Explanation of Significant Differences
Groundwater and Sediments Operable Unit
Teledyne Wah Chang Superfund Site Albany, Oregon

1. Introduction to the Site and Statement of Purpose

Site Name and Location
Teledyne Wah Chang Albany
1600 Old Salem Road, NE
Albany, Oregon
97321-4548

Identification of Lead and Support Agencies

The United States Environmental Protection Agency (EPA) is the lead agency for this Superfund site. The Oregon Department of Environmental Quality (DEQ) is the support agency for this Superfund site.

Statutory Citation for an Explanation of Significant Differences

This Explanation of Significant Differences (ESD) has been prepared in accordance with Section 117(c) of the "Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)"and Section 300.435(c)(2)(i) of the "National Oil and Hazardous Substances Pollution Contingency Plan (NCP)." An ESD is required when there is a significant change in the remedial action (RA) that does not fundamentally alter the remedy selected in the ROD with respect to scope, performance or cost. It is EPA's policy to prepare an ESD prior to implementation of a secondary technology (*Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents, EPA 540-R098-031, 1999*).

Date of ROD Signature

This Explanation of Significant Differences (ESD) applies to the remedial actions selected in the Final Record of Decision (ROD) for the Groundwater and Sediments Operable Unit (OU2) for the Teledyne Wah Chang (Wah Chang) Superfund Site signed June 10, 1994.

Circumstances Prompting the Present Change to the Selected Groundwater Remedy in the ROD

Additional studies since the ROD have demonstrated that the selected remedy for the Feed Makeup Area (FMA) of the Site, a combination of in-situ soil flushing and groundwater extraction and treatment, is not expected to achieve the ROD performance goals for increased pH and reduction of contaminants of concern (COCs) in groundwater

to the cleanup levels specified in the ROD in the estimated 15-year time frame. After further evaluations, EPA has determined that it is necessary to enhance the selected remedy by adding a groundwater flushing system using a buffering solution and a downgradient buffering barrier as a secondary technology to the selected remedy. The acidic soils have proven resistant to neutralization using groundwater alone. However, the buffered solution proposed for injection should rapidly and permanently neutralize the area of residual acidity. Once the groundwater is neutralized, the transport of metals and radionuclides should decrease to levels approaching the ROD performance goals. Once neutralized, the effect is expected to be permanent. Groundwater monitoring of the area is in place to confirm the ongoing protectiveness of this remedy component.

Administrative Record File and Public Access to the ESD

This ESD will become part of a new Wah Chang administrative record in accordance with NCP 300.435(a)(2)(i). This ESD will be available to the public at the following locations:

EPA Region 10
1200 Sixth Avenue
Records Center 7th Floor
Seattle, WA
Hours: Monday through Friday 8:30 am - 4:30 pm

Albany Public Library
2450 14th Ave. SE
Albany, OR 97322
Hours: M-W 10-8; Th, Fri 10-6; Sat 10-5; Sunday 1-5

2. Site History, Contamination, and Selected Remedy

Summary of Site History and Contamination

The Teledyne Wah Chang (Wah Chang) Superfund site is located in Albany, Oregon, adjacent to the city of Millersburg. The facility covers approximately 225 acres near the Willamette River (Figure 1). The Wah Chang facility is divided into the Main Plant which consists of the Fabrication Area and Extraction Area (90 acres), the Solids Area (20 acres), and the Farm Ponds Area (115 acres). In addition to the CERCLA Consent Decree, Wah Chang has a RCRA hazardous waste permit issued by DEQ.

Wah Chang is an active operating facility that manufactures zirconium and other non-ferrous metals. The manufacturing operation consists of numerous production facilities used primarily for the extraction and refining of zirconium and hafnium from zircon sands. A small amount of tantalum, columbium, titanium and vanadium is also produced in this process. The plant also has a number of waste treatment and storage facilities and several on-site ponds that were, or presently are, being used for the storage of liquid and solid wastes.

