Teledyne Wah Chang
Addendum - Third Five Year Review Report

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Region 10

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ACRONYMS

µg/L	microgram per liter
ASA	Acid Sump Area
bgs	below ground surface
CCA	Crucible Cleaning Area
COC	contaminant of concern
CVOC	chlorinated volatile organic compound
DCE	dichloroethene
DEQ	Oregon Department of Environmental Quality
EISB	enhanced in-situ bioremediation
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
FMA	Feed Makeup Area
FYR	Five Year Review
GETS	Groundwater Extraction and Treatment System
IDW	investigation derived waste
OU	operable unit
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
RAO	Remedial Action Objective
RCB	Risk Based Concentrations
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SEA	South Extraction Area
TCA	trichloroethane
TCE	trichloroethene
VC	vinyl chloride
VOC	volatile organic compound

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Addendum to the Third Teledyne Wah Chang Superfund Site Five-Year Review Report, dated January 8, 2008

The Environmental Protection Agency completes a Five-Year Review addendum for remedies where the protectiveness determination is deferred until further information is obtained. When deferring protectiveness in the FYR report, the EPA typically provides a timeframe for when the information will be obtained and a protectiveness statement can be made. This document describes progress since the January 2008 FYR and provides justification for continuing with the sitewide protectiveness deferred determination, made in the January 2008 FYR for the remedies in the groundwater operable unit.

The Third FYR report for the Teledyne Wah Chang Superfund Site in Millersburg, Oregon, was signed by Daniel D. Opalski, Director of the Office of Environmental Cleanup, EPA Region 10 on January 8, 2008 (EPA 2008a). The protectiveness statements outlined in the January 2008 Report were as follows:

Sludge Ponds – OU1

The remedy for OU1 is protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled.

Groundwater and Sediment – OU2

The EPA cannot make a protectiveness determination for the remedy at OU2 until Wah Chang provides further information regarding the effect that enhanced in situ bioremediation enhancements have made on the groundwater remedy and the ability of the remedy to meet RAOs

Surface and Subsurface Soil and the Soil Amendment Area – OU3

The remedy for OU3 is protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled.

Site Wide Protectiveness

The EPA could not make a site wide protectiveness determination for the implementation of the overall remedies at the Teledyne Wah Chang Superfund Site at the time of the January 2008 FYR until further information was obtained from proposed remedy enhancements to the groundwater operable unit (OU2).

This March 2012 Addendum to the January 2008 report addresses the Protectiveness Statements for the Groundwater Operable Unit OU2.

Progress Since the Five-Year Review Completion Date

Addendum to the Groundwater and Sediment OU2

The following are issues that led to the protectiveness determination from the January 2008 report and progress made since that time. This discussion supports why a protectiveness determination was not made at the time of the January 2008 FYR and provides evaluations and actions taken to resolve issues.

Extraction Area

Feed Makeup Area

Historical industrial activities in the FMA consisted of dissolving zirconium and hafnium tetrachloride in water and transferring the resulting feed solution to separations systems. During the 1980s, Wah Chang released a large quantity of hydrochloric acid into the surface and subsurface soils and contaminated the underlying groundwater aquifer as a result of these industrial activities. The EPA determined following an RI/FS for the Wah Chang facility that groundwater in the FMA was highly acidic (pH near 1) and contained elevated concentrations of dissolved metals, anions/cations and radionuclides. Following completion of the RI/FS, the EPA issued a ROD for the Groundwater OU2 that selected in-situ soil flushing for the contaminated source material and subsequently the groundwater aquifer in the FMA. The in-situ soil flushing was meant to increase pH levels in the contaminated groundwater so that COCs would no longer be released from soil by acidic groundwater to the underlying aquifer, increasing groundwater concentrations above ROD cleanup levels. To date, soil flushing has not been implemented due to the infeasibility of utilizing large amounts of water. However a groundwater extraction and treatment system, also selected by the ROD, was implemented to remediate hot-spot areas with high groundwater COC levels.

Annual monitoring in the FMA currently shows that COCs in groundwater in the FMA are above ROD cleanup levels. The EPA has concluded that this could be resulting from historical acidic conditions in groundwater mobilizing metals from soil into the groundwater aquifer. The GETS system was not designed to address the acidic groundwater condition in the FMA that is potentially mobilizing COCs into groundwater. Therefore, in accordance with the ROD, implementation of in-situ soil flushing is necessary. However, since the last FYR, discussions between the EPA and Wah Chang resulted in the EPA's decision not to implement the original in-situ soil flushing with solely water as specified in the ROD. The large amounts of water that are needed would overwhelm the utility trenches at the Site. At this time, Wah Chang is evaluating the option of neutralizing the chemistry of the FMA acid plume by direct injection of base or buffer solutions instead of just using water. This would likely yield the desired effect with more manageable volumes of liquid being added. In order to implement this unanticipated change in the ROD, an ESD to the groundwater ROD is needed and the EPA needs to approve a work plan for the in-situ soil flushing. The remedy at the Groundwater OU2, and thus the site, would not be protective in the long term until this work is completed and the EPA has assessed the results.

Since the January 2008 FYR, