev)
Perched Water	Bench-scale tests have shown equivalent reduction of residual arsenic and lead concentrations using Alternatives 3 and 4(Rev). The treatment in Alternative 4(Rev) reduced arsenic concentrations from 36.7 mg/L to 0.013 mg/L; the treatment in Alternative 3 reduced arsenic concentrations from 3.6 mg/L to below the detection limit of 0.001 mg/L.	
Soil	COC soil concentrations greater than SPWRELs will be stabilized to reduce leachability to below the SPWREL, thereby eliminating the soil-to-perched water pathway. Placement of a cover would reduce the potential for human and ecological exposure to the stabilized soils.	COC soil concentrations greater than the SPWRELs will be excavated and disposed of off-Property, thereby eliminating the soil-to-perched water pathway. Soil with COC concentrations greater than the RELs will be transported off-Property (i.e., no stabilized soil will be left on-Property). As a result, Alternative 4(Rev) represents the lowest risk for on-Property exposure.

Adequacy and Reliability of Controls

The adequacy and reliability of controls and how they relate to future land uses at the Property were evaluated for each alternative. Currently, the Property is zoned for industrial use, and that designation is unlikely to change in the future; therefore, site-specific RELs were calculated based on industrial land use. Non-potable groundwater standards were also used to develop RELs for both soil and perched water.

Both alternatives were developed assuming the future land use of the Property will remain industrial. Since the Property is currently zoned as industrial, and since a deed restriction specifying ongoing commercial/industrial land use will be a component of these remedies, the future land use controls are adequate.

Construction-grade clean soil will be used to backfill the excavations. Under Alternative 3, stabilized existing soils will remain on the Property, though this material will not have the same properties as the clean backfill and may not be as structurally sound. Under Alternative 4(Rev), no stabilized existing soils would remain on the Property and a greater volume of construction-grade backfill will be used for future development.

4.1.4. Short-term Effectiveness

The short-term effectiveness evaluation criterion addresses the effects of the alternatives during the construction and implementation phases of the cleanup action. Each alternative is evaluated with respect to the potential impact on human health in the surrounding community, Property workers, and the environment.

Potential Community Exposure during Implementation

This aspect of short-term effectiveness addresses any exposures that may result from implementation of the proposed alternative, such as dust generation during materials handling and transportation, or air emissions resulting from equipment operation. Dust generation may require monitoring so that the level of dust generated during soil handling does not exceed allowable levels in downwind areas. Dust control methods (e.g. applying water to work areas prior to and during excavation) could be required. The air quality impacts may be monitored to protect both the Property and the surrounding Property workers' health and safety. Soil excavation and handling along the southern Property boundary will require perimeter dust monitoring and dust prevention measures.

The high moisture content of the excavated soil and fill is one of the most significant factors mitigating significant dust generation. While transporting (by truck or rail) soil off-Property has a low potential for exposure, such exposures due to releases of soil or wastes during transport have been known to occur. As a result, the quantity of material being transported to an off-Property landfill was the basis for this evaluation.

The potential community exposure during implementation evaluation is presented in the following table.

Medium	Alternative 3	Alternative 4(Rev)
Perched Water	Both alternatives have the same potential for community exposure from the perched water treatment process.	
Soil	Alternative 3 will have the least potential for community exposure during implementation. This alternative requires the smallest volume of soil transport, since soils/wastes from OUs 1, 2, and 3 are intended to be stabilized and reused on-Property. Though it will require excavation of soils for stabilization and/or disposal, it is unlikely (due to high moisture content) that this activity will increase community exposure during implementation.	Alternative 4(Rev) will have the most potential for community exposure during implementation due to the higher volume of soil disposal and will require greater controls to minimize the risk associated with off-Property dust generation. Truck traffic will also be greater in Alternative 4(Rev) than Alternative 3 due to the additional 3,532 tons of soil being shipped off-Property, and a relatively larger volume of backfill being brought on-Property.

Potential Worker Exposure during Implementation

The potential worker exposure during implementation was evaluated based on the effectiveness and reliability of protective measures. Personal protective equipment (PPE) appropriate for the type of potential worker exposure will be worn during cleanup activities. Workers will receive health and safety training appropriate for their respective tasks, and receive equipment (e.g., trucks and backhoes) operation training. Workers will also be required to comply with the appropriate safety regulations.

Both remedial alternatives will generate dust and/or require transportation to a landfill during implementation. Dust generation will be managed by wetting the soil during handling, paving the centralized treatment area, and/or covering stockpiles when not adding or removing material. Transportation of soil to the landfill will be managed by conforming to applicable Department of Transportation regulations. Alternative 3 also involves excavation during installation of the slurry/grout wall, which could potentially increase safety risks to workers on the Property.

The relative magnitude of each alternative to reduce the risks associated with worker exposure during implementation is presented in the following table. The total volume of material handled, the use of water or extraction solutions, and the additional excavation and construction of the slurry/grout wall in Alternative 3 are the primary criteria for this evaluation.

The potential worker exposure during implementation evaluation is presented in the following table.

Medium	Alternative 3	Alternative 4(Rev)
Perched Water	The likelihood of contacting perched water is greater under Alternative 3 because the perched water will be extracted from the subsurface and treated aboveground.	The likelihood of contacting perched water is less under Alternative 4(Rev) because all perched water will be treated in-situ.
Soil	Since the stabilization process under Alternative 3 will be performed ex-situ, the amount of excavation will be identical to the excavation in Alternative 4(Rev).	
	The physical handling of soil will be greater under Alternative 3, since the time required to stabilize the soil greater than the SPWREL but, less than the DCREL will be greater than the time required to load and dispose of the same soil under Alternative 4(Rev). Furthermore, the additional stabilization step in Alternative 3 could generate local dust if the soil is dry, which could increase the potential for worker exposure during implementation.	

Potential Environmental Impacts

The potential environmental impacts that may result from the implementation of one of the alternatives, and the mitigation measures that could be implemented to prevent or reduce these impacts, were evaluated. Potential environmental impacts include but are not limited to: dispersion of constituents, treatment water releases, spills, and wildlife exposure. All remedial alternatives have the same impacts during the initial soil excavation. Remedial alternatives that include stabilization have the potential for additional impacts.

The potential environmental impacts evaluation is presented in the following table.

Medium	Alternative 3	Alternative 4(Rev)
Perched Water	Environmental impacts associated with perched water will be greater under Alternative 3 than Alternative 4(Rev) because the perched water will be extracted from the subsurface and treated aboveground.	Environmental impacts associated with perched water will be less under Alternative 4(Rev) than Alternative 3 because all perched water will be treated in-situ.
Soil	The potential for environmental impacts associated with soil is low for Alternative 3. A slight increase in impacts is possible during the construction of the slurry/grout wall under Alternative 3.	The potential for environmental impacts associated with soil is low for Alternative 4(Rev). If a spill occurs during truck loading or at the stabilization plant, the soil will be promptly excavated and treated. The underlying soil will be sampled to ensure the completeness of any additional cleanup.

4.1.5. Implementability

The implementability criterion addresses the technical feasibility of implementing the alternative, as well as the availability of materials and services. This evaluation focuses on the:

- Ability and reliability of the technology to operate as required by the design and implementation schedule;
- Ease of undertaking additional cleanup actions; and,
- Availability of services and materials.

Additional criteria (e.g., availability of equipment, availability of commercially-demonstrated technologies, administrative and regulatory requirements, scheduling, availability of appropriately-sized equipment, construction access, and monitoring access) are considered to have minor impacts on the Alternative 3 and 4(Rev).

Ability and Reliability of Technology

The ability and reliability of technology was evaluated to compare the technical difficulties and unknowns associated with the alternatives. Technical problems associated with the implementation of the alternatives may prevent attainment of the RELs, or result in delays in the cleanup schedule.

The ability and reliability of technology evaluation is presented in the following table.

Medium	Alternative 3	Alternative 4(Rev)
Perched Water	The potential for technical difficulties is greater for Alternative 3 than Alternative 4(Rev) because of the pump-and-treat system.	The potential for technical difficulties is less for Alternative 4(Rev) than Alternative 3 because the process of mixing the additive in perched water or with clean backfill is fairly simple.
Soil Treatment	Both of the alternatives could be readily implemented. No delays in the excavation and stabilization process are anticipated. Application of excavation and stabilization as part of the interim action for Building B has demonstrated the viability. Trained professionals are readily available to conduct the remedial activities, including the construction of the slurry/grout wall.	
	Alternative 3 could be readily implemented, but is more technically challenging than Alternative 4(Rev). Since this alternative requires the least volume of soil to be transported for off-Property disposal, limitations associated with the availability of waste transport vehicles and landfill capacity would be less than Alternative 4(Rev). Stabilization technologies have been proven on large scale at several sites and have been successful during interim actions at the Property. Only minor delays associated with the startup of a process containing a number of mechanical operations are anticipated.	Alternative 4(Rev) could be readily implemented. No limitations on the availability of transportation and/or landfill capacity are anticipated.

Ease of Undertaking Additional Actions

The ease of undertaking additional actions was evaluated to compare what possible future cleanup actions may be necessary, and how difficult it would be to implement any additional actions after one or more of the remedial alternatives have already been set in place.

Medium	Alternative 3	Alternative 4(Rev)
Perched Water	Both alternatives are considered to be permanent solutions and will meet all RAOs. No further cleanup actions would be anticipated following the implementation of these permanent treatment and/or disposal remedial alternatives.	
Soil	Both alternatives are considered to be permanent solutions and will meet all RAOs. No further cleanup actions would be anticipated following the implementation of these permanent treatment and/or disposal remedial alternatives.	

Availability of Services and Materials

The availability of services and materials, as well as the availability of contractors to provide competitive bids for the work, was evaluated. Cleanup actions to address lead- and arsenic-impacted soil have been, and are currently being implemented throughout the Northwest — even throughout North America and Europe. Many vendors were interviewed to determine the efficacy and availability of the technology used and the information was used to screen the two alternatives. These same vendors continue to provide updates on the activities and new developments in the technologies in the form of soil treatment field demonstrations.

The ability of services and materials evaluation is presented in the following table.

Media	Alternative 3	Alternative 4(Rev)
Perched Water	The ability of services and materials to achieve the RAOs is not anticipated to be a limiting factor, and is unlikely to impact the schedule for the alternatives.	
Soil	The ability of services and materials to achieve the RAOs is not anticipated to be a limiting factor, and is unlikely to impact the schedule for the alternatives.	

4.1.6. Consideration of Public Concerns

MTCA requires the evaluation of any local community concerns regarding the alternative and how the alternative addresses those concerns. Consideration of public concerns related to truck traffic was evaluated. Truck traffic is common within the vicinity of the Property; however, effective staging truck traffic will reduce additional potential impacts. It is believed that truck traffic will be a minor concern to the public.

The consideration of public concern evaluation is presented in the following table.

Medium	Alternative 3	Alternative 4(Rev)
Perched Water	All work under both alternatives will be performed on-Property; therefore, the potential for public concern will be the same for the perched water treatment process.	
Soil	The potential for public concern is lowest with Alternative 3 since it is the alternative with the smallest volume of soil leaving the Property and the smallest volume of required backfill (approximately 1,107 trucks). The installation of the cover will additionally minimize the potential for exposure.	The potential for public concern is highest with Alternative 4(Rev) since it is the alternative that requires the greatest volume of soil leaving the Property, and a relatively larger volume of backfill being brought on to the Property. Alternative 4(Rev) will require approximately 1,238 truckloads. Additional truck traffic will be of minor concern to the public.

4.1.7. Sustainability

Sustainability is not specifically required under MTCA as a screening criterion; however, it is an important consideration. Of the environmental stressors associated with sustainability, the greatest impact will be the emission of greenhouse gases resulting from waste transport by truck. A surrogate for the evaluation of greenhouse gas emissions can be the number of truck miles required to complete the alternative.

The sustainability evaluation is presented in the following table.

Medium	Alternative 3	Alternative 4(Rev)
Perched Water	Both alternatives have the same level of sustainability concerns related to the perched water treatment process.	
Soil	Approximately 1,107 trucks will be required to complete the remediation of the Property under Alternative 3, thus creating the least amount of greenhouse gases. Fifty percent of the trucks would be used for hauling backfill, cover, and cap soil, with a distance of 15 miles roundtrip. The other 50% of the trucks would travel 21 miles to dispose of waste at the landfill. This results in a total of 18,306 truck miles associated with this alternative which is lower than Alternative 4(Rev).	Approximately 1,238 trucks would be required to complete the remediation of the Property under Alternative 4(Rev). The number of trucks would create marginally more greenhouse gases than Alternative 3, due to the transport of a greater volume of soils and the import of backfill. Fifty percent of the trucks would be used for hauling backfill, cover, and cap soil, with a distance of 15 miles roundtrip. The other 50% of the trucks would travel approximately 21 miles to dispose of waste at the landfill. This results in a total of 22,824 truck miles, which is 22% more than Alternative 3.

4.1.8. Safety

The safety criterion was included because the Companies, PERC, and PIONEER believe that worker safety is always a primary consideration when performing any work, and because safety is an Applicable or Relevant and Appropriate Requirement (ARAR) under the Washington Industrial Safety and Health Act (RCW 49.17) and the federal Occupational Safety and Health Act (29 CFR 1910, 1926).

Each alternative presents a significant safety risk without proper training of health and safety procedures. Written procedures will need to be established, and an exclusion zone will be created to minimize potential hazards. All remediation workers would require appropriate training.

The safety evaluation is presented in the following table.

Medium	Alternative 3	Alternative 4(Rev)
Perched Water	Maintenance of the pump-and-treat system in Alternative 3 will require higher occupational exposure hours than Alternative 4(Rev). The treatment media will need to be changed and the withdrawal wells will need to be installed.	
Soil	Potential worker safety risks are higher for Alternative 3 than Alternative 4(Rev). This alternative will involve the same amount of excavation and processing of hazardous soil as Alternative 4(Rev) but will have the additional step of processing the soil with COC concentrations greater than the PWREL in OUs 1, 2, and 3. This alternative will also involve the potential exposure to the same soil during stabilization, which could potentially increase safety risks on the Property not only to those implementing the action, but to other workers on the Property.	Potential worker safety risks are lower for Alternative 4(Rev) than Alternative 3. This alternative will involve the least amount of material handling, which could potentially decrease safety risks on the Property not only to those implementing the action, but to other workers on the Property. A shorter remediation time and lower occupational exposure hours are required to meet RAOs for Alternative 4(Rev) than for Alternative 3.

4.1.9. Cost

This cost evaluation criterion addresses the costs that may be incurred to implement the cleanup action. The evaluation considers three cost categories: direct costs, indirect costs, and long-term operation and maintenance (O&M) costs, and presents the total cost for each alternative.

Cost Analysis

Direct Capital Costs

Direct capital costs are the costs associated with the implementation of each alternative. These costs are associated with construction, equipment, property preparation, operation/maintenance, and disposal. Direct costs were obtained from vendor solicitations and were based on previous experience and actual costs generated during interim actions and pilot studies at the Property.

Indirect Capital Costs

Indirect capital costs are those costs associated with administration, community relations, engineering design, construction oversight, and contingency for the alternative. These costs were estimated based on previous experience during interim actions.

Long-term O&M Costs

Long-term O&M costs associated with site remediation activities typically include items such as long-term monitoring, cap and cover maintenance, site security maintenance. These costs are most often

associated with a site where there is an active on-going operation after completion of the remedy that is necessary to maintain the protectiveness of the site.

Capital Costs	Alternative 3	Alternative 4(Rev)
Direct Costs	The direct capital costs for Alternative 3 are between $5.5 million (MM) and $7.4MM.	The direct capital costs for Alternative 4(Rev) are between $4.3MM and $5.8MM. This makes Alternative 4(Rev) the most viable alternative with respect to direct capital costs.
Indirect Costs	The indirect capital costs for Alternative 3 are between $0.71MM and $0.96MM.	The indirect capital costs for the Alternative 4(Rev) are between $0.65MM and $0.87MM. This makes the Alternative 4(Rev) the most viable alternative with respect to indirect capital costs.
Long-term O&M Costs	Both alternatives are considered to be permanent solutions and will meet all RAOs. Further cleanup actions and ongoing long-term maintenance would not be anticipated following the implementation of the selected alternative. Any minor maintenance of the cover would likely be conducted as part of the normal operations of the business interest occupying the Property.	

Summary Cost Analysis

An estimate of the anticipated costs associated with each alternative is presented in Table 1. Alternative 3 had the highest estimated total cost (approximately $7.3MM with a +/- 15% range between $6.2MM and $8.4MM). Alternative 4(Rev) had the lowest estimated cost (approximately $5.8MM with a +/- 15% range between $5.0MM and $6.7MM). The average of the range for Alternative 4(Rev) was approximately 25% lower than the average for the range for Alternative 3.

Disproportionate Cost Analysis

According to MTCA (WAC 173-340-360(3)(e)), "costs are disproportionate to benefits if the incremental costs of the alternative over that of a lower cost alternative exceed the incremental degree of benefits achieved by the alternative over that of the other lower cost alternative." Using this definition, the cost of Alternative 3 is clearly disproportionate to benefits over Alternative 4(Rev). The protectiveness, permanence, effectiveness over the long-term (especially as it applies to risk), management of short-term risks, consideration of public concerns, and the technical and administrative ease of implementation of Alternative 4(Rev) are similar to Alternative 3; however, the costs are significantly lower.

Accuracy of Estimate

The ranges of the estimated total costs for the two alternatives are presented on Table 1. These remedial action cost estimates were assumed to be accurate to within +/-15%. In effect, the estimated "Best Estimate" remedial action cost would be defined as the average of the high and low estimate. Cost estimates that overlap once the +/-15% factor is applied were considered equal for the purpose of this evaluation.

This cost estimate is NOT all-inclusive and does not include costs for documentation, studies, or related tasks. It also does not include costs for pilot studies, the remediation design process, or

documentation, studies, pilot studies, and design of off-Property impacts to groundwater. This estimate should be used for comparison basis only.

5. Summary of Analysis

Alternatives 3 and 4(Rev) were evaluated based on the criteria presented in Section 3, and each criterion was scored based on the results of the analysis (see Table 2). Each criterion was assigned a score of 1 or 2 for each alternative based on the performance of the alternative compared to the other alternative. The lower value (i.e., 1) represents the best performance; the higher value (i.e., 2) represents the worst performance. In cases where it was not possible to distinguish performance between the alternatives an equal score was assigned.

The scores for each criterion (e.g. long-term effectiveness and implementability) and the overall score for all criteria are presented on Table 2. The results for the sub-criteria were equally weighted. This approach is consistent with MTCA guidance, which emphasizes the permanence of the selected remedial alternatives.

5.1 Analysis

Alternative 4(Rev) received a total score of 19 and Alternative 3 had a higher (less desirable) score of 24 (see Table 2). Alternative 4(Rev) scored lower than Alternative 3 for Protectiveness, Permanence, Long-term Effectiveness, Implementability, Safety, and Cost.

5.2 Proposed Preferred Alternative

Alternative 4(Rev) is the revised preferred alternative for the FS-OSP based the detailed analyses of alternatives and the total score presented in Table 2. Alternative 3 is the proposed secondary alternative.

As the preferred alternative, the conceptual design for the Alternative 4(Rev) is described in the next section of this addendum.

6. Conceptual Design of the Preferred Remedial Alternative

This section describes how the Property cleanup will be achieved using Alternative 4(Rev). A description of how the preferred alternative will be implemented to achieve RAOs is presented in Section 5.1. An estimate of the total remediation cost for on-Property soils and surface water, and an estimate of the time necessary to implement the preferred alternative are presented in Section 5.2.

6.1 Conceptual Design of the Preferred Remedial Alternative

A summary of how the preferred remedial alternative will be implemented is described in this section. The process will be described in more detail in the Remedial Design Report, which will be submitted to Ecology in July 2017.

6.1.1. Perched Water Treatment

Perched water is located throughout the Property and requires treatment. The volume of perched water at the Property is unknown due to its discontinuous nature, but it is estimated to be 850,000 U.S. gallons. The treatment method for perched water consists of adding Free Flow FF-200 FS (1:1 buffer:iron reagent) to clean imported soil which will be used to backfill the each excavation containing perched water, or directly to the perched water. The FF-200 FS treatment process removes arsenic and lead from the groundwater by binding the metals to the soil.

As the perched water at the Property is discontinuous and will not occur in each excavation area, the amount of water treatment must be determined on a case-by-case basis and at the time of excavation. In addition, the results of a pilot study indicated that a wide range of COC concentrations can be expected during remediation. These wide ranges of concentrations will require different additive dosing rates. Dosing rate adjustments will be made based upon available data and the location of the excavation.

The purpose of adding the perched water treatment additive to imported backfill soil is to introduce the perched water treatment additive directly to the water without the use of injection wells (or other similar methods). Placing the additive directly into the perched water will eliminate the uncertainty associated with distributing the additive throughout the water body.

6.1.2. Soil Treatment

Soil with COC concentrations greater than DCRELs and/or SPWRELs (depending on the OU) will be excavated. Excavation and associated tasks are described in this section and more detail will be presented in the Remedial Design Report.

Excavation Process

The excavation process for soil will consist of the following:

- Excavating, stockpiling and, if necessary, analyzing overburden[5];
- Excavating soil with COC concentrations greater than the SPWREL but below the concentration expected to be characteristically hazardous; and
- Excavating soil with COC concentrations greater than the concentration expected to be characteristically hazardous.

Overburden

Overburden will be excavated and stockpiled prior to impacted soil excavation and if present, between impacted soil layers within the excavation. Where necessary, the overburden will be field-screened using an XRF to determine if the soil can be used as backfill. This screening step is particularly important in sections of the Property where a geotextile barrier has not been installed at the overburden/impacted soil interface during a previous interim action.

Non-Hazardous Soil

Excavated soil that is designated as non-hazardous will not require sampling/analysis prior to stockpiling for de-watering and subsequent load-out for off-Property disposal. A plastic-lined or asphalt-based stockpile storage cell will be constructed to store non-hazardous soil prior to disposal. This storage cell will prevent contaminated soil from contacting underlying soil. All stockpiles will be covered with a 20 mil liner when not in use.

Hazardous Soil

Excavated soil designated as hazardous will be transported to and processed by the soil screening plant for size separation. All stockpiles will be covered with a 20 mil plastic when not in use.

Screened Soil

Soil will be separated into fine (3-inch minus) and coarse fractions (3-inch plus). The fine (3-inch minus) soil will be processed through the screen, collected below, and transported from the screen to the hazardous waste treatment cell. The 3-inch plus soil/rock and debris (which will remain hazardous) will be transported to the hazardous waste disposal cell for analysis and storage. The stockpiled debris will be sampled (on a rate of 1 sample per every 100 cubic yards of debris) and analyzed by the XRF to determine the total arsenic and lead COC concentrations in the sample. If the total COC concentrations are equal to or greater than the concentration expected to be characteristically hazardous, the sample will be delivered to the project laboratory for TCLP analysis. The results of the TCLP analysis will determine if the debris can be disposed of as non-hazardous waste. If the debris has a total COC concentration that is significantly greater than the concentration expected to be

[5] Overburden consisting of imported gravels will not require analysis.

characteristically hazardous or if the debris fails TCLP analysis it will be staged in the stockpile for disposal at the Chemical Waste Management Landfill in Arlington, Oregon.

Characteristically hazardous soil will be treated with EnviroBlend® 50/50 HXD (at a dosing rate of 4%) to lower the leachability so that it is no longer a D-listed waste and can be disposed of as non-hazardous waste.

Excavation and Backfill

The excavations will be backfilled to the approximate pre-construction grade using a combination of stockpiled reusable overburden soil and imported gravel borrow from a known source of uncontaminated fill. Stockpiled reusable overburden soil that meets RELs will be used preferentially over imported gravel borrow. Depending upon the condition of the subgrade material prior to backfill, quarry spalls may be required as a base for the backfilled materials.

The backfill soil will be placed in lifts and loosely compacted by the excavator. In cases where excavation is deep enough to potentially impact the aquitard, the excavation will be backfilled initially with locally-sourced pond-liner grade clay. This step will re-establish the aquitard and help eliminate preferential pathways to the groundwater. This is a precautionary step, as the perched water treatment process should eliminate the source of any environmental impacts to groundwater over time. To add structural strength to the backfilled excavation, a layer of woven filter fabric or geotextile will be added above the additive/imported backfill or the quarry spills.

6.2 Cost and Timing of the Preferred Remedial Alternative

The anticipated cost[6] of the proposed preferred alternative ranged from $5.0MM and $6.7MM (see Table 1). The completion of this alternative is estimated to require between 1.7 and 2.3 years.[7] The initial selected preferred alternative estimated cost was between $6.2MM and $8.4MM, and completion of the alternative was expected to take between 2.25 and 2.8 years.

[6] This estimate of cost is NOT all-inclusive and does not include costs for documentation, studies, or related tasks. It also does not include costs for pilot studies, design of the remediation process or for documentation, studies, pilot studies, and design of off-property impacts or groundwater. This estimate should be used for comparison purposes only.
[7] This estimate includes the time it will take to implement the remedy and time directly associated with the remedy; it does not include time for other items such as reporting, design, documentation, studies, pilot studies, and design of off-property impacts, or groundwater.

7. References

PERC/PIONEER. 2014. Feasibility Study Report for On-Property Soils and Perched Water at the Superlon Plastics Property, Tacoma, Washington. December.

PERC/PIONEER. 2017. Soil Volume Verification and XRF Demonstration for the Superlon Plastics Site, Tacoma, Washington. January.

TABLES

Table 1: Estimated Implementation Costs for Alternatives 3 and 4(Rev)

Cost Comparison	Alternative 3	Alternative 4(Rev)
Direct Costs		
PW Treatment	**$494,949**	**$16,959**
Construction of Slurry Wall	$289,000	$0
Analytical Testing (Slurry Wall Waste)	$7,856	$0
Cost of Treatment Plant/Costs	$150,000	INCLUDED IN SOILS PROCESSING BELOW
Analytical Testing (Treated Water)	$48,093	$16,959
Soil Treatment	**$5,954,676**	**$5,054,248**
SOILS PROCESSING: Cost of Excavation of Overburden, Excavation of Impacted soils, Stabilization of Hazardous soils, Backfilling and Analytical	$3,963,058[(1)]	$3,162,332
Disposal of Waste (ALL Soil/Waste types)[(1)]	$785,100	$785,100
Disposal of Debris	$349,616	$349,616
Backfilling of Excavation	$688,272	$683,675
Cover Construction	$168,630	$73,525
Total Direct Cost	**$6,449,625**	**$5,071,207**
15% LOW	**$5,482,181**	**$4,310,526**
15% HIGH	**$7,417,069**	**$5,831,888**

Indirect Costs		
Project Management & Legal (Estimated at 5% of Direct Costs)	**$322,481**	**$253,560**
Construction Oversight (Estimated at 10% of Direct Costs)	**$644,963**	**$507,121**
Contingency NOT INCLUDED PER MTCA	**N/A**	**N/A**
Total Indirect Cost	**$832,118**	**$759,448**
15% LOW	**$707,300**	**$645,531**
15% HIGH	**$956,936**	**$873,365**

TOTAL COST OF ALTERNATIVE	$7,281,743	$5,830,655
15% LOW	**$6,189,482**	**$4,956,057**
15% HIGH	**$8,374,004**	**$6,705,253**

TOTAL TIME REQUIIRED TO COMPLETE ALTERNATIVE (YEARS)	3.5	3.1
15% LOW	**2.9**	**2.6**
15% HIGH	**4.0**	**3.6**

Note:
[(1)]Volume adjusted to equal the proposed preferred alternative

Table 2: Scoring of the Alternatives

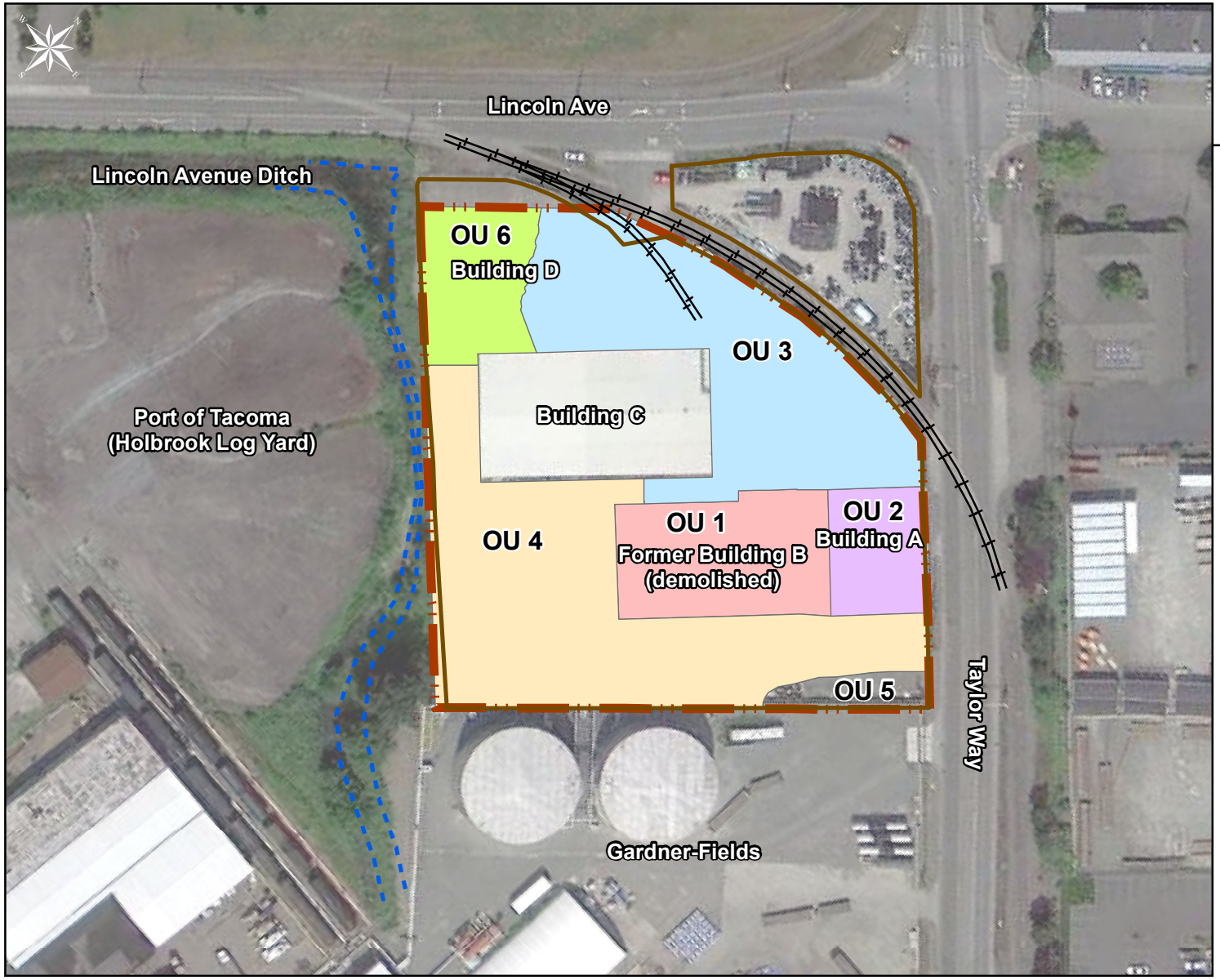
Criterion	Alternative 3	Alternative 4(Rev)
Protectiveness		
Time to Achieve RAOs	2	1
Permanence		
Toxicity Reduction	1	1
Mobility Reduction	2	1
Total Volume Reduction	2	1
Long-term Effectiveness and Permanence		
Magnitude of Residual Risk On-Property	2	1
Adequacy and Reliability of Controls	1	1
Short-term Effectiveness		
Potential Community Exposure during Implementation	2	1
Potential Worker Exposure during Implementation	2	1
Potential Environmental Impacts	2	1
Implementability		
Ability and Reliability of Technology	2	1
Ease of Undertaking Additional Actions	1	1
Availability of Services and Materials	1	1
Consideration of Public Concern		
	1	2
Sustainability		
	1	2
Safety		
	2	1
Cost		
	2	1
Total	**26**	**18**

Notes:

The scores for each evaluation criteria category (e.g. long-term effectiveness, and implementability) and the total score for the sum of all criteria are presented in the bottom row of the table. Note that the lowest score indicates the best performance. The results for the sub-criteria were equally weighted. This approach is consistent with MTCA guidance, which emphasizes the permanence of the selected remedial alternatives.

Addendum 1 to the
Feasibility Study for On-Property Soils and Perched Water
Superlon Plastics Property

FIGURES:



Legend

- OU 1
- OU 2
- OU 3
- OU 4
- OU 5
- OU 6
- Railroad
- Fence
- Ditch
- Property Boundary

0 50 100 150 200 Feet

PIONEER TECHNOLOGIES CORPORATION

Operable Units
Addendum 1 to the Feasibility Study for On-Property Soils and Perched Water
Superlon Plastics Property, Tacoma, Washington

Figure 1

Appendix A: Perched Water Treatability Studies

for the

Superlon Plastics Site Tacoma, Washington

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Acronyms and Abbreviations

Acronym/Abbreviation	Description
Pilot	Field Pilot Treatability Study
Property	Superlon Plastics Property
PW	Perched Water
RELs	Remediation Levels

A1 Introduction

Laboratory bench-scale and field pilot treatability studies (Pilot) were conducted to evaluate the technical feasibility of applying three additive technologies to perched water (PW) at The Superlon Plastics Property (Property). The purpose of treating the water with additives was to reduce dissolved arsenic and lead concentrations to meet Site-specific groundwater remediation levels (RELs).[1] This appendix is organized as follows:

- Section A2 presents the objective, characterization, and methodology of the laboratory bench-scale PW treatability studies;
- Section A3 presents the PW bench-scale treatability study results for Free Flow (FF) Technologies;
- Section A4 presents the PW bench-scale treatability study results for Peroxychem (MetaFix);
- Section A5 presents the PW bench-scale treatability study results for Premier Magnesia (EnviroBlend HXD);
- Section A6 describes the transfer process of arsenic and lead to soil after water treatment,
- Section A7 describes the PW field pilot treatability results, selected additive test treatment conditions, and results; and
- Section A8 presents the conclusion and recommended additive for the full-scale remediation.

[1] For the purposes of this report, remediation levels (RELs) include soil-to-groundwater RELs and groundwater and perched water cleanup levels.

A2 Laboratory PW Bench-Scale Treatability Studies

A2.1 Goals and Objectives

The goal of the PW treatability studies was to determine if amending PW with different additives would be an effective means to reduce the dissolved arsenic and lead concentrations to achieve groundwater RELs. Three Laboratories conducted the PW treatability studies:

- Free Flow Technologies (TRC Laboratory conducted the study);
- Peroxychem; and
- Premier Magnesia (Ursus laboratory conducted the study).

Each PW treatability study focused on the following objectives:

- Confirm the suitability of the selected technologies for property PW;
- Identify the appropriate additive dose to achieve the objective; and
- Identify any potential problems associated with the selected technologies at the Property.

A2.2 PW Characterization

Groundwater was collected from two shallow aquifer locations using a peristaltic pump to represent PW with low and high arsenic and lead concentrations (see Figure A-1 and Table A-1):

- Monitoring well MW-11S to represent low arsenic and lead concentrations, and
- Monitoring well MW-12S to represent high arsenic and lead concentrations.

Water and clean soil samples were provided to each laboratory. Analytical results are presented in Table A-1.

Clean soil purchased from an off-Property source was included in the study as it will be used to back fill excavations. Clean soil samples were sent to the lab and mixed with an additive, and then combined with the PW. This approach was tested in the lab since it reflects the process that will take place in the field. Additional testing was performed to determine if applying the additive directly to the PW and then adding the clean soil was equally effective. The results of the laboratory PW bench-scale treatability study are presented in Section A-3 through A-5.

A2.3 Blended Additive and Clean Soil Methodology

The PW treatability study methodology and results are presented in the Free Flow, Peroxychem, and Premier Magnesia reports, which are included in Attachments A-2, A-3, and A-4, respectively. The three vendors blended the additives with clean back fill soil, added the mixture to Property PW, and then collected a treated water sample. In addition, Free Flow additive was used to determine the effectiveness of the treatment if the additive was blended with the PW and then clean soil was added. The water sample was then analyzed for dissolved arsenic and lead (see Free Flow Report Number 2). The laboratory reports are included with each vendors' reports in Attachments A-2, A-3, and A-4, respectively.

A3 Free Flow PW Bench-Scale Treatability Study Results

The bench-scale treatability study report documenting the ability of the Free Flow additive to treat Superlon PW is presented in Attachment A-2. The initial water samples had dissolved arsenic concentrations of 3.0 mg/L for the less concentrated water, and 36.7 mg/L for the more concentrated water (MW-11s) (see Table A-1). The initial lead concentrations in each sample were below the REL and are not discussed further. Each treatment dose successfully lowered the dissolved arsenic concentrations to below the target concentration of 0.66 mg/L. A 0.25% treatment dose of the FF-200 + FS (1:1 - buffer:iron ratio) brought the concentration of arsenic down to below the remedial level of 0.67 mg/L in the saturated soil test. In addition, the higher buffer:iron source ratios resulted in higher final pH values in the water. Since arsenic absorption is stronger at slightly acidic pH values, rather than at slightly basic pH values, the 1:1 buffer:iron reagent is recommended. Lower doses of reagent were not tested due to the difficulty of homogeneously mixing small amounts of dry treatment reagent in the soil to ensure uniform treatment. Based on the results of the study, a dose of 0.25% FF-200 FS (at a 1:1 ratio) was recommended.

A4 Peroxychem PW Bench-Scale Treatability Study Results

The bench-scale treatability study report documenting the ability of the Peroxychem Metafix® additive to treat Superlon PW is presented in Attachment A-3. The initial groundwater samples had dissolved arsenic concentrations of 2.9 mg/L (MW-12s) for the less concentrated water, and 30.9 mg/L (MW-11s)for the more concentrated water (see Table A-1). The results of treatability testing indicate that the Peroxychem MetaFix® treatment can reduce dissolved arsenic concentrations below the REL. The dissolved lead concentration was below the method detection limit in the untreated baseline water sample, and was not evaluated further.

The results indicate that the Peroxychem MetaFix I-6A formulation was the most effective for treatment of arsenic. The dose response results suggest that even the lowest evaluated dose of 0.25% w/w could result in achievement of the REL. The Peroxychem MetaFix® bench-scale treatability study results of increasing the additive dose indicates that higher dosages (i.e., 0.5% or 1.0%) would provide increased assurance of high removal efficiency. In addition, the use of a higher additive dose would make adequate distribution of the Peroxychem MetaFix® reagent within the backfill matrix easier to achieve.