The processing of the zircon sands generates sludge, waste water, and solid waste, some of which are radioactive. These wastes are managed under Wah Chang's Waste Program regulated by the Oregon Public Health Division Radiation Protective Services. The facility's central wastewater treatment system consists of a continuous chemical precipitation and clarification system. Effluent water is discharged from the treatment plant to Truax Creek under a National Pollutant Discharge Elimination System (NPDES) wastewater discharge permit. Precipitated metals and lime solids are removed in a clarifier by settling and then dewatered in the Sludge Treatment System. Solid waste is disposed at a public landfill or at hazardous waste material storage and/or treatment facilities.

Groundwater Contamination

The nature and extent of groundwater contamination is documented in the Remedial Investigation / Feasibility Study (RI /FS) Report, dated March 1993. Contaminants of concern (COCs) include:

- Benzene
- 1,2-Dichloroethane (1,2-DCA)
- 1,1-Dichloroethene (1,1-DCE)
- Methyl isobutyl ketone (MIBK)
- 1,1,2,2-Tetrachloroethane (Farm Ponds Area only)
- Tetrachloroethene (PCE)
- 1,1,1-Trichloroethane (1,1,1-TCA)
- 1,1,2-Trichloroethane (1,1,2-TCA)
- Trichloroethene (TCE)
- Vinyl Chloride (VC)
- Hexachlorobenzene
- Bis(2-ethylhexyl)phthalate
- Beryllium
- Copper
- Manganese
- Uranium
- Total polychlorinated biphenyls (PCBs)
- Radium-226
- Radium-228
- Ammonium

- Fluoride

Main Plant

Manufacturing of zirconium and other non-ferrous metals is done in the Extraction Area and Fabrication Area of the main plant. Zircon sands are processed into a zirconium sponge in the Extraction Area and then fabricated into metal ingots in the Fabrication Area. The Extraction Area contains the physical and chemical processes that isolate and extract target metals (zirconium and hafnium) from the zircon sand concentrate. There are two primary contaminant sources in the Extraction Area, a chlorinated volatile organic compounds (CVOCs) source present in the South Extraction Area (SEA), and an inorganic/pH source present in the Feed Makeup Area (FMA). A third low-level source associated with the former V-2 Pond was remediated in 1989.

Historical industrial activities in the FMA consisted of dissolving zirconium and hafnium tetrachloride in water and transferring the resulting feed solution to separations systems. The RI/FS indicated that a spill or leaks of acidic feed solution consisting of zirconium tetrachloride from tanks and underground transfer pipes in the 1970s had occurred in an inaccessible portion of the FMA resulting in low groundwater pH and contaminants associated with the feed solution, including radium and metals. The low pH observed in well PW-28A may be the result of buried feed solution previously used by Wah Chang prior to 1978.

Groundwater Remedial Action Objectives (RAOs) and the ROD Selected Remedy

Section 7.4 of the ROD specified the following RAOs for groundwater:

- Prevent people from drinking groundwater containing contaminant levels above federal and state drinking water standards.
- Prevent contaminated groundwater above federal and state drinking water standards from leaving the TWCA property boundary.
- Reduce the concentrations of TWCA-related organic, inorganic, or radionuclide compounds in groundwater to concentrations below federal or state drinking water standards or other risk-based levels.
- Prevent groundwater containing TWCA-related organic, inorganic, or radionuclide compounds above federal or state standards from discharging into nearby surface waters.

In addition, the selected remedy in the ROD set out in Section 10.1 stated the following:

- Remediation of groundwater via groundwater extraction in the Feed Makeup Area and at areas on Site where contaminant concentrations exceed lifetime cancer risk levels of 10[-4] and/or substantially exceed noncancer hazard index (HI) of 1 for worker exposure. Extraction shall continue until contaminant concentrations in groundwater throughout the Site are reduced to below Safe Drinking Water Act (SDWA) maximum contaminant levels (MCLs), non-zero maximum contaminant

level goals (MCLGs), or cancer risk levels of 10[-6] and noncancer risk HI < 1 for worker exposure, or until EPA in consultation with DEQ determines that continued groundwater extraction would not be expected to result in additional cost effective reduction in contaminant concentrations at the Site. Contaminated groundwater in exceedance of SDWA MCLs, non-zero MCLs, or cancer risk levels of 10[-6] and noncancer risk HI > 1 for residential use shall be prevented from migrating off the plant site, or beyond the current boundary of the groundwater contaminant plume at the Farm Ponds Area.