A5 Premier Magnesia PW Bench-Scale Treatability Study Results

The treatability study report documenting the ability of the Premier Magnesia EnviroBlend® additive to treat Superlon PW is presented in Attachment A-4. The initial groundwater samples had dissolved arsenic concentrations of 2.75 mg/L (MW-12s) for the less concentrated water, and 36.7 mg/L (MW-11s) for the more concentrated water (see Table A-1). Enviroblend HXD was amended to backfill material with concentrations of 3%, 4%, and 5% and then the material was added to the PW (see Attachment A-4, Table 3). The less concentrated groundwater sample was effectively treated, and met the RELs with a 3% EnviroBlend® HXD dosage. A 4% EnviroBlend® HXD dosage met the REL for the more concentrated groundwater. In fact, the treatments reduced both arsenic and lead concentrations to below their respective detection limit.

A6 Transfer of Arsenic and Lead to Soil after Water Treatment

The treatment process removes arsenic from PW by binding arsenic to iron, and then to the particulates in the soil. This results in arsenic and lead being transferred from the PW to the soil after the water treatment.

In the laboratory bench-scale studies, the saturated soil samples, (which represents approximate field conditions) had a solid solution ratio of 5:1. This means that 500 g of soil will contain 100 mL water. Assuming the water has 100 mg/L arsenic, the increase in the arsenic soil concentration will be (100 mg/L arsenic x 0.10 L) / 500 g soil = 20 mg/kg arsenic. For the 36.7 mg/L arsenic concentration sample, the increase is 7.5 mg/kg arsenic (See Attachment A-2). These arsenic levels are below state background concentrations (20 mg/kg), default industrial cleanup levels (90 mg/kg), and the lowest Property-specific REL of 91 mg/kg for Operable Unit 2. This means that soil RELs will not be exceeded as a result of using of a water treatment additive.

A7 Field Pilot PW Treatability Studies

A7.1 Goals and Objectives

The goal of the PW field pilot treatability study was to confirm that amending PW with FF-200 FS (1:1 ratio), METAFIX I6i, and EnviroBlend® additives could be an effective means to reduce the dissolved arsenic and lead concentrations to achieve groundwater RELs. The PW field pilot treatability study was conducted in March and April of 2017 and focused on the following objectives:

- Confirming the suitability of the three additives for treating Property PW;
- Confirming the appropriate dose of the three additives to achieve PW RELs; and
- Identifying potential problems associated with mixing clean soil with additives at the Property.

A7.2 Methodology

The methodology used for the field pilot treatability study consisted of placing PW collected from four different source areas into 20-gallon drums and then treating the PW by adding soil amended with the three additives as follows:

PW Source	Free Flow FF 200 (1:1) Dose as W%/W% of Clean Backfill	Peroxychem Metafix I-6A Dose as W%/W% of Clean Backfill	Premier Magnesia Enviroblend HXD Dose as W%/W% of Clean Backfill
Former Building B Sampling Port	0.5	0.25	4
Monitoring Well 12s (MW-12S)	0.5	0.25	4
Pilot Study SL-79 Excavation	0.5	0.25	4
Pilot Study SL-90 Excavation	0.5	0.25	4

Representative arsenic and lead concentrations were obtained from PW samples prior to treatment with the additives. The PW from SL-79 excavation contained the highest concentrations of arsenic and/or lead obtainable and represented the worst case scenario. The PW from former Building B sampling ports represented the expected typical scenario. Treated water samples were collected one week later from each drum and the analytical results are presented in Table A-2.

A7.3 Results

Based on the results of the Pilot, FF 200 (1:1) was the most effective PW treatment under current field conditions (see table A-2 and the table below and Table A-2). FF 200 (1:1) successfully treated the water from Former Building B, Monitoring Well 12s and the Pilot SL-90 excavation whereas the other additives were only successful in treating water from the Former Building B. In addition, the treatment with FF 200 (1:1) resulted in dissolved arsenic concentrations that were more than an order of magnitude lower than the other additives for the Building B and MW-12 water.

	Achieve Groundwater REL		
PW Source	**Free Flow FF 200 (1:1) Dose as W%/W% of Clean Backfill**	**Peroxychem Metafix I-6A Dose as W%/W% of Clean Backfill**	**Premier Magnesia Enviroblend HXD Dose as W%/W% of Clean Backfill**
Former Building B Sampling Ports	Yes	No	Yes
Monitoring Well 12s (MW-12S)	Yes	No	No
Pilot SL-79 Excavation	No	No	No
Pilot SL-90 Excavation	Yes	Yes	Yes

The additives doses were too low to successfully treat the PW in SL-79 due to the sample collection method used in this excavation. An excavator bucket was used to collect the PW from the bottom of the excavation and a significant amount of suspended soil was inadvertently collected with the PW. The suspended soil in the PW sample resulted in unrealistically high arsenic and lead concentrations. The total arsenic concentration (which included solids) was 95 mg/L and the dissolved arsenic concentration (which did not include solids) was 6.1 mg/L; the total lead concentration (which included solids) was 137 mg/L and the dissolved lead concentration (which did not include solids) was 0.02 mg/L (see Attachment A-2).

Suspended soil in PW will not impact sample concentrations during the remedial action because suspended soil will be filtered from PW samples. In addition, during the remedial action, some of the suspended soil in PW will settle to the bottom of the excavation, and other suspended soil will be bound up to clean backfill as it is used to fill the excavation. This will result in dissolved PW concentrations that are expected to be approximately 10 times lower during the remedial action than they were in the Pilot SL-79 drums.

A7.3 Results

Based on the results of the Pilot, FF 200 (1:1) was the most effective PW treatment under current field conditions (see table A-2 and the table below and Table A-2). FF 200 (1:1) successfully treated the water from Former Building B, Monitoring Well 12s and the Pilot SL-90 excavation whereas the other additives were only successful in treating water from the Former Building B. In addition, the treatment with FF 200 (1:1) resulted in dissolved arsenic concentrations that were more than an order of magnitude lower than the other additives for the Building B and MW-12 water.

	Achieve Groundwater REL		
PW Source	**Free Flow FF 200 (1:1) Dose as W%/W% of Clean Backfill**	**Peroxychem Metafix I-6A Dose as W%/W% of Clean Backfill**	**Premier Magnesia Enviroblend HXD Dose as W%/W% of Clean Backfill**
Former Building B Sampling Ports	Yes	No	Yes
Monitoring Well 12s (MW-12S)	Yes	No	No
Pilot SL-79 Excavation	No	No	No
Pilot SL-90 Excavation	Yes	Yes	Yes

The additives doses were too low to successfully treat the PW in SL-79 due to the sample collection method used in this excavation. An excavator bucket was used to collect the PW from the bottom of the excavation and a significant amount of suspended soil was inadvertently collected with the PW. The suspended soil in the PW sample resulted in unrealistically high arsenic and lead concentrations. The total arsenic concentration (which included solids) was 95 mg/L and the dissolved arsenic concentration (which did not include solids) was 6.1 mg/L; the total lead concentration (which included solids) was 137 mg/L and the dissolved lead concentration (which did not include solids) was 0.02 mg/L (see Attachment A-2).

Suspended soil in PW will not impact sample concentrations during the remedial action because suspended soil will be filtered from PW samples. In addition, during the remedial action, some of the suspended soil in PW will settle to the bottom of the excavation, and other suspended soil will be bound up to clean backfill as it is used to fill the excavation. This will result in dissolved PW concentrations that are expected to be approximately 10 times lower during the remedial action than they were in the Pilot SL-79 drums.

A8 Conclusions

Treatability studies were performed to determine if on-Property PW could be treated to reduce dissolved arsenic and lead concentrations to achieve RELs. The results of the treatability studies demonstrated that Free Flow FF 200 (1:1) at a 0.5% dose was the most effective treatment for on-Property PW and that it will successfully treat on-Property PW to achieve site-specific groundwater RELs.

Tables

Table A-1: Bench-Scale Treatability Study Perched Water and Soil Concentrations

Sample Source	Lab Sample Number	Treatment	Additive	Dose % Weight of Backfill	Sample Number	Dissolved or Total?	Arsenic (mg/L)[1]	Lead (mg/L)[2]	pH (SU)
MW-12s	Free Flow (TRC Lab)	Baseline	None	None	GW-MW-11S-Low 102416-(20)	Dissolved	3	0.17	6.99
MW-11s	Free Flow (TRC Lab)	Baseline	None	None	GW-MW-11S-Low 102416-(20)	Dissolved	36.7	0.075	6.65
Clean Backfill Soil	Peroxychem	Baseline	None	None	Soil-SO Backfill-102416-0-0.5	Not Applicable	1.8[(3)]	2.5[(3)]	7.59
MW-12s	Peroxychem	Baseline	None	None	GW-MW-12S-High 102416-(20)	Dissolved	2.9	0.15	6.36
MW-11s	Peroxychem	Baseline	None	None	GW-MW-11S-Low 102416-(20)	Dissolved	30.9	<0.03	6.78
MW-12S	Premier Magnesia (Ursus Lab)	Baseline	None	None	GW-MW-12S-High 102416-(20)	Dissolved	2.75	0.29	6.81
MW-11s	Premier Magnesia (Ursus Lab)	Baseline	None	None	GW-MW-11S-Low 102416-(20)	Dissolved	36.7	0.76	6.41

Notes:

[1]Remedial level is 0.67 mg/L

[2]Remedial level is 1.65 mg/L

[3]Units are mg/kg for this sample

Table A-2: Pilot Study Treatability Study Laboratory Results

Sample Source	Lab Sample Number	Treatment	Additive	Dose % Weight of Backfill	Sample Number	Dissolved or Total?	Arsenic (mg/L)[1]	Lead (mg/L)[2]	pH (SU)
Bld_B	580-66530-2	Baseline	None	None	PP-Bld_B_Sample Ports-030317	Total	66	0.70	--
Bld_B	580-66905-1	Free Flow	FF-200 + FS (1:1 - buffer:iron ratio)	0.5	PP-BLD_B-Freeflow-PT-032217	Dissolved	0.091	0.0020	7.2
Bld_B	580-66905-2	Peroxychem	MetaFix I-6A	0.25	PP-BLD_B-MFIX-PT-032217	Dissolved	1.5	0.0020	7.3
Bld_B	580-66905-3	Peroxychem	MetaFix I-6A	0.25	PP-BLD_B-MFIX-PT-032217-(01)	Dissolved	1.4	0.0020	7.3
Bld_B	580-66905-4	Premier Magnesia	Enviroblend HXD	4	PP-BLD_B-PM-PT-032217	Dissolved	0.61	0.040	4.2
MW-12	580-66530-1	Baseline	None	None	GW-MW-12S-030317	Total	59	0.046	--
MW-12	580-66905-5	Free Flow	FF-200 + FS (1:1 - buffer:iron ratio)	0.5	PP-MW-12i-Freeflow-PT-032217	Dissolved	0.12	0.0020	7.1
MW-12	580-66905-6	Peroxychem	MetaFix I-6A	0.25	PP-MW-12i-MFIX-PT-032217	Dissolved	3.0	0.0020	7.6
MW-12	580-66905-7	Premier Magnesia	Enviroblend HXD	4	PP-MW-12i-PM-PT-032217	Dissolved	4.2	0.040	3.9
SL-79	580-66386-1	Baseline	None	None	PP-SL-79-022717	Total	330	380	--
SL-79	580-66905-8	Free Flow	FF-200 + FS (1:1 - buffer:iron ratio)	0.5	PP-SL-79-Freeflow-PT-032217	Dissolved	4.4	0.0036	7.0
SL-79	580-66905-9	Peroxychem	MetaFix I-6A	0.25	PP-SL-79-MFIX-PT-032217	Dissolved	11	0.0070	7.3
SL-79	580-66905-10	Premier Magnesia	Enviroblend HXD	4	PP-SL-79-PM-PT-032217	Dissolved	10	0.040	5.1
SL-90	580-66530-3	Baseline	None	None	PP-SL 90-030317	Total	1.1	1.5	--
SL-90	580-66905-11	Free Flow	FF-200 + FS (1:1 - buffer:iron ratio)	0.5	PP-SL-90-Freeflow-PT-032217	Dissolved	0.013	0.0066	12.7
SL-90	580-66905-12	Peroxychem	MetaFix I-6A	0.25	PP-SL-90-MFIX-PT-032217	Dissolved	0.017	0.055	12.8
SL-90	580-66905-13	Premier Magnesia	Enviroblend HXD	4	PP-SL-90-PM-PT-032217	Dissolved	0.10	0.040	6.8

Notes:

[1]Groundwater remediation level is 0.67 mg/L.

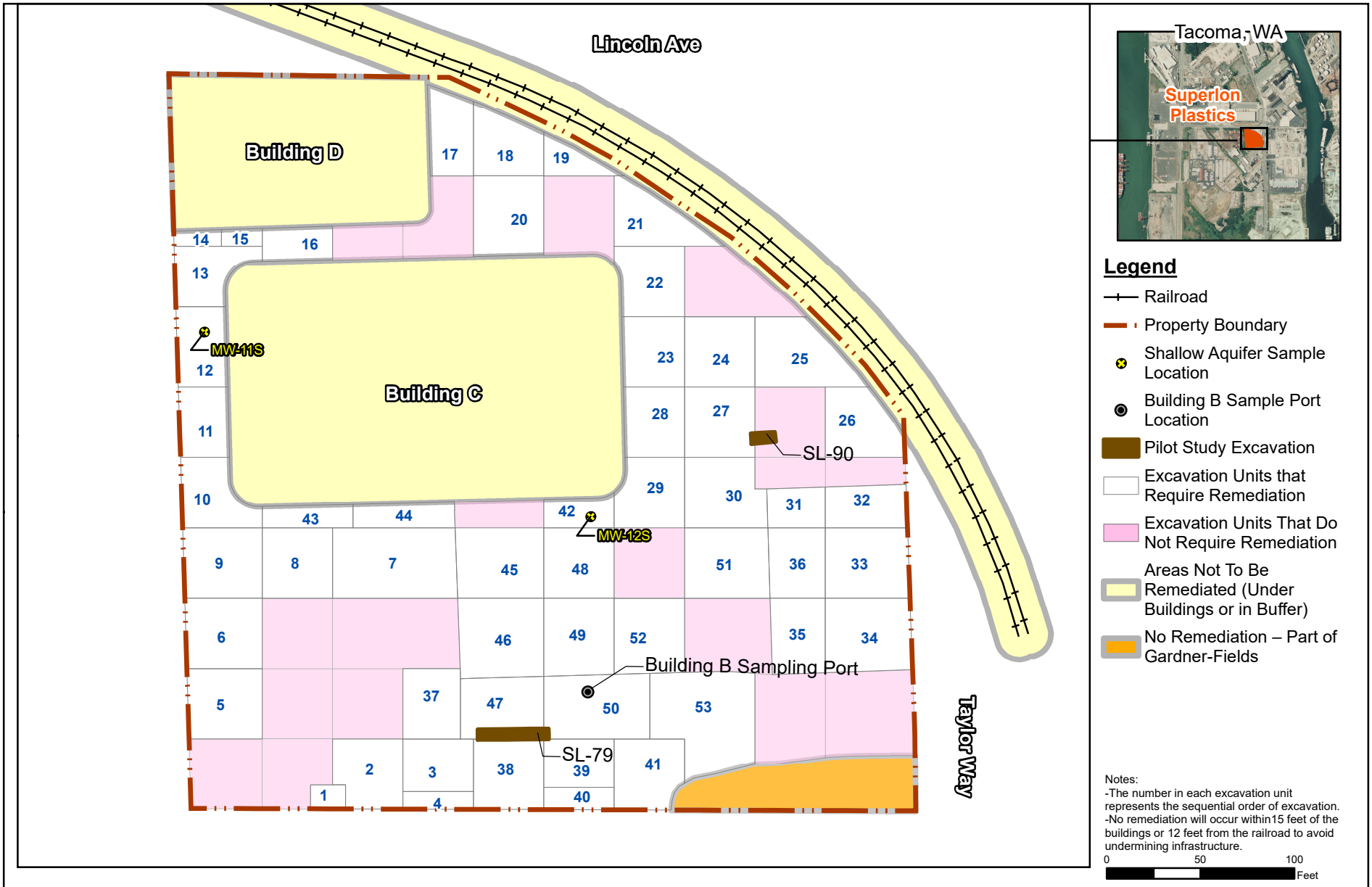
[2]Groundwater remediation level is 1.65 mg/L.

-- = Not analyzed for constituent

See Attachments A-2, A-3, and A-4 for laboratory reports for Free Flow, Peroxychem, and Premier Magnesia, respectively.

NA = Not applicable since criteria are for dissolved constituent concentrations

Figures



Legend

- Railroad
- Property Boundary
- Shallow Aquifer Sample Location
- Building B Sample Port Location
- Pilot Study Excavation
- Excavation Units that Require Remediation
- Excavation Units That Do Not Require Remediation
- Areas Not To Be Remediated (Under Buildings or in Buffer)
- No Remediation – Part of Gardner-Fields

Notes:
-The number in each excavation unit represents the sequential order of excavation.
-No remediation will occur within15 feet of the buildings or 12 feet from the railroad to avoid undermining infrastructure.

0 50 100 Feet

PIONEER TECHNOLOGIES CORPORATION

Perched Water Treatability Study Sample Locations
Remedial Design Report
Superlon Plastics Property, Tacoma, Washington

Figure A-1

Attachment A-1: Laboratory Reports

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Seattle
5755 8th Street East
Tacoma, WA 98424
Tel: (253)922-2310

TestAmerica Job ID: 580-66386-1
Client Project/Site: Superlon Metals Fractionation

For:
Pioneer Technologies Corporation
5205 Corporate Ctr. Ct. SE
Ste A
Olympia, Washington 98503

Attn: Brad Grimsted

M. Elaine Walker

Authorized for release by:
3/8/2017 12:45:09 PM

Elaine Walker, Project Manager II
(253)248-4972
elaine.walker@testamericainc.com

Table of Contents

Case Narrative

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66386-1

Job ID: 580-66386-1

Laboratory: TestAmerica Seattle

Narrative

Job Narrative
580-66386-1

Receipt
One sample was received on 2/27/2017 3:50 PM; the sample arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 14.4º C.

Receipt Exceptions

The reference method requires samples to be preserved to a pH of 2 or less. The following sample was received with insufficient preservation at a pH of 6: PP-SL-79-022717 (580-66386-1). The sample was preserved with nitric aciid from lot 0000133393 to the appropriate pH at 0930 in the laboratory on the first of March in 2017.

Metals
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Client Sample Results

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66386-1

Client Sample ID: PP-SL-79-022717
Date Collected: 02/27/17 10:45
Date Received: 02/27/17 15:50

Lab Sample ID: 580-66386-1
Matrix: Water

Method: 6020A - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	330		0.50		mg/L		03/06/17 10:03	03/07/17 13:24	500
Lead	380		0.20		mg/L		03/06/17 10:03	03/07/17 13:24	500

Method: 6020A - Metals (ICP/MS)

Lab Sample ID: MB 580-239776/21-A
Matrix: Water
Analysis Batch: 239958

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 239776

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.0010		mg/L		03/06/17 10:03	03/07/17 11:31	1
Lead	ND		0.00040		mg/L		03/06/17 10:03	03/07/17 11:31	1

Lab Sample ID: LCS 580-239776/22-A
Matrix: Water
Analysis Batch: 239958

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 239776

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	4.00	4.05		mg/L		101	80 - 120
Lead	1.00	1.05		mg/L		105	80 - 120

Lab Sample ID: LCSD 580-239776/23-A
Matrix: Water
Analysis Batch: 239958

Client Sample ID: Lab Control Sample Dup
Prep Type: Total Recoverable
Prep Batch: 239776

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	4.00	3.99		mg/L		100	80 - 120	2	20
Lead	1.00	1.04		mg/L		104	80 - 120	1	20

Lab Chronicle

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66386-1

Client Sample ID: PP-SL-79-022717
Date Collected: 02/27/17 10:45
Date Received: 02/27/17 15:50

Lab Sample ID: 580-66386-1
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			239776	03/06/17 10:03	MKN	TAL SEA
Total Recoverable	Analysis	6020A		500	239958	03/07/17 13:24	FCW	TAL SEA

Laboratory References:

TAL SEA = TestAmerica Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

Certification Summary

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66386-1

Laboratory: TestAmerica Seattle

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Alaska (UST)	State Program	10	UST-022	03-02-18
California	State Program	9	2901	01-31-18
L-A-B	DoD ELAP		L2236	01-19-19
L-A-B	ISO/IEC 17025		L2236	01-19-19
Montana (UST)	State Program	8	N/A	04-30-20
Oregon	NELAP	10	WA100007	11-05-17
US Fish & Wildlife	Federal		LE058448-0	10-31-17
USDA	Federal		P330-14-00126	04-08-17
Washington	State Program	10	C553	02-17-18

Sample Summary

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66386-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
580-66386-1	PP-SL-79-022717	Water	02/27/17 10:45	02/27/17 15:50

66386

Chain of Custody Record

CHOC Number: 03_1.1_E52_40421_27022017

Send Results To:
munsons@uspioneer.com, jking@perc-nw.com, sduggan@perc-nw.com

Site Contact:
PIONEER Technologies Corporation
Brad Grimsted
Phone: (360) 570-1700 Email: grimstedb@uspioneer.com

PIONEER Technologies Corporation.
5205 Corporate Ctr. Court SE, Suite A
Lacey, WA 98503
Phone: 360.570.1700
Fax: 360.570.1777
www.uspioneer.com

Send Invoice To:
Pacific Environmental Redevelopment Coporation
Jeff King
Phone: 425-238-2212 Email: jking@perc-nw.com

Laboratory Information:
TestAmerica-Tacoma
ELAINE WALKER
Phone: 253.248.4972 Email:

CHOC Version: 0.99.05

Sample Information | **Analytes**

Sample ID (Auto Generated)	Date (MM/DD/YYYY)	Time (0000 to 2400)	Sampler's Initials	Leachate	Filtered	MS/MSD	Metals in Water								<== Special Lab Instructions
		Special Lab Instructions Included ==>													Comments for Sample
PP-SL-79-022717	02/27/2017	10:45	BG				X								Water from SL-79 excavation. A lot of si

TB___ Cooler IR5 Cor 13.4 w/o 14.6 Unc___
Cooler Dsc Med Blue @Lab___
Wet/Packs Packing___
cl: dro

Cooler (Yes/No): Cooler Temp:	Turnaround Time: Std	Hazard Identification:	Sample Disposal:	HNO3								
				Preservative								

Lab Use Only:

580-66386 Chain of Custody

These data are protected by Attorney/Client Privelege. No Un-Authorized distribution is allowed.

QA/QC Requirements:

Sampling Event Comments:
Analyze for total arsenic and lead

1. Relinquished By: (Sign and Print) Brad Grimsted	**Date/Time:** 2/27/17 3:50	**1. Received By:** (Sign and Print) Tom	**Date/Time:** 2/27/17 1550
2. Relinquished By: (Sign and Print)	**Date/Time:**	**2. Received By:** (Sign and Print)	**Date/Time:**
3. Relinquished By: (Sign and Print)	**Date/Time:**	**3. Received By:** (Sign and Print)	**Date/Time:**

Stat Form: 01 - 07/24/2015

Login Sample Receipt Checklist

Client: Pioneer Technologies Corporation

Job Number: 580-66386-1

Login Number: 66386
List Number: 1
Creator: Blankinship, Tom X

List Source: TestAmerica Seattle

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	Thermal preservation not required.
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	Required adjustment.
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Seattle
5755 8th Street East
Tacoma, WA 98424
Tel: (253)922-2310

TestAmerica Job ID: 580-66530-1
Client Project/Site: Superlon Metals Fractionation

For:
Pioneer Technologies Corporation
5205 Corporate Ctr. Ct. SE
Ste A
Olympia, Washington 98503

Attn: Brad Grimsted

M. Elaine Walker

Authorized for release by:
3/17/2017 2:06:06 PM

Elaine Walker, Project Manager II
(253)248-4972
elaine.walker@testamericainc.com

Table of Contents

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Job ID: 580-66530-1

Laboratory: TestAmerica Seattle

Narrative

Job Narrative
580-66530-1

Receipt
Eleven samples were received on 3/3/2017 3:40 PM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 14.7º C.

Receipt Exceptions

The reference method requires samples to be preserved to a pH of 2 or less. The following sample was received with insufficient preservation at a pH of more than 2: PP-SL 90-030317 (580-66530-3). The sample was preserved to the appropriate pH in the laboratory using Nitric Acid Lot# 0000133393:

The following samples were received at the laboratory outside the required temperature criteria: GW-MW-12S-030317 (580-66530-1), PP-Bld_B_Sample Ports-030317 (580-66530-2), PP-SL 90-030317 (580-66530-3), SO-SL-90-Pilot_bottom-030317-12-12.5 (580-66530-4), SO-SL-90-Pilot_Interfac-030317-8-9 (580-66530-5), WD-SL-79debris_a-030217 (580-66530-6), WD-SL-79debris_a-030217-(01) (580-66530-7), WD-SL-79debris_b-030217 (580-66530-8), WD-SL-79debris_b-030217-(01) (580-66530-9), WD-SL-79debris_c-030217 (580-66530-10) and WD-SL-79debris_c-030217-(01) (580-66530-11). There was no cooling media present in the cooler. As these are samples for metals analysis, the temperature guidance is not applicable.

Metals
Method(s) 6010C: The laboratory control sample duplicate (LCSD) for preparation batch 580-240133, 580-240133, 580-240204 and 580-240204 and analytical batch 580-240412 recovered outside control limits for the following analytes: Se. These analytes were biased high in the LCSD and were not detected in the associated samples; therefore, the data have been reported.

Method(s) 6010C: The continuing calibration verification (CCV) associated with batch 580-240412 recovered above the upper control limit for Se. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

General Chemistry
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Qualifiers

Metals

Qualifier	Qualifier Description
*	LCS or LCSD is outside acceptance limits.
^	ICV,CCV,ICB,CCB, ISA, ISB, CRI, CRA, DLCK or MRL standard: Instrument related QC is outside acceptance limits.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Client Sample Results

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: GW-MW-12S-030317
Date Collected: 03/03/17 01:15
Date Received: 03/03/17 15:40

Lab Sample ID: 580-66530-1
Matrix: Water

Method: 6020A - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	59		0.50		mg/L		03/13/17 10:51	03/16/17 08:33	500
Lead	0.046		0.0020		mg/L		03/13/17 10:51	03/13/17 18:59	5

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: PP-Bld_B_Sample Ports-030317
Date Collected: 03/03/17 01:40
Date Received: 03/03/17 15:40

Lab Sample ID: 580-66530-2
Matrix: Water

Method: 6020A - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	66		0.50		mg/L		03/13/17 10:51	03/16/17 08:38	500
Lead	0.70		0.0020		mg/L		03/13/17 10:51	03/13/17 19:04	5

Client Sample Results

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: PP-SL 90-030317
Date Collected: 03/03/17 11:30
Date Received: 03/03/17 15:40

Lab Sample ID: 580-66530-3
Matrix: Water

Method: 6020A - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	1.1		0.0050		mg/L		03/13/17 10:51	03/13/17 19:08	5
Lead	1.5		0.0020		mg/L		03/13/17 10:51	03/13/17 19:08	5

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: SO-SL-90-Pilot_bottom-030317-12-12.5 **Lab Sample ID: 580-66530-4**
Date Collected: 03/03/17 10:35 **Matrix: Solid**
Date Received: 03/03/17 15:40

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	99.6		0.1		%			03/10/17 11:20	1
Percent Moisture	0.4		0.1		%			03/10/17 11:20	1

Client Sample Results

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: SO-SL-90-Pilot_bottom-030317-12-12.5
Lab Sample ID: 580-66530-4
Date Collected: 03/03/17 10:35
Matrix: Solid
Date Received: 03/03/17 15:40
Percent Solids: 99.6

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	5.5		2.9		mg/Kg	☼	03/10/17 17:08	03/13/17 21:10	1
Lead	5.3		1.5		mg/Kg	☼	03/10/17 17:08	03/13/17 21:10	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: SO-SL-90-Pilot_Interfac-030317-8-9 **Lab Sample ID: 580-66530-5**
Date Collected: 03/03/17 11:15 **Matrix: Solid**
Date Received: 03/03/17 15:40

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	99.1		0.1		%			03/10/17 11:22	1
Percent Moisture	0.9		0.1		%			03/10/17 11:22	1

Client Sample Results

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: SO-SL-90-Pilot_Interfac-030317-8-9
Date Collected: 03/03/17 11:15
Date Received: 03/03/17 15:40

Lab Sample ID: 580-66530-5
Matrix: Solid
Percent Solids: 99.1

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	320		2.9		mg/Kg	☼	03/10/17 17:08	03/13/17 21:13	1
Lead	86		1.5		mg/Kg	☼	03/10/17 17:08	03/13/17 21:13	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: WD-SL-79debris_a-030217
Date Collected: 03/02/17 08:50
Date Received: 03/03/17 15:40

Lab Sample ID: 580-66530-6
Matrix: Solid

Method: 6010C - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**9.7**		0.060		mg/L		03/10/17 12:20	03/14/17 12:10	1
Barium	**0.31**		0.010		mg/L		03/10/17 12:20	03/13/17 17:06	1
Cadmium	ND		0.020		mg/L		03/10/17 12:20	03/13/17 17:06	1
Chromium	ND		0.025		mg/L		03/10/17 12:20	03/13/17 17:06	1
Lead	**2.7**		0.030		mg/L		03/10/17 12:20	03/13/17 17:06	1
Selenium	ND	* ^	0.10		mg/L		03/10/17 12:20	03/13/17 17:06	1
Silver	ND		0.050		mg/L		03/10/17 12:20	03/13/17 17:06	1

Method: 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020		mg/L		03/10/17 12:45	03/13/17 12:01	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**51.5**		0.1		%			03/15/17 16:39	1
Percent Moisture	**48.5**		0.1		%			03/15/17 16:39	1

Client Sample Results

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: WD-SL-79debris_a-030217
Date Collected: 03/02/17 08:50
Date Received: 03/03/17 15:40

Lab Sample ID: 580-66530-6
Matrix: Solid
Percent Solids: 51.5

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	10000		36		mg/Kg	☼	03/10/17 17:08	03/14/17 12:30	10
Lead	8200		18		mg/Kg	☼	03/10/17 17:08	03/14/17 12:30	10

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: WD-SL-79debris_a-030217-(01) — **Lab Sample ID: 580-66530-7**
Date Collected: 03/02/17 08:50 — **Matrix: Solid**
Date Received: 03/03/17 15:40

Method: 6010C - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**10**		0.060		mg/L		03/10/17 12:20	03/14/17 12:13	1
Barium	**0.30**		0.010		mg/L		03/10/17 12:20	03/13/17 17:10	1
Cadmium	ND		0.020		mg/L		03/10/17 12:20	03/13/17 17:10	1
Chromium	ND		0.025		mg/L		03/10/17 12:20	03/13/17 17:10	1
Lead	**2.7**		0.030		mg/L		03/10/17 12:20	03/13/17 17:10	1
Selenium	ND	* ^	0.10		mg/L		03/10/17 12:20	03/13/17 17:10	1
Silver	ND		0.050		mg/L		03/10/17 12:20	03/13/17 17:10	1

Method: 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020		mg/L		03/10/17 12:45	03/13/17 11:45	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**47.0**		0.1		%			03/10/17 11:22	1
Percent Moisture	**53.0**		0.1		%			03/10/17 11:22	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: WD-SL-79debris_a-030217-(01) — **Lab Sample ID: 580-66530-7**
Date Collected: 03/02/17 08:50 — **Matrix: Solid**
Date Received: 03/03/17 15:40 — **Percent Solids: 47.0**

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	4000		5.7		mg/Kg	☼	03/10/17 17:08	03/13/17 21:20	1
Lead	710		2.9		mg/Kg	☼	03/10/17 17:08	03/13/17 21:20	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: WD-SL-79debris_b-030217
Date Collected: 03/02/17 08:45
Date Received: 03/03/17 15:40

Lab Sample ID: 580-66530-8
Matrix: Solid

Method: 6010C - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**3.3**		0.060		mg/L		03/10/17 12:20	03/14/17 12:17	1
Barium	**0.49**		0.010		mg/L		03/10/17 12:20	03/13/17 17:13	1
Cadmium	ND		0.020		mg/L		03/10/17 12:20	03/13/17 17:13	1
Chromium	ND		0.025		mg/L		03/10/17 12:20	03/13/17 17:13	1
Lead	**2.9**		0.030		mg/L		03/10/17 12:20	03/13/17 17:13	1
Selenium	ND	* ^	0.10		mg/L		03/10/17 12:20	03/13/17 17:13	1
Silver	ND		0.050		mg/L		03/10/17 12:20	03/13/17 17:13	1

Method: 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020		mg/L		03/10/17 12:45	03/13/17 11:47	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**51.8**		0.1		%			03/10/17 11:22	1
Percent Moisture	**48.2**		0.1		%			03/10/17 11:22	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: WD-SL-79debris_b-030217
Date Collected: 03/02/17 08:45
Date Received: 03/03/17 15:40

Lab Sample ID: 580-66530-8
Matrix: Solid
Percent Solids: 51.8

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	3500		4.7		mg/Kg	☼	03/10/17 17:08	03/13/17 21:24	1
Lead	1200		2.4		mg/Kg	☼	03/10/17 17:08	03/13/17 21:24	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: WD-SL-79debris_b-030217-(01) — **Lab Sample ID: 580-66530-9**
Date Collected: 03/02/17 08:45 — **Matrix: Solid**
Date Received: 03/03/17 15:40

Method: 6010C - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**3.0**		0.060		mg/L		03/10/17 12:20	03/14/17 12:20	1
Barium	**0.45**		0.010		mg/L		03/10/17 12:20	03/13/17 17:16	1
Cadmium	ND		0.020		mg/L		03/10/17 12:20	03/13/17 17:16	1
Chromium	ND		0.025		mg/L		03/10/17 12:20	03/13/17 17:16	1
Lead	**1.8**		0.030		mg/L		03/10/17 12:20	03/13/17 17:16	1
Selenium	ND	* ^	0.10		mg/L		03/10/17 12:20	03/13/17 17:16	1
Silver	ND		0.050		mg/L		03/10/17 12:20	03/13/17 17:16	1

Method: 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020		mg/L		03/10/17 12:45	03/13/17 11:49	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**51.2**		0.1		%			03/10/17 11:55	1
Percent Moisture	**48.8**		0.1		%			03/10/17 11:55	1

Client Sample Results

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: WD-SL-79debris_b-030217-(01)
Date Collected: 03/02/17 08:45
Date Received: 03/03/17 15:40

Lab Sample ID: 580-66530-9
Matrix: Solid
Percent Solids: 51.2

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	4500		45		mg/Kg	☼	03/10/17 17:08	03/14/17 12:33	10
Lead	710		2.2		mg/Kg	☼	03/10/17 17:08	03/13/17 21:28	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: WD-SL-79debris_c-030217
Date Collected: 03/02/17 08:35
Date Received: 03/03/17 15:40

Lab Sample ID: 580-66530-10
Matrix: Solid

Method: 6010C - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**7.4**		0.060		mg/L		03/10/17 12:20	03/14/17 12:23	1
Barium	**0.056**		0.010		mg/L		03/10/17 12:20	03/13/17 17:20	1
Cadmium	ND		0.020		mg/L		03/10/17 12:20	03/13/17 17:20	1
Chromium	ND		0.025		mg/L		03/10/17 12:20	03/13/17 17:20	1
Lead	**1.7**		0.030		mg/L		03/10/17 12:20	03/13/17 17:20	1
Selenium	ND	* ^	0.10		mg/L		03/10/17 12:20	03/13/17 17:20	1
Silver	ND		0.050		mg/L		03/10/17 12:20	03/13/17 17:20	1

Method: 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020		mg/L		03/10/17 12:45	03/13/17 11:56	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**46.2**		0.1		%			03/10/17 11:55	1
Percent Moisture	**53.8**		0.1		%			03/10/17 11:55	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: WD-SL-79debris_c-030217
Date Collected: 03/02/17 08:35
Date Received: 03/03/17 15:40

Lab Sample ID: 580-66530-10
Matrix: Solid
Percent Solids: 46.2

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	3800		5.6		mg/Kg	☼	03/10/17 17:08	03/13/17 21:31	1
Lead	900		2.8		mg/Kg	☼	03/10/17 17:08	03/13/17 21:31	1

Client Sample ID: WD-SL-79debris_c-030217-(01) **Lab Sample ID: 580-66530-11**
Date Collected: 03/02/17 08:35 **Matrix: Solid**
Date Received: 03/03/17 15:40

Method: 6010C - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**7.8**		0.060		mg/L		03/10/17 12:20	03/14/17 12:27	1
Barium	**0.097**		0.010		mg/L		03/10/17 12:20	03/13/17 17:23	1
Cadmium	ND		0.020		mg/L		03/10/17 12:20	03/13/17 17:23	1
Chromium	ND		0.025		mg/L		03/10/17 12:20	03/13/17 17:23	1
Lead	**0.87**		0.030		mg/L		03/10/17 12:20	03/13/17 17:23	1
Selenium	ND	* ^	0.10		mg/L		03/10/17 12:20	03/13/17 17:23	1
Silver	ND		0.050		mg/L		03/10/17 12:20	03/13/17 17:23	1

Method: 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020		mg/L		03/10/17 12:45	03/13/17 11:58	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	**45.4**		0.1		%			03/10/17 11:55	1
Percent Moisture	**54.6**		0.1		%			03/10/17 11:55	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: WD-SL-79debris_c-030217-(01) — **Lab Sample ID: 580-66530-11**
Date Collected: 03/02/17 08:35 — **Matrix: Solid**
Date Received: 03/03/17 15:40 — **Percent Solids: 45.4**

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	3600		6.4		mg/Kg	☼	03/10/17 17:08	03/13/17 21:35	1
Lead	430		3.2		mg/Kg	☼	03/10/17 17:08	03/13/17 21:35	1

Method: 6010C - Metals (ICP)

Lab Sample ID: MB 580-240266/20-A
Matrix: Solid
Analysis Batch: 240412

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 240266

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		3.0		mg/Kg		03/10/17 17:08	03/13/17 20:06	1
Lead	ND		1.5		mg/Kg		03/10/17 17:08	03/13/17 20:06	1

Lab Sample ID: LCS 580-240266/21-A
Matrix: Solid
Analysis Batch: 240412

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 240266

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	200	205		mg/Kg		103	80 - 120
Lead	50.0	52.1		mg/Kg		104	80 - 120

Lab Sample ID: LCSD 580-240266/22-A
Matrix: Solid
Analysis Batch: 240412

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 240266

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	200	212		mg/Kg		106	80 - 120	3	20
Lead	50.0	53.8		mg/Kg		108	80 - 120	3	20

Lab Sample ID: LCSSRM 580-240266/23-A
Matrix: Solid
Analysis Batch: 240412

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 240266

Analyte	Spike Added	LCSSRM Result	LCSSRM Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	139	141		mg/Kg		101.6	70.4 - 140.3
Lead	133	144		mg/Kg		108.0	72.9 - 127.8