- Discharge of extracted groundwater to Teledyne Wah Chang Albany's wastewater treatment plant. Pretreatment of groundwater to comply with Clean Water Act (CWA) requirements prior to discharge to the wastewater treatment plant.
- Treatment or removal of subsurface source material near the Feed Makeup Building on the main plant.

3. Basis for the Change in the Remedy

The remedy for contaminated groundwater is being modified from in-situ soil flushing with water, to soil flushing with a buffer solution in order to meet groundwater cleanup levels in the 15-year time frame specified in the ROD.

The 1994 ROD for OU2 issued by EPA selected in-situ soil flushing with water to remediate the contaminated subsurface source material in the FMA. The source material was a release of highly acidic fluid, rich in metals and radionuclides. The acidity of this fluid has maintained conditions leading to the high mobility of the metals and radionuclides into groundwater. The selected remedy in the ROD was to neutralize the acid, increasing pH levels in the contaminated groundwater using the weak buffering capacity of natural water, so that COCs would no longer be released from soil by acidic groundwater to the underlying Linn Gravel aquifer. This, in turn, would decrease groundwater concentrations of COCs within this aquifer to below ROD cleanup levels.

Pursuant to Section 10.1 of the ROD, if groundwater cleanup levels cannot be achieved, then the potential responsible party (PRP) shall conduct periodic reevaluations of alternate remedial technologies to achieve groundwater restoration. Based on the evaluation of the current remedy, EPA has determined that groundwater extraction alone is not likely to achieve ROD cleanup levels and restoration in the FMA within the estimated 15-year time frame from the onset of the remedy.

Section 10.1.3 of the ROD stated that if pilot testing indicates that flushing of source materials is not feasible, or if implementation is not effective in achieving RAOs, EPA may determine that additional remediation should be implemented. Although pilot testing of in-situ soil flushing was not conducted, information obtained during implementation of Groundwater Extraction and Treatment System (GETS) and operation of the extraction wells has indicated there is limited availability of groundwater in the subsurface. EPA determined that this would likely limit the effectiveness of soil flushing using natural water alone. Furthermore, the large volumes of water required could not be moved

through the limited saturated thickness of the aquifer and the weak buffering capacity would likely fail to effectively neutralize the acid remaining in the area. Water from the City of Albany, being in the vicinity of pH 5.5, would not neutralize the soils and groundwater to the pH needed in the ROD required cleanup timeframe.

Wah Chang completed several soil studies in the FMA to assist in locating the source of low pH groundwater. Analytical results of soil during installation of monitoring wells PW-50A and PW-51A in 1997 did not reveal a concentrated contaminant source. Between 1997 and 2005, nine additional evaluations were conducted on excavated soils in the FMA and no additional sources were identified. Beginning in 2007 and continuing into 2008, the Feed Deck in the FMA was relocated. As part of the relocation, soil was excavated and sheet pilling was driven along the shoreline of Pond 1B down to the top of the Blue Clay.

In September 2011, Wah Chang performed source characterization in the FMA to define the extent of area that would need soil flushing. Wah Chang's source characterization included sampling a groundwater transect to determine if low groundwater pH and the associated dissolved contaminants were reaching Second Lake. From the results of the study, the EPA determined that low groundwater pH was not detected in groundwater entering Second Lake.

In 2013, Wah Chang evaluated remediation alternatives in the *Feed Makeup Area Groundwater Focused Feasibility Study and Treatability Study Work Plan* (Work Plan). The study concluded that although implementation of a groundwater flushing system using fresh water would provide COC concentration reduction through dilution and displacement, pH adjustment would be limited because of the limited buffering capacity of the water. Use of a strong buffering solution instead of water would provide for enhanced treatment of COCs through co-precipitation and a rapid and complete neutralization of acidity. The neutralization, by returning the groundwater to near neutral pH, is expected to greatly decrease mobility of COCs as they are bound to the solids in the saturated soils. The persistence of this remedy will be enhanced by leaving excess buffer in the soil after injection. This material will be available to continue to treat residual acidity which may exist in low permeability areas or which may be transported through the treatment area after active injection ceases.