Lab Sample ID: MB 580-240133/1-C
Matrix: Solid
Analysis Batch: 240412

Client Sample ID: Method Blank
Prep Type: TCLP
Prep Batch: 240204

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.060		mg/L		03/10/17 12:20	03/13/17 16:30	1
Barium	ND		0.010		mg/L		03/10/17 12:20	03/13/17 16:30	1
Cadmium	ND		0.020		mg/L		03/10/17 12:20	03/13/17 16:30	1
Chromium	ND		0.025		mg/L		03/10/17 12:20	03/13/17 16:30	1
Lead	ND		0.030		mg/L		03/10/17 12:20	03/13/17 16:30	1
Selenium	ND		0.10		mg/L		03/10/17 12:20	03/13/17 16:30	1
Silver	ND		0.050		mg/L		03/10/17 12:20	03/13/17 16:30	1

Lab Sample ID: MB 580-240133/1-C
Matrix: Solid
Analysis Batch: 240447

Client Sample ID: Method Blank
Prep Type: TCLP
Prep Batch: 240204

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.060		mg/L		03/10/17 12:20	03/14/17 11:34	1

Method: 6010C - Metals (ICP) (Continued)

Lab Sample ID: LCS 580-240133/2-C
Matrix: Solid
Analysis Batch: 240412

Client Sample ID: Lab Control Sample
Prep Type: TCLP
Prep Batch: 240204

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	4.00	4.42		mg/L		110	80 - 120
Barium	4.00	4.00		mg/L		100	80 - 120
Cadmium	0.100	0.104		mg/L		104	80 - 120
Chromium	0.400	0.360		mg/L		90	80 - 120
Lead	1.00	0.970		mg/L		97	80 - 120
Selenium	4.00	4.65		mg/L		116	80 - 120
Silver	0.600	0.589		mg/L		98	80 - 120

Lab Sample ID: LCS 580-240133/2-C
Matrix: Solid
Analysis Batch: 240447

Client Sample ID: Lab Control Sample
Prep Type: TCLP
Prep Batch: 240204

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	4.00	4.34		mg/L		108	80 - 120

Lab Sample ID: LCSD 580-240133/3-C
Matrix: Solid
Analysis Batch: 240412

Client Sample ID: Lab Control Sample Dup
Prep Type: TCLP
Prep Batch: 240204

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Barium	4.00	4.41		mg/L		110	80 - 120	10	20
Cadmium	0.100	0.114		mg/L		114	80 - 120	9	20
Chromium	0.400	0.398		mg/L		100	80 - 120	10	20
Lead	1.00	1.05		mg/L		105	80 - 120	8	20
Selenium	4.00	5.22	*	mg/L		131	80 - 120	12	20
Silver	0.600	0.653		mg/L		109	80 - 120	10	20

Lab Sample ID: LCSD 580-240133/3-C
Matrix: Solid
Analysis Batch: 240447

Client Sample ID: Lab Control Sample Dup
Prep Type: TCLP
Prep Batch: 240204

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	4.00	4.26		mg/L		106	80 - 120	2	20

Method: 6020A - Metals (ICP/MS)

Lab Sample ID: MB 580-240321/16-A
Matrix: Water
Analysis Batch: 240426

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 240321

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.0010		mg/L		03/13/17 10:51	03/13/17 17:02	1
Lead	ND		0.00040		mg/L		03/13/17 10:51	03/13/17 17:02	1

Method: 6020A - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 580-240321/17-A
Matrix: Water
Analysis Batch: 240426

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 240321

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	4.00	3.96		mg/L		99	80 - 120
Lead	1.00	0.960		mg/L		96	80 - 120

Lab Sample ID: LCSD 580-240321/18-A
Matrix: Water
Analysis Batch: 240426

Client Sample ID: Lab Control Sample Dup
Prep Type: Total Recoverable
Prep Batch: 240321

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	4.00	4.01		mg/L		100	80 - 120	1	20
Lead	1.00	0.967		mg/L		97	80 - 120	1	20

Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 580-240133/1-D
Matrix: Solid
Analysis Batch: 240341

Client Sample ID: Method Blank
Prep Type: TCLP
Prep Batch: 240209

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020		mg/L		03/10/17 12:45	03/13/17 11:23	1

Lab Sample ID: LCS 580-240133/2-D
Matrix: Solid
Analysis Batch: 240341

Client Sample ID: Lab Control Sample
Prep Type: TCLP
Prep Batch: 240209

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.0200	0.0216		mg/L		108	80 - 120

Lab Sample ID: LCSD 580-240133/3-D
Matrix: Solid
Analysis Batch: 240341

Client Sample ID: Lab Control Sample Dup
Prep Type: TCLP
Prep Batch: 240209

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	0.0200	0.0215		mg/L		107	80 - 120	1	20

Lab Chronicle

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: GW-MW-12S-030317 — Lab Sample ID: 580-66530-1

Date Collected: 03/03/17 01:15 — **Matrix: Water**
Date Received: 03/03/17 15:40

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			240321	03/13/17 10:51	ADB	TAL SEA
Total Recoverable	Analysis	6020A		5	240426	03/13/17 18:59	HJM	TAL SEA
Total Recoverable	Prep	3005A			240321	03/13/17 10:51	ADB	TAL SEA
Total Recoverable	Analysis	6020A		500	240691	03/16/17 08:33	FCW	TAL SEA

Client Sample ID: PP-Bld_B_Sample Ports-030317 — Lab Sample ID: 580-66530-2

Date Collected: 03/03/17 01:40 — **Matrix: Water**
Date Received: 03/03/17 15:40

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			240321	03/13/17 10:51	ADB	TAL SEA
Total Recoverable	Analysis	6020A		5	240426	03/13/17 19:04	HJM	TAL SEA
Total Recoverable	Prep	3005A			240321	03/13/17 10:51	ADB	TAL SEA
Total Recoverable	Analysis	6020A		500	240691	03/16/17 08:38	FCW	TAL SEA

Client Sample ID: PP-SL 90-030317 — Lab Sample ID: 580-66530-3

Date Collected: 03/03/17 11:30 — **Matrix: Water**
Date Received: 03/03/17 15:40

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			240321	03/13/17 10:51	ADB	TAL SEA
Total Recoverable	Analysis	6020A		5	240426	03/13/17 19:08	HJM	TAL SEA

Client Sample ID: SO-SL-90-Pilot_bottom-030317-12-12.5 — Lab Sample ID: 580-66530-4

Date Collected: 03/03/17 10:35 — **Matrix: Solid**
Date Received: 03/03/17 15:40

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D 2216		1	240182	03/10/17 11:20	DSO	TAL SEA

Client Sample ID: SO-SL-90-Pilot_bottom-030317-12-12.5 — Lab Sample ID: 580-66530-4

Date Collected: 03/03/17 10:35 — **Matrix: Solid**
Date Received: 03/03/17 15:40 — **Percent Solids: 99.6**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			240266	03/10/17 17:08	PAB	TAL SEA
Total/NA	Analysis	6010C		1	240412	03/13/17 21:10	HJM	TAL SEA

Client Sample ID: SO-SL-90-Pilot_Interfac-030317-8-9
Lab Sample ID: 580-66530-5
Date Collected: 03/03/17 11:15
Matrix: Solid
Date Received: 03/03/17 15:40

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	D 2216		1	240182	03/10/17 11:22	DSO	TAL SEA

Client Sample ID: SO-SL-90-Pilot_Interfac-030317-8-9
Lab Sample ID: 580-66530-5
Date Collected: 03/03/17 11:15
Matrix: Solid
Date Received: 03/03/17 15:40
Percent Solids: 99.1

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			240266	03/10/17 17:08	PAB	TAL SEA
Total/NA	Analysis	6010C		1	240412	03/13/17 21:13	HJM	TAL SEA

Client Sample ID: WD-SL-79debris_a-030217
Lab Sample ID: 580-66530-6
Date Collected: 03/02/17 08:50
Matrix: Solid
Date Received: 03/03/17 15:40

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
TCLP	Leach	1311			240133	03/09/17 14:32	R1K	TAL SEA
TCLP	Prep	3010A			240204	03/10/17 12:20	PAB	TAL SEA
TCLP	Analysis	6010C		1	240412	03/13/17 17:06	HJM	TAL SEA
TCLP	Leach	1311			240133	03/09/17 14:32	R1K	TAL SEA
TCLP	Prep	3010A			240204	03/10/17 12:20	PAB	TAL SEA
TCLP	Analysis	6010C		1	240447	03/14/17 12:10	HJM	TAL SEA
TCLP	Leach	1311			240133	03/09/17 14:32	R1K	TAL SEA
TCLP	Prep	7470A			240209	03/10/17 12:45	PAB	TAL SEA
TCLP	Analysis	7470A		1	240341	03/13/17 12:01	FCW	TAL SEA
Total/NA	Analysis	D 2216		1	240630	03/15/17 16:39	Y1W	TAL SEA

Client Sample ID: WD-SL-79debris_a-030217
Lab Sample ID: 580-66530-6
Date Collected: 03/02/17 08:50
Matrix: Solid
Date Received: 03/03/17 15:40
Percent Solids: 51.5

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			240266	03/10/17 17:08	PAB	TAL SEA
Total/NA	Analysis	6010C		10	240447	03/14/17 12:30	HJM	TAL SEA

Client Sample ID: WD-SL-79debris_a-030217-(01)
Lab Sample ID: 580-66530-7
Date Collected: 03/02/17 08:50
Matrix: Solid
Date Received: 03/03/17 15:40

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
TCLP	Leach	1311			240133	03/09/17 14:32	R1K	TAL SEA
TCLP	Prep	3010A			240204	03/10/17 12:20	PAB	TAL SEA
TCLP	Analysis	6010C		1	240412	03/13/17 17:10	HJM	TAL SEA
TCLP	Leach	1311			240133	03/09/17 14:32	R1K	TAL SEA

Lab Chronicle

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: WD-SL-79debris_a-030217-(01)

Lab Sample ID: 580-66530-7
Date Collected: 03/02/17 08:50
Matrix: Solid
Date Received: 03/03/17 15:40

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
TCLP	Prep	3010A			240204	03/10/17 12:20	PAB	TAL SEA
TCLP	Analysis	6010C		1	240447	03/14/17 12:13	HJM	TAL SEA
TCLP	Leach	1311			240133	03/09/17 14:32	R1K	TAL SEA
TCLP	Prep	7470A			240209	03/10/17 12:45	PAB	TAL SEA
TCLP	Analysis	7470A		1	240341	03/13/17 11:45	FCW	TAL SEA
Total/NA	Analysis	D 2216		1	240182	03/10/17 11:22	DSO	TAL SEA

Client Sample ID: WD-SL-79debris_a-030217-(01)

Lab Sample ID: 580-66530-7
Date Collected: 03/02/17 08:50
Matrix: Solid
Date Received: 03/03/17 15:40
Percent Solids: 47.0

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			240266	03/10/17 17:08	PAB	TAL SEA
Total/NA	Analysis	6010C		1	240412	03/13/17 21:20	HJM	TAL SEA

Client Sample ID: WD-SL-79debris_b-030217

Lab Sample ID: 580-66530-8
Date Collected: 03/02/17 08:45
Matrix: Solid
Date Received: 03/03/17 15:40

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
TCLP	Leach	1311			240133	03/09/17 14:32	R1K	TAL SEA
TCLP	Prep	3010A			240204	03/10/17 12:20	PAB	TAL SEA
TCLP	Analysis	6010C		1	240412	03/13/17 17:13	HJM	TAL SEA
TCLP	Leach	1311			240133	03/09/17 14:32	R1K	TAL SEA
TCLP	Prep	3010A			240204	03/10/17 12:20	PAB	TAL SEA
TCLP	Analysis	6010C		1	240447	03/14/17 12:17	HJM	TAL SEA
TCLP	Leach	1311			240133	03/09/17 14:32	R1K	TAL SEA
TCLP	Prep	7470A			240209	03/10/17 12:45	PAB	TAL SEA
TCLP	Analysis	7470A		1	240341	03/13/17 11:47	FCW	TAL SEA
Total/NA	Analysis	D 2216		1	240182	03/10/17 11:22	DSO	TAL SEA

Client Sample ID: WD-SL-79debris_b-030217

Lab Sample ID: 580-66530-8
Date Collected: 03/02/17 08:45
Matrix: Solid
Date Received: 03/03/17 15:40
Percent Solids: 51.8

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			240266	03/10/17 17:08	PAB	TAL SEA
Total/NA	Analysis	6010C		1	240412	03/13/17 21:24	HJM	TAL SEA

Client Sample ID: WD-SL-79debris_b-030217-(01)

Lab Sample ID: 580-66530-9

Date Collected: 03/02/17 08:45

Matrix: Solid

Date Received: 03/03/17 15:40

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
TCLP	Leach	1311			240133	03/09/17 14:32	R1K	TAL SEA
TCLP	Prep	3010A			240204	03/10/17 12:20	PAB	TAL SEA
TCLP	Analysis	6010C		1	240412	03/13/17 17:16	HJM	TAL SEA
TCLP	Leach	1311			240133	03/09/17 14:32	R1K	TAL SEA
TCLP	Prep	3010A			240204	03/10/17 12:20	PAB	TAL SEA
TCLP	Analysis	6010C		1	240447	03/14/17 12:20	HJM	TAL SEA
TCLP	Leach	1311			240133	03/09/17 14:32	R1K	TAL SEA
TCLP	Prep	7470A			240209	03/10/17 12:45	PAB	TAL SEA
TCLP	Analysis	7470A		1	240341	03/13/17 11:49	FCW	TAL SEA
Total/NA	Analysis	D 2216		1	240182	03/10/17 11:55	DSO	TAL SEA

Client Sample ID: WD-SL-79debris_b-030217-(01)

Lab Sample ID: 580-66530-9

Date Collected: 03/02/17 08:45

Matrix: Solid

Date Received: 03/03/17 15:40

Percent Solids: 51.2

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			240266	03/10/17 17:08	PAB	TAL SEA
Total/NA	Analysis	6010C		1	240412	03/13/17 21:28	HJM	TAL SEA
Total/NA	Prep	3050B			240266	03/10/17 17:08	PAB	TAL SEA
Total/NA	Analysis	6010C		10	240447	03/14/17 12:33	HJM	TAL SEA

Client Sample ID: WD-SL-79debris_c-030217

Lab Sample ID: 580-66530-10

Date Collected: 03/02/17 08:35

Matrix: Solid

Date Received: 03/03/17 15:40

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
TCLP	Leach	1311			240133	03/09/17 14:32	R1K	TAL SEA
TCLP	Prep	3010A			240204	03/10/17 12:20	PAB	TAL SEA
TCLP	Analysis	6010C		1	240412	03/13/17 17:20	HJM	TAL SEA
TCLP	Leach	1311			240133	03/09/17 14:32	R1K	TAL SEA
TCLP	Prep	3010A			240204	03/10/17 12:20	PAB	TAL SEA
TCLP	Analysis	6010C		1	240447	03/14/17 12:23	HJM	TAL SEA
TCLP	Leach	1311			240133	03/09/17 14:32	R1K	TAL SEA
TCLP	Prep	7470A			240209	03/10/17 12:45	PAB	TAL SEA
TCLP	Analysis	7470A		1	240341	03/13/17 11:56	FCW	TAL SEA
Total/NA	Analysis	D 2216		1	240182	03/10/17 11:55	DSO	TAL SEA

Client Sample ID: WD-SL-79debris_c-030217

Lab Sample ID: 580-66530-10

Date Collected: 03/02/17 08:35

Matrix: Solid

Date Received: 03/03/17 15:40

Percent Solids: 46.2

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			240266	03/10/17 17:08	PAB	TAL SEA
Total/NA	Analysis	6010C		1	240412	03/13/17 21:31	HJM	TAL SEA

Lab Chronicle

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Client Sample ID: WD-SL-79debris_c-030217-(01)

Lab Sample ID: 580-66530-11

Date Collected: 03/02/17 08:35

Matrix: Solid

Date Received: 03/03/17 15:40

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
TCLP	Leach	1311			240133	03/09/17 14:32	R1K	TAL SEA
TCLP	Prep	3010A			240204	03/10/17 12:20	PAB	TAL SEA
TCLP	Analysis	6010C		1	240412	03/13/17 17:23	HJM	TAL SEA
TCLP	Leach	1311			240133	03/09/17 14:32	R1K	TAL SEA
TCLP	Prep	3010A			240204	03/10/17 12:20	PAB	TAL SEA
TCLP	Analysis	6010C		1	240447	03/14/17 12:27	HJM	TAL SEA
TCLP	Leach	1311			240133	03/09/17 14:32	R1K	TAL SEA
TCLP	Prep	7470A			240209	03/10/17 12:45	PAB	TAL SEA
TCLP	Analysis	7470A		1	240341	03/13/17 11:58	FCW	TAL SEA
Total/NA	Analysis	D 2216		1	240182	03/10/17 11:55	DSO	TAL SEA

Client Sample ID: WD-SL-79debris_c-030217-(01)

Lab Sample ID: 580-66530-11

Date Collected: 03/02/17 08:35

Matrix: Solid

Date Received: 03/03/17 15:40

Percent Solids: 45.4

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			240266	03/10/17 17:08	PAB	TAL SEA
Total/NA	Analysis	6010C		1	240412	03/13/17 21:35	HJM	TAL SEA

Laboratory References:

TAL SEA = TestAmerica Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

Certification Summary

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Laboratory: TestAmerica Seattle

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Alaska (UST)	State Program	10	UST-022	03-02-18
California	State Program	9	2901	01-31-18
L-A-B	DoD ELAP		L2236	01-19-19
L-A-B	ISO/IEC 17025		L2236	01-19-19
Montana (UST)	State Program	8	N/A	04-30-20
Oregon	NELAP	10	WA100007	11-05-17
US Fish & Wildlife	Federal		LE058448-0	10-31-17
USDA	Federal		P330-14-00126	04-08-17
Washington	State Program	10	C553	02-17-18

Sample Summary

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66530-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
580-66530-1	GW-MW-12S-030317	Water	03/03/17 01:15	03/03/17 15:40
580-66530-2	PP-Bld_B_Sample Ports-030317	Water	03/03/17 01:40	03/03/17 15:40
580-66530-3	PP-SL 90-030317	Water	03/03/17 11:30	03/03/17 15:40
580-66530-4	SO-SL-90-Pilot_bottom-030317-12-12.5	Solid	03/03/17 10:35	03/03/17 15:40
580-66530-5	SO-SL-90-Pilot_Interfac-030317-8-9	Solid	03/03/17 11:15	03/03/17 15:40
580-66530-6	WD-SL-79debris_a-030217	Solid	03/02/17 08:50	03/03/17 15:40
580-66530-7	WD-SL-79debris_a-030217-(01)	Solid	03/02/17 08:50	03/03/17 15:40
580-66530-8	WD-SL-79debris_b-030217	Solid	03/02/17 08:45	03/03/17 15:40
580-66530-9	WD-SL-79debris_b-030217-(01)	Solid	03/02/17 08:45	03/03/17 15:40
580-66530-10	WD-SL-79debris_c-030217	Solid	03/02/17 08:35	03/03/17 15:40
580-66530-11	WD-SL-79debris_c-030217-(01)	Solid	03/02/17 08:35	03/03/17 15:40

Loc: 580
66530

Chain of Custody Record

CHOC Number: 05_1.1_E52_19868_03032017

Send Results To:
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Lacey, WA 98503
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Send Invoice To:
Pacific Environmental Redevelopment Coporation
Jeff King
Phone: 425-238-2212 Email: jking@perc-nw.com

Laboratory Information:
TestAmerica-Tacoma
ELAINE WALKER
Phone: 253.248.4972 Email:

CHOC Version: 0.99.05

Sample Information | **Analytes**

Special Lab Instructions Included ==>

Sample ID (Auto Generated)	Date (MM/DD/YYYY)	Time (0000 to 2400)	Sampler's Initials	Leachate	Filtered	MS/MSD	EPA 6010C--Inorganic	Metals in Water	TCLP RCRA 8 Metals					<== Special Lab Instructions / Comments for Sample
									X					
GW-MW-12S-030317	03/03/2017	01:15	BG					X						Water from MW-12S
PP-Bld_B_Sample Ports-030317	03/03/2017	01:40	BG					X						
PP-SL-90-030317	03/03/2017	11:30	BG					X						Water from Pilot SL-90 Excavation
~~SO-SL-79-022717-13~~	~~02/27/2017~~	~~00:00~~	~~BG~~				~~X~~							~~Pilot Study - Sample from bottom of SL~~
SO-SL-90-Pilot_bottom-030317-12-12.5	03/03/2017	10:35	BG				X							
SO-SL-90-Pilot_Interfac-030317-8-9	03/03/2017	11:15	BG				X							
WD-SL-79debris_a-030217	03/02/2017	08:50	BG				X		X					
WD-SL-79debris_a-030217-(01)	03/02/2017	08:50	BG				X		X					
WD-SL-79debris_b-030217	03/02/2017	08:45	BG				X		X					
WD-SL-79debris_b-030217-(01)	03/02/2017	08:45	BG				X		X					
WD-SL-79debris_c-030217	03/02/2017	08:35	BG				X		X					
WD-SL-79debris_c-030217-(01)	03/02/2017	08:35	BG				X		X					
Cooler (Yes/No): Cooler Temp:	**Turnaround Time:** Std	**Hazard Identification:**	**Sample Disposal:**				None	HNO3	None					**Lab Use Only:**
							Preservative							

TB Cooler IR5 Cor 14.7 Unc 14.9
Cooler Dsc Med. blue unk @ Lab
~~Wet/Packs~~ Packing none
none
Cli drop w/o CS

These data are protected by Attorney/Client Privelege. No Un-Authorized distribution is allowed.

QA/QC Requirements:

Sampling Event Comments:

1. Relinquished By: (Sign and Print) BRAD Grimsted	**Date/Time:** 3/3/17 3:40	**1. Received By:** (Sign and Print)	**Date/Time:** 3/3/17 1540
2. Relinquished By: (Sign and Print)	**Date/Time:**	**2. Received By:** (Sign and Print)	**Date/Time:**
	Date/Time:	**3. Received By:** (Sign and Print)	**Date/Time:**

580-66530 Chain of Custody

Stat Form: 01 - 07/24/2015

Special Instructions for Laboratory

CHOC Number: 05_1.1_E52_19868_03032017

Send Results To: munsons@uspioneer.com, jking@perc-nw.com, sduggan@perc-nw.com	**Site Contact:** PIONEER Technologies Corporation Brad Grimsted Phone: (360) 570-1700 Email: grimstedb@uspioneer.com	PIONEER Technologies Corporation 5205 Corporate Ctr. Court SE, Suite A Lacey, WA 98503 Phone: 360.570.1700 Fax: 360.570.1777 PIONEER TECHNOLOGIES CORPORATION
Send Invoice To: Pacific Environmental Redevelopment Coporation Jeff King Phone: 425-238-2212 Email: jking@perc-nw.com	**Laboratory Information:** TestAmerica-Tacoma ELAINE WALKER Phone: 253.248.4972 Email:	CHOC Version: 0.99.05

Analytical Method	Lab Comments	Specified Analyte	Samples Included
EPA 6010C--Inorganic		Arsenic Inorganic Lead and Compounds	SO-SL-79-022717-15 WD-SL-79debris_a-030217 WD-SL-79debris_a-030217-(01) WD-SL-79debris_b-030217 WD-SL-79debris_b-030217-(01) WD-SL-79debris_c-030217 WD-SL-79debris_c-030217-(01) SO-SL-90-Pilot_bottom-030317-12-12.5 SO-SL-90-Pilot_Interfac-030317-8-9
TCLP RCRA 8 Metals	All 8 metals	Arsenic Inorganic Barium Chromium Total Lead and Compounds Mercury (elemental) Selenium Silver Cadmium	WD-SL-79debris_a-030217 WD-SL-79debris_a-030217-(01) WD-SL-79debris_b-030217 WD-SL-79debris_b-030217-(01) WD-SL-79debris_c-030217 WD-SL-79debris_c-030217-(01)
Metals in Water		Arsenic Inorganic Lead and Compounds	PP-SL-90-030317 PP-Bld_B_Sample Ports-030317 GW-MW-12S-030317

Login Sample Receipt Checklist

Client: Pioneer Technologies Corporation

Job Number: 580-66530-1

Login Number: 66530
List Number: 1
Creator: Gonzales, Steve

List Source: TestAmerica Seattle

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	No ice
Cooler Temperature is acceptable.	False	Cooler temperature outside required temperature criteria.
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	False	Not requested on COC.
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	pH adjusted
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Seattle
5755 8th Street East
Tacoma, WA 98424
Tel: (253)922-2310

TestAmerica Job ID: 580-66905-1
Client Project/Site: Superlon Metals Fractionation

For:
Pioneer Technologies Corporation
5205 Corporate Ctr. Ct. SE
Ste A
Olympia, Washington 98503

Attn: Brad Grimsted

Kristine D. Allen

Authorized for release by:
3/29/2017 3:18:47 PM
Kristine Allen, Manager of Project Management
(253)248-4970
kristine.allen@testamericainc.com

Designee for

Elaine Walker, Project Manager II
(253)248-4972
elaine.walker@testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Job ID: 580-66905-1

Laboratory: TestAmerica Seattle

Narrative

Job Narrative
580-66905-1

Comments
No additional comments.

Receipt
The samples were received on 3/22/2017 10:10 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 8.1° C.

Metals
Method(s) 6020A: The following samples was diluted due to the nature of the sample matrix: PP-BLD_B-PM-PT-032217 (580-66905-4), PP-MW-12i-PM-PT-032217 (580-66905-7), PP-SL-79-PM-PT-032217 (580-66905-10) and PP-SL-90-PM-PT-032217 (580-66905-13). Elevated reporting limits (RLs) are provided.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

General Chemistry
Method(s) 150.1, 9045D: The sample duplicate (DUP) precision for analytical batch 580-241403 was outside control limits. Sample matrix interference is suspected.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66905-1

Qualifiers

General Chemistry

Qualifier	Qualifier Description
HF	Field parameter with a holding time of 15 minutes. Test performed by laboratory at client's request.
F3	Duplicate RPD exceeds the control limit

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66905-1

Client Sample ID: PP-BLD_B-Freeflow-PT-032217
Lab Sample ID: 580-66905-1
Date Collected: 03/22/17 08:30
Matrix: Water
Date Received: 03/22/17 10:10

Method: 6020A - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.091**		0.0050	0.0014	mg/L		03/24/17 16:46	03/28/17 13:11	5
Lead	ND		0.0020	0.00017	mg/L		03/24/17 16:46	03/28/17 13:11	5

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**7.2**	**HF**			SU			03/27/17 09:34	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66905-1

Client Sample ID: PP-BLD_B-MFIX-PT-032217
Date Collected: 03/22/17 08:30
Date Received: 03/22/17 10:10

Lab Sample ID: 580-66905-2
Matrix: Water

Method: 6020A - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**1.5**		0.0050	0.0014	mg/L		03/24/17 16:46	03/28/17 13:29	5
Lead	ND		0.0020	0.00017	mg/L		03/24/17 16:46	03/28/17 13:29	5

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**7.3**	**HF**			SU			03/27/17 09:37	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66905-1

Client Sample ID: PP-BLD_B-MFIX-PT-032217-(01) — **Lab Sample ID: 580-66905-3**
Date Collected: 03/22/17 08:30 — **Matrix: Water**
Date Received: 03/22/17 10:10

Method: 6020A - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**1.4**		0.0050	0.0014	mg/L		03/24/17 16:46	03/28/17 13:34	5
Lead	ND		0.0020	0.00017	mg/L		03/24/17 16:46	03/28/17 13:34	5

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**7.3**	**HF**			SU			03/27/17 09:39	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66905-1

Client Sample ID: PP-BLD_B-PM-PT-032217
Lab Sample ID: 580-66905-4
Date Collected: 03/22/17 08:30
Matrix: Water
Date Received: 03/22/17 10:10

Method: 6020A - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.61**		0.10	0.027	mg/L		03/24/17 16:46	03/27/17 19:56	100
Lead	ND		0.040	0.0034	mg/L		03/24/17 16:46	03/27/17 19:56	100

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**4.2**	**HF**			SU			03/27/17 09:41	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66905-1

Client Sample ID: PP-MW-12i-Freeflow-PT-032217
Lab Sample ID: 580-66905-5
Date Collected: 03/22/17 08:30
Matrix: Water
Date Received: 03/22/17 10:10

Method: 6020A - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.12**		0.0050	0.0014	mg/L		03/24/17 16:46	03/28/17 13:25	5
Lead	ND		0.0020	0.00017	mg/L		03/24/17 16:46	03/28/17 13:25	5

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**7.1**	**HF**			SU			03/27/17 09:44	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66905-1

Client Sample ID: PP-MW-12i-MFIX-PT-032217
Lab Sample ID: 580-66905-6
Date Collected: 03/22/17 08:30
Matrix: Water
Date Received: 03/22/17 10:10

Method: 6020A - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**3.0**		0.0050	0.0014	mg/L		03/24/17 16:46	03/28/17 13:38	5
Lead	ND		0.0020	0.00017	mg/L		03/24/17 16:46	03/28/17 13:38	5

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**7.6**	**HF**			SU			03/27/17 09:46	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66905-1

Client Sample ID: PP-MW-12i-PM-PT-032217
Lab Sample ID: 580-66905-7
Date Collected: 03/22/17 08:45
Matrix: Water
Date Received: 03/22/17 10:10

Method: 6020A - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**4.2**		0.10	0.027	mg/L		03/24/17 16:46	03/27/17 19:52	100
Lead	ND		0.040	0.0034	mg/L		03/24/17 16:46	03/27/17 19:52	100

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**3.9**	**HF**			SU			03/27/17 09:48	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66905-1

Client Sample ID: PP-SL-79-Freeflow-PT-032217
Lab Sample ID: 580-66905-8
Date Collected: 03/22/17 08:45
Matrix: Water
Date Received: 03/22/17 10:10

Method: 6020A - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	4.4		0.0050	0.0014	mg/L		03/24/17 16:46	03/28/17 13:43	5
Lead	0.0036		0.0020	0.00017	mg/L		03/24/17 16:46	03/28/17 13:43	5

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.0	HF			SU			03/27/17 09:50	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66905-1

Client Sample ID: PP-SL-79-MFIX-PT-032217
Date Collected: 03/22/17 08:45
Date Received: 03/22/17 10:10

Lab Sample ID: 580-66905-9
Matrix: Water

Method: 6020A - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	11		0.0050	0.0014	mg/L		03/24/17 16:46	03/28/17 13:47	5
Lead	0.0070		0.0020	0.00017	mg/L		03/24/17 16:46	03/28/17 13:47	5

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.3	HF			SU			03/27/17 09:53	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66905-1

Client Sample ID: PP-SL-79-PM-PT-032217 — **Lab Sample ID: 580-66905-10**
Date Collected: 03/22/17 08:45 — **Matrix: Water**
Date Received: 03/22/17 10:10

Method: 6020A - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**10**		0.10	0.027	mg/L		03/24/17 16:46	03/27/17 20:01	100
Lead	ND		0.040	0.0034	mg/L		03/24/17 16:46	03/27/17 20:01	100

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**5.1**	**HF**			SU			03/27/17 09:55	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66905-1

Client Sample ID: PP-SL-90-Freeflow-PT-032217
Date Collected: 03/22/17 09:00
Date Received: 03/22/17 10:10

Lab Sample ID: 580-66905-11
Matrix: Water

Method: 6020A - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.013		0.0050	0.0014	mg/L		03/24/17 16:46	03/28/17 13:16	5
Lead	0.0066		0.0020	0.00017	mg/L		03/24/17 16:46	03/28/17 13:16	5

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	12.7	HF			SU			03/27/17 09:57	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66905-1

Client Sample ID: PP-SL-90-MFIX-PT-032217
Date Collected: 03/22/17 09:00
Date Received: 03/22/17 10:10

Lab Sample ID: 580-66905-12
Matrix: Water

Method: 6020A - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.017		0.0050	0.0014	mg/L		03/24/17 16:46	03/28/17 13:20	5
Lead	0.055		0.0020	0.00017	mg/L		03/24/17 16:46	03/28/17 13:20	5

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	12.8	HF			SU			03/27/17 09:59	1

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66905-1

Client Sample ID: PP-SL-90-PM-PT-032217
Date Collected: 03/22/17 09:00
Date Received: 03/22/17 10:10

Lab Sample ID: 580-66905-13
Matrix: Water

Method: 6020A - Metals (ICP/MS) - Dissolved

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.10	0.027	mg/L		03/24/17 16:46	03/27/17 20:06	100
Lead	ND		0.040	0.0034	mg/L		03/24/17 16:46	03/27/17 20:06	100

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	6.8	HF			SU			03/27/17 10:00	1

Method: 6020A - Metals (ICP/MS)

Lab Sample ID: LCS 580-241356/18-A
Matrix: Water
Analysis Batch: 241499

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 241356

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	4.00	3.86		mg/L		97	80 - 120
Lead	1.00	0.935		mg/L		94	80 - 120

Lab Sample ID: LCSD 580-241356/19-A
Matrix: Water
Analysis Batch: 241499

Client Sample ID: Lab Control Sample Dup
Prep Type: Total Recoverable
Prep Batch: 241356

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	4.00	3.89		mg/L		97	80 - 120	1	20
Lead	1.00	0.949		mg/L		95	80 - 120	1	20

Lab Sample ID: MB 580-241251/14-B
Matrix: Water
Analysis Batch: 241499

Client Sample ID: Method Blank
Prep Type: Dissolved
Prep Batch: 241356

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.010	0.0027	mg/L		03/24/17 16:46	03/27/17 15:56	10
Lead	ND		0.0040	0.00034	mg/L		03/24/17 16:46	03/27/17 15:56	10

Lab Sample ID: 580-66905-1 MS
Matrix: Water
Analysis Batch: 241499

Client Sample ID: PP-BLD_B-Freeflow-PT-032217
Prep Type: Dissolved
Prep Batch: 241356

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	ND		4.00	3.81		mg/L		93	80 - 120
Lead	ND		1.00	0.909		mg/L		91	80 - 120

Lab Sample ID: 580-66905-1 MSD
Matrix: Water
Analysis Batch: 241499

Client Sample ID: PP-BLD_B-Freeflow-PT-032217
Prep Type: Dissolved
Prep Batch: 241356

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	ND		4.00	3.79		mg/L		93	80 - 120	1	20
Lead	ND		1.00	0.912		mg/L		91	80 - 120	0	20

Lab Sample ID: 580-66905-1 DU
Matrix: Water
Analysis Batch: 241499

Client Sample ID: PP-BLD_B-Freeflow-PT-032217
Prep Type: Dissolved
Prep Batch: 241356

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Arsenic	ND		ND		mg/L		NC	20
Lead	ND		ND		mg/L		NC	20

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66905-1

Method: 150.1 - pH (Electrometric)

Lab Sample ID: 580-66905-13 DU
Matrix: Water
Analysis Batch: 241403

Client Sample ID: PP-SL-90-PM-PT-032217
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
pH	6.8	HF		6.6	F3	SU				2	1

Client Sample ID: PP-BLD_B-Freeflow-PT-032217 — **Lab Sample ID: 580-66905-1**
Date Collected: 03/22/17 08:30 — **Matrix: Water**
Date Received: 03/22/17 10:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Filtration	FILTRATION			241251	03/23/17 15:21	ADB	TAL SEA
Dissolved	Prep	3005A			241356	03/24/17 16:46	ADB	TAL SEA
Dissolved	Analysis	6020A		5	241643	03/28/17 13:11	FCW	TAL SEA
Total/NA	Analysis	150.1		1	241403	03/27/17 09:34	RSB	TAL SEA

Client Sample ID: PP-BLD_B-MFIX-PT-032217 — **Lab Sample ID: 580-66905-2**
Date Collected: 03/22/17 08:30 — **Matrix: Water**
Date Received: 03/22/17 10:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Filtration	FILTRATION			241251	03/23/17 15:21	ADB	TAL SEA
Dissolved	Prep	3005A			241356	03/24/17 16:46	ADB	TAL SEA
Dissolved	Analysis	6020A		5	241643	03/28/17 13:29	FCW	TAL SEA
Total/NA	Analysis	150.1		1	241403	03/27/17 09:37	RSB	TAL SEA

Client Sample ID: PP-BLD_B-MFIX-PT-032217-(01) — **Lab Sample ID: 580-66905-3**
Date Collected: 03/22/17 08:30 — **Matrix: Water**
Date Received: 03/22/17 10:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Filtration	FILTRATION			241251	03/23/17 15:21	ADB	TAL SEA
Dissolved	Prep	3005A			241356	03/24/17 16:46	ADB	TAL SEA
Dissolved	Analysis	6020A		5	241643	03/28/17 13:34	FCW	TAL SEA
Total/NA	Analysis	150.1		1	241403	03/27/17 09:39	RSB	TAL SEA

Client Sample ID: PP-BLD_B-PM-PT-032217 — **Lab Sample ID: 580-66905-4**
Date Collected: 03/22/17 08:30 — **Matrix: Water**
Date Received: 03/22/17 10:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Filtration	FILTRATION			241251	03/23/17 15:21	ADB	TAL SEA
Dissolved	Prep	3005A			241356	03/24/17 16:46	ADB	TAL SEA
Dissolved	Analysis	6020A		100	241499	03/27/17 19:56	FCW	TAL SEA
Total/NA	Analysis	150.1		1	241403	03/27/17 09:41	RSB	TAL SEA

Client Sample ID: PP-MW-12i-Freeflow-PT-032217 — **Lab Sample ID: 580-66905-5**
Date Collected: 03/22/17 08:30 — **Matrix: Water**
Date Received: 03/22/17 10:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Filtration	FILTRATION			241251	03/23/17 15:21	ADB	TAL SEA
Dissolved	Prep	3005A			241356	03/24/17 16:46	ADB	TAL SEA
Dissolved	Analysis	6020A		5	241643	03/28/17 13:25	FCW	TAL SEA

Client Sample ID: PP-MW-12i-Freeflow-PT-032217

Lab Sample ID: 580-66905-5

Date Collected: 03/22/17 08:30

Matrix: Water

Date Received: 03/22/17 10:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	150.1		1	241403	03/27/17 09:44	RSB	TAL SEA

Client Sample ID: PP-MW-12i-MFIX-PT-032217

Lab Sample ID: 580-66905-6

Date Collected: 03/22/17 08:30

Matrix: Water

Date Received: 03/22/17 10:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Filtration	FILTRATION			241251	03/23/17 15:21	ADB	TAL SEA
Dissolved	Prep	3005A			241356	03/24/17 16:46	ADB	TAL SEA
Dissolved	Analysis	6020A		5	241643	03/28/17 13:38	FCW	TAL SEA
Total/NA	Analysis	150.1		1	241403	03/27/17 09:46	RSB	TAL SEA

Client Sample ID: PP-MW-12i-PM-PT-032217

Lab Sample ID: 580-66905-7

Date Collected: 03/22/17 08:45

Matrix: Water

Date Received: 03/22/17 10:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Filtration	FILTRATION			241251	03/23/17 15:21	ADB	TAL SEA
Dissolved	Prep	3005A			241356	03/24/17 16:46	ADB	TAL SEA
Dissolved	Analysis	6020A		100	241499	03/27/17 19:52	FCW	TAL SEA
Total/NA	Analysis	150.1		1	241403	03/27/17 09:48	RSB	TAL SEA