Administrative Record Files Supporting Current Change in the ROD

Information collected and developed since the 1994 ROD that is pertinent to this ESD is contained in a new Administrative Record for the Site. The primary documents referenced in this ESD include:

- Feed Makeup Area - Second Lake Groundwater pH Sampling Transect Results. prepared by GSI, October 26, 2011.

- Addendum - Third Five Year Review Report, Teledyne Wah Chang Superfund Site. March 28, 2012.

- Extraction Area Groundwater Year 2011 Remedial Action Progress Summary. prepared by GSI, September 5, 2012.
- Fourth Five Year Review, Teledyne Wah Chang Superfund Site. December 28, 2012.
- Feed Makeup Area Groundwater Focused Feasibility Study and Treatability Study Work Plan –Revised. prepared by GSI, January 11, 2013.

4. Description of Significant Differences

Significant Differences between ROD Remedy and Action Now Proposed (Implementation of the Groundwater Flushing System Using a Buffering Solution and a Downgradient Buffering Barrier as a Secondary Technology to the Selected Remedy for the Groundwater OU)

With this ESD, EPA is modifying the selected remedy for groundwater (soil flushing) in the FMA by adding a secondary treatment technology, specifically by adding a buffering solution to the soil flushing and a downgradient buffering barrier. This change represents a significant but not fundamental change because the basic approach, scope, RAOs and cleanup levels remain unchanged by the addition of this secondary treatment technology.

The overall objectives of this ESD at the FMA remain the same as the remedial action objectives (RAOs) and cleanup levels/goals documented in the 1994 Record of Decision. The significant differences between the selected remedy as presented in the ROD and the action now proposed are summarized in Table 1.

	Comparison of ROD Remedy and Revised Remedy	
	ROD Soil Flushing Remedy	**Proposed Revised Remedy - Groundwater Flushing with Strong Buffer Solution and Downgradient Barrier**
Remedy Description	In addition to groundwater extraction, the ROD remedy included: - Treatment or removal of subsurface source material near the FMA. The ROD required that pilot tests be conducted if necessary to determine the effectiveness of removal of contaminants in the subsurface via flushing of the source material with water. - The flushing technology proposed for evaluation would use infiltration trenches to introduce large volumes of clean water into the low pH treatment area. -The added water and dissolved contaminants would be removed with an extraction well.	- Install four strings of temporary injection wells to inject strong buffering solution into the low pH treatment area. The initial two strings will be used to develop a downgradient barrier containing additional buffering capacity to treat migrating low pH groundwater.
Remedy Performance	The ROD GETS remedy was not designed to increase pH and thus decrease concentrations of released COCs to ROD cleanup levels within the estimated 15-year time frame. With regards to soil flushing with water, the limited availability of groundwater in the subsurface would likely limit the effectiveness of treating the low pH area by flushing with water alone, and the large volume of natural water required could not feasibly be moved through the area of spilled acidic feed solution.	The modified remedy is expected to increase pH and reduce concentrations of COCs to ROD cleanup levels within the estimated 15-year time frame, and will also address raising the pH of incoming city water that is rarely above a pH of 5.5 to the 5.5 to 6.5 range. 12 month monitoring data and an 18 month groundwater monitoring progress summary will be used by EPA to determine remedy effectiveness and whether additional source remediation is needed.
Cost	Implementation of the 1994 ROD soil flushing remedy at the redesigned[1] FMA: • Capital costs $20,000 • Consulting Costs (first year of quarterly monitoring assuming separate reporting) $30,000	Implementation of revised soil flushing remedy for FMA groundwater : • Capital costs $110,000 • Consulting Costs (system operation, data collection, and reporting) $150,000

	• Wah Chang Operations Costs	$10,000		
	Updated total	$60,000	Total	$260,000

[1] Feed Deck was relocated in 2007-2008 from the FMA to floating containment on Pond 1B

The decision to modify Section 10.1.3 of the ROD has been made at the discretion of the EPA in consultation with the DEQ. Based on information summarized in this ESD, EPA and DEQ have concluded that injection of buffer solution can be used as a secondary technology, along with ongoing ground-water extraction, to help achieve RAOs in the FMA of the Main Plant.