Client Sample ID: PP-SL-79-Freeflow-PT-032217

Lab Sample ID: 580-66905-8

Date Collected: 03/22/17 08:45

Matrix: Water

Date Received: 03/22/17 10:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Filtration	FILTRATION			241251	03/23/17 15:21	ADB	TAL SEA
Dissolved	Prep	3005A			241356	03/24/17 16:46	ADB	TAL SEA
Dissolved	Analysis	6020A		5	241643	03/28/17 13:43	FCW	TAL SEA
Total/NA	Analysis	150.1		1	241403	03/27/17 09:50	RSB	TAL SEA

Client Sample ID: PP-SL-79-MFIX-PT-032217

Lab Sample ID: 580-66905-9

Date Collected: 03/22/17 08:45

Matrix: Water

Date Received: 03/22/17 10:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Filtration	FILTRATION			241251	03/23/17 15:21	ADB	TAL SEA
Dissolved	Prep	3005A			241356	03/24/17 16:46	ADB	TAL SEA
Dissolved	Analysis	6020A		5	241643	03/28/17 13:47	FCW	TAL SEA
Total/NA	Analysis	150.1		1	241403	03/27/17 09:53	RSB	TAL SEA

Lab Chronicle

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66905-1

Client Sample ID: PP-SL-79-PM-PT-032217

Lab Sample ID: 580-66905-10

Date Collected: 03/22/17 08:45

Matrix: Water

Date Received: 03/22/17 10:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Filtration	FILTRATION			241251	03/23/17 15:21	ADB	TAL SEA
Dissolved	Prep	3005A			241356	03/24/17 16:46	ADB	TAL SEA
Dissolved	Analysis	6020A		100	241499	03/27/17 20:01	FCW	TAL SEA
Total/NA	Analysis	150.1		1	241403	03/27/17 09:55	RSB	TAL SEA

Client Sample ID: PP-SL-90-Freeflow-PT-032217

Lab Sample ID: 580-66905-11

Date Collected: 03/22/17 09:00

Matrix: Water

Date Received: 03/22/17 10:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Filtration	FILTRATION			241251	03/23/17 15:21	ADB	TAL SEA
Dissolved	Prep	3005A			241356	03/24/17 16:46	ADB	TAL SEA
Dissolved	Analysis	6020A		5	241643	03/28/17 13:16	FCW	TAL SEA
Total/NA	Analysis	150.1		1	241403	03/27/17 09:57	RSB	TAL SEA

Client Sample ID: PP-SL-90-MFIX-PT-032217

Lab Sample ID: 580-66905-12

Date Collected: 03/22/17 09:00

Matrix: Water

Date Received: 03/22/17 10:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Filtration	FILTRATION			241251	03/23/17 15:21	ADB	TAL SEA
Dissolved	Prep	3005A			241356	03/24/17 16:46	ADB	TAL SEA
Dissolved	Analysis	6020A		5	241643	03/28/17 13:20	FCW	TAL SEA
Total/NA	Analysis	150.1		1	241403	03/27/17 09:59	RSB	TAL SEA

Client Sample ID: PP-SL-90-PM-PT-032217

Lab Sample ID: 580-66905-13

Date Collected: 03/22/17 09:00

Matrix: Water

Date Received: 03/22/17 10:10

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Filtration	FILTRATION			241251	03/23/17 15:21	ADB	TAL SEA
Dissolved	Prep	3005A			241356	03/24/17 16:46	ADB	TAL SEA
Dissolved	Analysis	6020A		100	241499	03/27/17 20:06	FCW	TAL SEA
Total/NA	Analysis	150.1		1	241403	03/27/17 10:00	RSB	TAL SEA

Laboratory References:

TAL SEA = TestAmerica Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

Certification Summary

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66905-1

Laboratory: TestAmerica Seattle

The certifications listed below are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Oregon	NELAP	10	WA100007	11-05-17
Washington	State Program	10	C553	02-17-18

The following analytes are included in this report, but certification is not offered by the governing authority:

Analysis Method	Prep Method	Matrix	Analyte
150.1		Water	pH
6020A	3005A	Water	Arsenic
6020A	3005A	Water	Lead

Sample Summary

Client: Pioneer Technologies Corporation
Project/Site: Superlon Metals Fractionation

TestAmerica Job ID: 580-66905-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
580-66905-1	PP-BLD_B-Freeflow-PT-032217	Water	03/22/17 08:30	03/22/17 10:10
580-66905-2	PP-BLD_B-MFIX-PT-032217	Water	03/22/17 08:30	03/22/17 10:10
580-66905-3	PP-BLD_B-MFIX-PT-032217-(01)	Water	03/22/17 08:30	03/22/17 10:10
580-66905-4	PP-BLD_B-PM-PT-032217	Water	03/22/17 08:30	03/22/17 10:10
580-66905-5	PP-MW-12i-Freeflow-PT-032217	Water	03/22/17 08:30	03/22/17 10:10
580-66905-6	PP-MW-12i-MFIX-PT-032217	Water	03/22/17 08:30	03/22/17 10:10
580-66905-7	PP-MW-12i-PM-PT-032217	Water	03/22/17 08:45	03/22/17 10:10
580-66905-8	PP-SL-79-Freeflow-PT-032217	Water	03/22/17 08:45	03/22/17 10:10
580-66905-9	PP-SL-79-MFIX-PT-032217	Water	03/22/17 08:45	03/22/17 10:10
580-66905-10	PP-SL-79-PM-PT-032217	Water	03/22/17 08:45	03/22/17 10:10
580-66905-11	PP-SL-90-Freeflow-PT-032217	Water	03/22/17 09:00	03/22/17 10:10
580-66905-12	PP-SL-90-MFIX-PT-032217	Water	03/22/17 09:00	03/22/17 10:10
580-66905-13	PP-SL-90-PM-PT-032217	Water	03/22/17 09:00	03/22/17 10:10

Chain of Custody Record

CHOC Number: 02_1.1_E52_197_21032017

Send Results To:
munsons@uspioneer.com, jking@perc-nw.com, grimstedb@uspioneer.com, sduggan@perc-nw.com

Site Contact:
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Brad Grimsted
Phone: (360) 570-1700 Email: grimstedb@uspioneer.com

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5205 Corporate Ctr. Court SE, Suite A
Lacey, WA 98503
Phone: 360.570.1700
Fax: 360.570.1777
www.uspioneer.com

Send Invoice To:
Pacific Environmental Redevelopment Coporation
Jeff King
Phone: 425-238-2212 Email: jking@perc-nw.com

Laboratory Information:
TestAmerica-Tacoma
ELAINE WALKER
Phone: 253.248.4972 Email:

CHOC Version: 0.99.05

Sample Information | **Analytes**

Sample ID (Auto Generated)	Date (MM/DD/YYYY)	Time (0000 to 2400)	Sampler's Initials	Special Lab Instructions Included ==> Leachate	Filtered	MS/MSD	150.2 USEPA pH	Dissolved Metals In Water							<== Special Lab Instructions Comments for Sample
PP-BLD_B-Freeflow-PT-032217	03/22/2017	08:30	sm				X	X							Filter in Lab
PP-BLD_B-MFIX-PT-032217	03/22/2017	08:30	sm				X	X							Filter in Lab
PP-BLD_B-MFIX-PT-032217-(01)	03/22/2017	08:30	sm				X	X							Filter in Lab
PP-BLD_B-PM-PT-032217	03/22/2017	08:30	sm				X	X							Filter in Lab
PP-MW-12i-Freeflow-PT-032217	03/22/2017	08:30	sm				X	X							Filter in Lab
PP-MW-12i-MFIX-PT-032217	03/22/2017	08:30	sm				X	X							Filter in Lab
PP-MW-12i-PM-PT-032217	03/22/2017	08:45	sm				X	X							Filter in Lab
PP-SL-79-Freeflow-PT-032217	03/22/2017	08:45	sm				X	X							Filter in Lab
PP-SL-79-MFIX-PT-032217	03/22/2017	08:45	sm				X	X							Filter in Lab
PP-SL-79-PM-PT-032217	03/22/2017	08:45	sm				X	X							Filter in Lab
PP-SL-90-Freeflow-PT-032217	03/22/2017	09:00	sm				X	X							Filter in Lab
PP-SL-90-MFIX-PT-032217	03/22/2017	09:00	sm				X	X							Filter in Lab
PP-SL-90-PM-PT-032217	03/22/2017	09:00	sm				X	X							Filter in Lab
Cooler (Yes/No): Cooler Temp:	Turnaround Time: Rush: 5 day TAT	Hazard Identification:	Sample Disposal:				HNO3 (2)	None							Lab Use Only:

Preservative

QA/QC Requirements:

Sampling Event Comments:

580-66905 Chain of Custody

TB___ Cooler IR5 Cor 3.1 Unc 3.3
Cooler Dscly blue wtr @ Lab
Wet/Packs Packing Bubble
cli drop w/o cs

1. Relinquished By: (Sign and Print) Stacy Munson	Date/Time: 3/22/17	1. Received By: (Sign and Print)	Date/Time: 3/22/17 1010
2. Relinquished By: (Sign and Print)	Date/Time:	2. Received By: (Sign and Print)	Date/Time:
3. Relinquished By: (Sign and Print)	Date/Time:	3. Received By: (Sign and Print)	Date/Time:

Special Instructions for Laboratory

CHOC Number: 02_1.1_E52_197_21032017

Send Results To:
munsons@uspioneer.com, jking@perc-nw.com,
grimstedb@uspioneer.com, sduggan@perc-nw.com

Site Contact:
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Brad Grimsted
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PIONEER Technologies Corporation.
5205 Corporate Ctr. Court SE, Suite A
Lacey, WA 98503
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Fax: 360.570.1777

Send Invoice To:
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Phone: 425-238-2212 Email: jking@perc-nw.com

Laboratory Information:
TestAmerica-Tacoma
ELAINE WALKER
Phone: 253.248.4972 Email:

CHOC Version: 0.99.05

Analytical Method	Lab Comments	Specified Analyte	Samples Included
150.2 USEPA pH			PP-BLD_B-Freeflow-PT-032217 PP-BLD_B-MFIX-PT-032217 PP-BLD_B-MFIX-PT-032217-(01) PP-BLD_B-PM-PT-032217 PP-MW-12i-Freeflow-PT-032217 PP-MW-12i-MFIX-PT-032217 PP-MW-12i-PM-PT-032217 PP-SL-79-Freeflow-PT-032217 PP-SL-79-MFIX-PT-032217 PP-SL-79-PM-PT-032217 PP-SL-90-Freeflow-PT-032217 PP-SL-90-MFIX-PT-032217 PP-SL-90-PM-PT-032217
Dissolved Metals In Water - 6010C		Arsenic Inorganic Lead and Compounds	PP-BLD_B-Freeflow-PT-032217 PP-BLD_B-MFIX-PT-032217 PP-BLD_B-MFIX-PT-032217-(01) PP-BLD_B-PM-PT-032217 PP-MW-12i-Freeflow-PT-032217 PP-MW-12i-MFIX-PT-032217 PP-MW-12i-PM-PT-032217 PP-SL-79-Freeflow-PT-032217 PP-SL-79-MFIX-PT-032217 PP-SL-79-PM-PT-032217 PP-SL-90-Freeflow-PT-032217 PP-SL-90-MFIX-PT-032217 PP-SL-90-PM-PT-032217

Login Sample Receipt Checklist

Client: Pioneer Technologies Corporation

Job Number: 580-66905-1

Login Number: 66905

List Source: TestAmerica Seattle

List Number: 1

Creator: Torres, Terri L

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	Received same day of collection; chilling process has begun.
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Attachment A-2: Free Flow Technologies Bench-Scale Treatability Study Report

Superlon Soil Amendment Treatability Study
Prepared for Pioneer Technologies Corporation
By Robert Stanforth, Ph.D., TRC Applied Chemistry Laboratory
November, 2016

Background

A study was conducted on amendments that could be introduced into backfill material that will be placed in contact with arsenic-contaminated groundwater from the Superlon site in Tacoma Washington. Pioneer sent samples of the backfill soil and two samples of groundwater (nominally 2 mg/L and 100 mg/L arsenic) to the TRC Applied Chemistry for testing. Pioneer had originally contacted Free Flow Technologies, of Rockford, IL for testing of their reagents. Free Flow Technologies suggested that TRC do the testing directly for Pioneer. Since the contact came through Free Flow, the appropriate Free Flow products (specifically FF-200 + FS) were used in the testing.

Methods.

The backfill soil contained both fine and sand-size material as well as larger gravel size material. The gravel size material interferes with the testing, and so the backfill was sieved using a ¼" mesh size sieve, and the smaller fraction used in the testing. The smaller fraction consisted of 50% of the total, by weight.

FF-200 + FS contains two components – an iron source and a pH buffer. The treatment is based on the sorption of arsenic and lead on ferric hydroxide. The sorption process is much greater if the ferric hydroxide is freshly formed, so the reagent consists of an iron source and a buffer to precipitate the iron without raising the pH to too high a level. Various blends of these reagents were used in the testing, ranging from a 1:1 blend to a 2:1 blend of the buffer to iron source.

The soil was mixed with the treatment reagent, allowed to sit for about an hour, and then mixed with one of the two samples of groundwater. The slurry was allowed to sit overnight and then centrifuged, filtered, and the filtrate analyzed for arsenic and lead concentrations using inductively coupled plasma-atomic emission spectrometry (ICP).

Several rounds of testing were conducted using varying solid solution ratios (i.e. the amount of soil and groundwater in the sample). The solid:solution ratio is particularly important in this testing, as the additive is being added to the soil but then used to treat contaminants in the groundwater. Treatment depends on having sufficient iron in the soil to adsorb the arsenic in the groundwater. The amount of iron in contact with the water depends both on the amount of additive in the soil and on the amount of soil in contact with the water, as indicated by the solid:liquid ratio. Since the soil will be used as backfill, the groundwater will be present in the pores in the soil, which means that in the field there will be a very high solid:solution ratio and the treatment testing should reflect this high solid:liquid ratio. Since the soil is simply the carrier for the treatment additives being used to remediate the groundwater, the composition of the soil itself is not crucial, hence the removal of the larger particle size pieces from the soil does not influence the dose being used. The dose used in the testing is the same whether the complete soil is used or just the finer fraction. In other words, if the testing indicates that a 1.0% dose should be used then a 1.0% dose is needed for the total soil as well as for the finer fraction. No correction should be made for using just the finer fraction in the testing.

The initial tests used 20 mL or water mixed with 20 g soil (wet weight) or a 1:1 solid:solution ratio. The slurry was placed in 50 mL centrifuge tubes for ease in the separation. The soil settled to the bottom with a significant volume of water above it. However, in the field the solid:solution ratio will be much higher (i.e. the amount of water in the pores of the soil will be much less than the weight of the soil), and a second round of tests were run using more realistic solid:solution ratios. Also this testing was done by placing the soil and water in a 40 mL VOA vial that was completely filled, thus eliminating any air contact with the slurry. Two solid:solution ratios were used, one in which the vials was filled with backfill soil and then sufficient water added to saturate the soil, and a second which used half the amount of soil required to fill the vial, and then the vial was filled with water. Both the amount of soil and water were measured for each vial. The saturated vials had a solid:solution ratio of 5:1 (i.e. 50 g of soil contained 10 g (or mL) of water). The vials with half as much soil had a solid:solution ratio of 1.27:1. A picture of the vials is shown below:

Results

Treatment Testing

The results of the testing are given in Table 1. The groundwater samples had initial dissolved arsenic concentrations of 3.0 mg/L for the low arsenic water and 37.6 mg/L for the high arsenic water. All the treatment dosages added were successful in bring the arsenic concentrations to below the target concentration of 0.66 mg/L. A 0.25% dose of the FF-200 FS (1:1 ratio) brought arsenic down to below the treatment criterion in the saturated soil test. The higher buffer:iron source ratios resulted in higher final pH values in the water. Since arsenic adsorption is stronger at slightly acidic pH values than at slightly basic pH values, the 1:1 buffer:iron reagent is recommended. Lower doses of reagent were not tested

due to the difficulty of homogeneously mixing such a small amount of dry treatment reagent in the soil to ensure uniform treatment.

Interestingly, the backfill itself with no treatment reagent lowered the arsenic concentration from the original groundwater concentration (as shown in the “None” row in the saturated soil sections of the table), presumably due to adsorption on the soil components in the backfill. The concentration was lowered to below the treatment criterion in the 3.0 mg/L sample (to 0.15 mg/L), and to slightly above the criterion in the 37.6 mg/L groundwater (to 0.94 mg/L versus the criterion of 0.66 mg/L). If the initial arsenic concentration had been higher, presumably the final concentration would be higher as well. This suggests that the soil used in areas with lower arsenic concentration groundwater may not need additional treatment. However, addition of a small amount of the FF-200 FS would provide insurance of the treatment effectiveness.

Based on the results, a dose of 0.25% FF-200 FS (at a 1:1 ratio) is recommended.

Compositional Analysis

The treatment process removes arsenic from the groundwater by binding the arsenic to particulates in the soil. During the process the compositional levels of arsenic in the soil will increase. The increase can be calculated if the solid:solution ratio is known. For the saturated soil samples (which approximates field conditions) the solid solution ratio was 5:1. Thus 500 g of soil will contain 100 mL water. Assuming the water has 100 mg/L arsenic, the increase in compositional arsenic will be

$$(100 \text{ mg/L As} \times 0.10 \text{ L}) / 500 \text{ g soil} = 20 \text{ mg/kg As.}$$

For the 37.6 mg/L arsenic concentration sample, the increase is 7.5 mg/kg arsenic.

Table 1. Groundwater Treatability Study Results

Sample		Results		
Reagent (FF-200 + FS)	Dose, %	pH	Arsenic, mg/L	Lead, mg/L
Treatment Criteria			0.66	Not Specified
Low Arsenic Groundwater				
Untreated		**6.99**	**3.0**	**0.17**
1:1 solid:liquid ratio				
1:1 FF-200:FS	0.50	6.64	0.049	0.017
	1.0	6.38	0.012	0.0286
	2.0	6.28	0.002	0.051
3:2 FF-200:FS	1.0	7.30	0.006	0.0104
	2.0	7.51	0.010	0.0165
2:1 FF-200:FS	1.0	7.93	0.023	0.0105
	2.0	9.33	0.011	0.0221
Saturated soil (5:1 solid:liquid ratio)				
1:1 FF-200:FS	None	Not Measured	0.150	0.083
	0.25		0.140	BD
	0.50		0.020	BD
	1.0		0.020	0.04
High Arsenic Groundwater				
Untreated		**6.65**	**37.6**	**0.075**
1:1 solid:liquid ratio				
1:1 FF-200:FS	0.50	6.56	0.013	0.0158
	1.0	6.19	BD	0.0246
	2.0	6.18	BD	0.0516
	3.0	6.09	BD	0.0861
	4.0	5.95	BD	0.138
3:2 FF-200:FS	1.0	7.50	0.053	0.016
	2.0	7.53	0.024	0.015
2:1 FF-200:FS	1.0	8.13	0.192	0.0383
	2.0	9.50	0.105	0.0146
1.27:1 solid:liquid ratio				
1:1 FF-200:FS	None	7.38	7.72	0.023
	0.25	6.96	0.113	0.0075
	0.50	6.65	0.031	0.022
	1.0	6.43	0.019	0.014
Saturated Soil (5:1 solid:liquid ratio)				
1:1 FF-200:FS	None	Not Measured	0.94	0.038
	0.25		0.059	BD
	0.50		0.257	BD
	1.0		0.229	BD

Superlon Site Perched Water Treatability Study
Prepared for Pioneer Technologies
By Robert Stanforth, Ph.D.
TRC Applied Chemistry Laboratory
June, 2017

Background

Some perched water samples form the Superlon site were found to contain elevated levels of arsenic and lead. Pioneer Technologies requested that a treatability study be run on the samples to see if one of the reagents used for treatment at the site – Free Flow 200-FS (1:1) – could be used to treat the perched water.

Methods and Results

A sample of the perched water labelled SL-79 was sent to the TRC Applied Chemistry Laboratory. The sample had a significant amount of suspended solids, which occupied approximately half the bottle when settled. Analysis of both the total and dissolved levels of arsenic and lead indicated that much of the arsenic and almost all the lead is contained in the particulates, with the supernatant concentrations being much lower (Table 1). Since the solids readily settle out, treatment testing was done on the supernatant after the solids have settled.

Table 1. Total and dissolved arsenic and lead concentrations in SL-79 water and solids

Sample	Results		
Perched Water			
Handling	pH	As, mg/L	Pb, mg/L
Total (including solids)	7.37	95	137
Dissolved		6.1	0.02

FF-200 FS consists of two components; FF-200 which is a pH buffer and FS. Treatment was conducted by adding varying amounts of FS to 250 mL samples of the SL-79 water. The reagent was allowed to react, then the sample divided into 50 aliquots in centrifuge tubes. Varying amounts of FF-200 were added and the samples shaken. The samples were then allowed to sit overnight, centrifuged and filtered, and the filtrate analyzed for arsenic and lead. The results are given in Table 2. The results indicate that the FF-200 FS 1:1 (i.e. the 0.1% FS : 0.1% FF-200 or 0.2% FS : 0.2% FF-200) effective treats the water. The lowest dose tested – 0.2% - brings both lead and arsenic to well below the treatment criteria for the water.

Conclusions

FF200-FS (1:1) can effectively treat the arsenic in the perched groundwater at SL-79 at doses of 0.2% and above.

Table 2. Treatment testing results on SL-79 water

Sample			Results		
FS	FF-200	Total Additive	pH	As, mg/L	Pb, mg/L
Untreated			7.50	4.43	0.03
0.1% FS	0	0.1%	6.31	<0.01	0.03
	0.1%	0.2%	6.64	0.03	0.02
	0.2%	0.3%	7.03	<0.01	0.03
	0.3%	0.4%	8.28	0.01	0.01
0.2% FS	0	0.2%	6.14	<0.01	0.05
	0.2%	0.4%	6.67	0.02	0.04
	0.4%	0.6%	7.01	0.02	0.03
	0.6%	0.8%	8.43	0.02	0.02
Treatment Criteria			-	0.66	Not Specified

Note: Doses based on weight of additive to volume of water, e.g. 0.1% = 1 g per 1000 mL water (or 0.1% by weight)

Attachment A-3: Peroxychem Bench-Scale Treatability Study Report

30 December 2016

Brad Grimsted M.S., M.B.A.
Project Manager
PIONEER Technologies Corporation
5205 Corporate Ctr. Ct. SE, Ste. A
Olympia, WA 98503-5901

Subject: Phase I and Phase II Bench-scale Treatability Investigation Results, Superlon Site, Tacoma WA

Dear Mr. Grimsted:

A bench-scale treatability study was conducted to determine if aqueous concentrations of arsenic and lead in groundwater from the Superlon site in Tacoma, WA ("the Site") could be reduced by treatment with PeroxyChem's MetaFix® reagent. Sharp reductions in aqueous metal concentrations were observed during an initial bench-scale treatability test; however, a second bench-scale treatability study was commissioned to more accurately determine the dosage requirements of the MetaFix reagents. This report provides a summary of the results from both the original bench-scale study (Phase I) and the subsequent dosage optimization study (Phase II).

Phase I Treatability Test

Baseline Characterization of Groundwater Sample

A groundwater sample was received on 27 April 2016 and analyzed to determine the baseline pH and heavy metal concentrations. The water sample, GW-MW-125-042216, (hereinafter MW-125) was used in the Phase I treatability test.

The values reported for the MW-125 water represent soluble metals as determined by ICP analysis of a filtered (0.45 µm, glass fiber) water sample. Water samples were filtered prior to metals analyses to make the test more representative of flowing groundwater in the aquifer. Use of a 0.45 µm glass fiber filter is considered to be standard practice in metals treatment work because the pore size is small enough to remove most suspended particulate and the glass fiber filter composition ensures that colloidal organic particles will not be adsorbed. The baseline metals concentrations in Site groundwater sample are presented in Table 1.

Table 1: Baseline metals concentrations and pH in as received Site groundwater sample.

Sample ID	Units	Metals		GW pH (SU)
		Arsenic	Lead	
MW-125	mg/L	56.1	<0.03	5.14

Treatability Study Set-up for Phase I

Based on the observed baseline pH and heavy metals concentrations (Table 1), testing was conducted on 200 mL samples of the MW-125 groundwater in amber glass reaction vessels that had previously received the specified mass (1.0% or 2.0% w/w) of the appropriate MetaFix reagent (I-6A or I-7A). The reaction vessels were then sealed with Teflon® lined lids, and tumbled daily during a 7 day reaction period. Upon completion of the reaction period, the samples were filtered through a 0.45 µm glass fiber filter and analyzed for metals by ICP.

Phase I Results

Substantial reductions in soluble arsenic were observed in response to all MetaFix treatments. Soluble lead was below the detection limit in the control as well as all the treatments. The results of the treatability testing are presented in Table 2.

Table 2. Influence of MetaFix treatments on soluble heavy metals concentrations.

Control/Treatment	Units	Metals		pH (s.u.)
		Arsenic	Lead	
Control (no amendments)	mg/L	76	<0.03	7.34
1.0 wt% MetaFix I-6A	mg/L	0.14	<0.03	7.27
2.0 wt% MetaFix I-6A	mg/L	0.16	<0.03	7.80
1.0 wt% MetaFix I-7A	mg/L	0.06	<0.03	7.55
2.0 wt% MetaFix I-7A	mg/L	0.04	<0.03	8.02

Equivalent reductions in soluble arsenic were observed in response to the low (1.0% w/w) and high (2.0% w/w) doses of the two MetaFix reagents. The reduction in soluble arsenic for the I-6A reagent was approximately 99.8% to <0.2 mg/L. The reduction in soluble arsenic for the I-7A reagent was approximately 99.9% to <0.1 mg/L. Hence, both treatments at both the low and high doses reduced soluble arsenic to well below the remedial objective of 0.67 mg/L. The soluble lead concentration was below the method detection limit in the untreated control and all the MetaFix treatments so the influence of treatments upon soluble lead could not be determined.

Phase II Treatability Test

Baseline Characterization of Soil and Groundwater Samples

One soil and two groundwater samples were received on 26 October 2016 and submitted for determination of baseline pH and heavy metal concentrations. These samples were used for the Phase II treatability test.

- Soil-SO Backfill-102416-0-0.5 (hereinafter SO-Backfill)
- GW-MW-11S (hereinafter MW-11S)
- GW-MW-12S (hereinafter MW-12S)

For soil, the total compositional metals analysis was based on a simplified soil digestion procedure. The procedure is similar to the SW-846 Method 3050B; however, 6N HNO_3/4 N HCl (Aqua Regia, slightly diluted) was used rather than additions of concentrated acid as in the SW-846 method. Furthermore, in the compositional procedure, the samples were heated, and the total digestion time was 3 hours. The baseline metals values reported for the groundwater samples represent soluble metals determined by ICP analysis of filtered (0.45 µm, glass fiber) samples. Water samples were filtered prior to metals analyses to make the test more representative of flowing groundwater in the aquifer. The use of a 0.45 µm glass fiber filter is considered to be standard practice in metals treatment work because the pore size is small enough to remove most suspended particulate and the glass fiber filter composition ensures that colloidal organic particles will not be adsorbed. The baseline metals concentrations in Site soil and groundwater samples are presented in Table 3.

Table 3: Baseline metals concentrations and pH in as received Site groundwater and soil samples.

Sample ID	Units	Metals		pH (s.u.)
		Arsenic	Lead	
SO-Backfill	mg/kg	1.8	2.5	7.59
MW-12S	mg/L	2.9	0.15	6.36
MW-11S	mg/L	30.9	<0.03	6.78

Phase II Results

For the MW-12S groundwater/SO-Backfill soil blend (200 mL groundwater/50.0 g soil), the soluble arsenic concentration in the control was below the remedial goal (0.67 mg/L); however, substantial reductions in soluble arsenic were observed in response to each of the MetaFix treatments. The results suggest that, for this soil/groundwater blend, even the lowest MetaFix dosage tested (0.25% w/w) will result in reduction of soluble arsenic to below the method detection limit of 0.030 mg/L. This was true for both MetaFix I-6A and MetaFix I-7A. Soluble lead was below the detection limit in the control and all the treatments, hence, it is not possible to draw conclusions about the influence of the various MetaFix dosages on soluble lead in this soil/groundwater blend.

Table 4: Influence of MetaFix treatments on soluble metals concentrations in the MW-12S groundwater/SO-Backfill soil blend (200 mL groundwater/50.0 g soil).

Control/Treatment	Metals (mg/L)		pH (SU)
	Arsenic	Lead	
Control (no treatment)	0.24	<0.030	7.09
0.25% I-6A	<0.030	<0.030	7.18
0.5% I-6A	0.037	<0.030	7.22
1.0% I-6A	0.037	<0.030	7.24
2.0% I-6A	0.037	<0.030	7.31
0.25% I-7A	<0.030	<0.030	7.24
0.5% I-7A	<0.030	<0.030	7.23
1.0% I-7A	0.042	<0.030	7.27
2.0% I-7A	<0.030	<0.030	7.31

Table 5: Influence of MetaFix treatments on soluble metals concentrations in the MW-11S groundwater/SO-Backfill soil blend (200 mL groundwater/50.0 g soil).

Control/Treatment	Metals (mg/L)		pH (SU)
	Arsenic	Lead	
Control (no treatment)	5.69	<0.030	6.99
0.25% I-6A	0.23	<0.030	6.99
0.5% I-6A	0.072	<0.030	7.05
1.0% I-6A	<0.030	<0.030	7.06
2.0% I-6A	0.041	<0.030	7.14
0.25% I-7A	0.38	<0.030	7.05
0.5% I-7A	0.042	<0.030	7.09
1.0% I-7A	0.057	<0.030	7.17
2.0% I-7A	0.11	<0.030	7.26

For the MW-11S groundwater/SO-Backfill soil blend (200 mL groundwater/50.0 g soil), the soluble arsenic concentration in the control was 5.69 mg/L – nearly ten-fold above the remedial goal (0.67 mg/L). Substantial reductions in soluble arsenic were observed in response to each of the I-6A MetaFix treatments, and a positive dosage response was observed from as dosage was increased from 0.25% to 0.5% to 1.0% (w/w). At the 1.0% w/w dosage, soluble arsenic fell to below the method detection limit of 0.03 mg/L. When the I-6A dosage was further increased to 2.0% w/w the observed soluble arsenic concentration was 0.041 mg/L, which is probably not significantly different from the value observed for the 1.0% w/w dosage. The results suggest that, for this soil/groundwater blend, even the lowest MetaFix dosage tested (0.25% w/w) would result in reduction of soluble arsenic to below the remedial objective of 0.67 mg/L; however, more complete removal of arsenic was observed as dosage increased up to 1.0% w/w. The results also suggest that performance was slightly better with the I-6A than with the I-7A reagent. The observed performance, and the fact that the I-6A reagent has a lower selling price than the I-7A reagent, makes it clear that the best approach for treatment of arsenic at the Site would be MetaFix I-6A. Regarding dosage, our recommendation would be to go with either 0.5% or 1.0% w/w to provide a margin of safety and greater longevity of treatment.

As noted above, for the other groundwater/soil blend, the soluble lead concentration in the MW-11S groundwater/SO-Backfill soil blend lead was below the detection limit in the control and all the treatments, hence, it is not possible to draw conclusions about the influence of the various MetaFix dosages on soluble lead in this soil/groundwater blend.

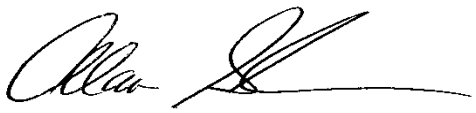
Summary and Conclusions

In summary, the results of treatability testing reported here indicate that MetaFix treatment can reduce soluble concentrations of arsenic in water from the Site to well below the remedial objective. The results suggest also indicate that the MetaFix I-6A formulation is somewhat more effective than the I-7A formulation for treatment of arsenic. The dosage response results suggest that even the lowest evaluated dosage (0.25% w/w) could result in achievement of the Site remedial objective; however, the

positive response to increasing dosage indicates that a one of the higher dosages (i.e., 0.5% or 1.0%) would provide increased assurance of high removal efficiency. It should also be noted that use of a higher dosage would make adequate distribution of the MetaFix reagent within the backfill matrix easier to achieve.

If you have questions regarding these results, please contact me at 949-514-1068.

Sincerely,



Alan Seech, Ph.D.
Senior Manager – Technology Applications
PeroxyChem Environmental Solutions

Copy: Stacey Telesz – PeroxyChem

Attachment A-4: Premier Magnesia Bench-Scale Treatability Study Report

200 E Lincoln Street
Mount Horeb, WI 53572
(608) 437-7413

November 28, 2016

Mr. Derek Pizarro
Premier Magnesia, LLC
1275 Drummers Lane, Suite 102
Wayne, PA 19087

Subject: Pioneer Technologies Corporation – Superlon Site Tacoma, WA.

Mr. Pizarro:

Ursus Remediation Testing & Technologies, LLC (Ursus) is pleased to provide Premier Magnesia LLC, (Premier) this report for treatability testing for the Pioneer Technologies Corporation – Superlon Site Tacoma, WA.

OBJECTIVE

The objective of the study was to evaluate the effectiveness of EnviroBlend® treated backfill material to lower dissolved phase arsenic and lead in groundwater when the treated backfill is placed in the saturated zone. The remedial objective is to reduce groundwater arsenic concentrations to < 666 ug/L and groundwater lead concentrations to < 1,650 ug/L.

BACKGROUND

One backfill material and two groundwater samples were received for the study on October 26, 2016. A description of the samples and comments are shown in Table 1.

Table 1.
Samples Received for Treatability Testing

Sample Name	Sample Date	Matrix	Comments
SO-Backfill-102416 0-0.5	10/24/16	Soil	Backfill material.
GW-MW-11S-Low 102416-(20). Low GW	10/24/16	GW	Sample received in 4 individual liter plastic containers, unpreserved. Some headspace in each container.
GW-MW-11S-High 102416-(20). High GW	10/24/16	GW	Sample received in 4 individual liter plastic containers, unpreserved. Some headspace in each container.

MATERIAL & METHODOLOGY

Backfill material was sieved to separate material > 3/8" in size. Material sized < 3/8" was treated with EnviroBlend® HXD. The EnviroBlend® HXD backfill was leached with the low concentration groundwater (GW-MW-11S-Low 102416-(20)) Low GW and the high concentration groundwater (GW-MW-11S-High 102416-(20)) High GW.

Leaching was performed in a Zero Headspace Extractor (ZHE) to retain redox conditions of groundwater. The mobility of arsenic is dependent on the oxidation state of arsenic. If groundwater arsenic is as arsenite (reduced As) and leached with exposure to air/headspace, then arsenite can be oxidized to arsenate. Arsenate is less soluble than arsenite; possibly biasing the treatment effectiveness by lowering dissolved phase total arsenic due to redox changes of arsenic. Therefore, if the groundwater is exposed to air during treatment/leaching in the laboratory, it may not model the disposal setting and may give false positives of performance.

Backfill material to groundwater ratio was performed at a 1:20 ratio (10g of backfill to 200 mls of GW). A ratio of 1:20 was performed to show the capacity of EnviroBlend® HXD treated backfill to stabilize arsenic and lead containing groundwater over time. Leachates where filtered through a 0.45µ filter prior to metal analysis.

Ursus is not a NELAC certified laboratory; therefore, results are screening results. Screening results are not intended for regulatory compliance.

RESULTS

Sizing of the backfill material was performed where the mass of backfill material > 3/8" and < 3/8" were determine. Testing found 54% by weight of the backfill was < 3/8" and 46% of the backfill material was > 3/8". For treatability testing, only the 3/8" material was used.

Compositional analysis of the < 3/8/" backfill material was performed. Testing found a total arsenic concentration of 0.88 mg/kg dry wt., 2.22 mg/kg lead dry wt., a total solids of 95%, and a bulk density of 2.18 tons/yard^3.

Total background analysis of the low and high GW samples is shown in Table 2. Arsenic concentrations exceeded the remedial objective of 666 ug/L (0.666 mg/L) for the Low GW and high GW samples. Low GW and High GW samples did not exceed the lead remedial objective of 1,650 ug/L (1.650 mg/L). Therefore, arsenic is the primary driver for treatment.

Table 2.
Dissolved Arsenic, Lead and pH of the Low and High Groundwater.

Sample Name	Arsenic, mg/L	Lead, mg/L	pH
Remedial Objective	0.666	1.650	-
GW-MW-11S-Low 102416-(20). Low GW	2.75	0.29	6.81
GW-MW-12S-High 102416-(20). High GW	36.7	0.076	6.41

Backfill material (<3/8/") was leached with the Low GW sample and the High GW sample in an "as is" untreated manner to determine baseline concentrations of GW with backfill alone. Leaching of untreated backfill material with the Low and High GW samples (Table 3) found lower arsenic concentrations when compared to background concentrations (Table 2). Thereby, the backfill material alone has properties to stabilize arsenic, but the level of stabilization is not enough to meet the remedial objective.

The <3/8" backfill material was treated with EnviroBlend® HXD at 3%, 4% and 5% by weight and leached with Low and High GW (Table 3). The low GW sample was effectively treated and met the remedial objective with a 3% EnviroBlend® HXD dosage. A 4% EnviroBlend® HXD dosage met the remedial objective for the High GW sample. In fact, the treatments reduced both arsenic and lead below their respective detection limit.

Table 3.
Screening Leaching Results of Untreated and EnviroBlend® HXD Treated Samples

Sample Name	EnviroBlend® Dosage		Treated Water Test Results, Dissolved Metals (<0.45u)		
	Chemical	Percentage wt./wt.	Final pH	Arsenic, mg/L	Lead, mg/L
Remedial Objective	-	-	-	0.666	1.650
GW-MW-11S-Low 102416-(20). Low GW	Untreated	-	7.28	1.92	0.092
	EnviroBlend® HXD	3%	6.52	<0.030	<0.030
GW-MW-12S-High 102416-(20). High GW	Untreated	-	7.26	23.0	<0.030
	EnviroBlend® HXD	3%	6.24	1.31	<0.030
		4%	6.06	<0.030	<0.030
		5%	5.66	<0.030	<0.030

This study designed testing to minimize oxidation of arsenite to arsenate by leaching samples in a ZHE. The ZHE provided a leaching environment free of air so arsenic oxidation could not occur. This better represents the disposal setting where groundwater low in oxygen and low in ORP will be exposed to treated backfill.

EnviroBlend® HXD was shown to be effective in treating arsenic and lead in groundwater at the Superlon site. EnviroBlend® HXD has demonstrated the ability to treat at least 100 PV of GW that may infiltrate the backfill material to <0.030 mg/L As and <0.030 mg/L Pb.

Sincerely,

Andrew Wenzel
Principal