Changes in Expected Outcomes Resulting from the ESD

The remedy for groundwater in the FMA as selected in the ROD cannot achieve the ROD RAOs and performance goals in the estimated timeframe. The implementation of the modified remedy, a groundwater flushing system using a buffering solution and a downgradient buffering barrier, is expected to increase pH in FMA groundwater and saturated soils and reduce COC concentrations to ROD cleanup levels that will meet the estimated ROD cleanup time frame of 15 years from the onset of the GETS system.

The Work Plan contains details regarding performance objectives, metrics, and compliance monitoring. Performance monitoring will be conducted to detect changes in groundwater pH and concentrations of COCs. Monthly groundwater monitoring for pH will be conducted at wells PW-28A, PW-50A, PW-51A, PW-52A, PW-102A, and PW-103A for six months after injections. After six months, results will be evaluated using data collected during routine biannual monitoring of the FMA well network. Groundwater sampling methods and protocols will be identified in the Operations Plan.

The modified remedy is expected to be protective in the long term because neutralization of acidity is highly effective and permanent to the extent that the neutralizing solution can be brought into contact with the acidified soils. The neutralization effect is expected to be permanent because the process of neutralization destroys the Hydronium Ion (H+) of the acid by adding a Hydroxide Ion (OH-) and creating water. The only way it would not be permanent is if the buffer solution cannot reach all the acidic source material. The facility is addressing this by injecting an excess of the buffering material necessary to reach the adjacent wells and by conducting monitoring at those wells. Additionally, the facility intends to inject enough excess buffering material to actually raise the water table to press up against the base of the concrete which covers the ground surface in the area. Additional permanence is supported by the natural ability of water to neutralize acid due to its weak buffering capacity after the injected solutions are flushed from the treatment area by natural gradients or operation of the recovery system. The screened zones of the injection wells will be completed across the full extent of the Linn Gravels to allow buffering amendments to be introduced through the water column and also into potentially contaminated soils above the water table. Monitoring during injection is planned to confirm that the buffer solution has been effectively distributed. Once the bulk of the acidity is addressed, rebound is not anticipated since the buffering capacity of

natural groundwater is expected to maintain neutral pH conditions. Furthermore, the buffering amendments are expected to remain in the aquifer for 6 months to 2 years to allow treatment of any residual acidity, and any reduction in permeability resulting from the injections will retard groundwater movement. No new contaminant sources are anticipated to be introduced in the FMA since the Feed Deck has been relocated. Long term monitoring will be conducted following completion of the treatment to verify that the remedy has been effective.

However, if EPA determines that the remedy as modified by this ESD is ineffective, does not result in RAOs being met in accordance with the ROD, and/or is not protective of human health or the environment, then EPA will work with Wah Chang to evaluate the need and options for further response actions in the FMA.

5. Affirmation of Statutory Determinations

The EPA has determined that the remedy for the Teledyne Wah Chang Superfund Site, as modified by this ESD, satisfies CERCLA §121 and remains protective of human health and the environment, complies with federal and state requirements identified in the ROD as applicable or relevant and appropriate to the remedial action at the time of the final ROD, and is cost-effective.

6. Compliance with Public Participation Requirements of CERCLA and the NCP and Administrative Record Availability to the Public

The NCP §300.435(c)(2)(i) allows significant changes to be made after the adoption of the ROD as appropriate, after consultation with the support agency, in this case Oregon DEQ. The Oregon DEQ supports the selected remedy as modified by this ESD.

Furthermore, when making such a change, the NCP requires the lead agency to make the explanation of significant differences and the supporting information available to the public in the Administrative Record and publish a notice that briefly summarizes the explanation of significant differences, including the reasons for it, in a major local newspaper.

This Explanation of Significant Differences has resulted in a specific Administrative Record being created. The Administrative Record is available in the EPA Region 10 Records Center located at 1200 Sixth Avenue, Seattle, Washington, and at the information repository located at the Albany Public Library, 2450 14th Ave. SE, Albany, Oregon.

The EPA will send out a notification by mail, as well as a published notice in accordance with requirements set out in NCP §300.435(c)(2)(i).

7. Authorizing Signature

Cami Grandinetti 5/6/13

Cami Grandinetti, Program Manager
Environmental Cleanup Office, Region 10
U.S. Environmental Protection Agency

Date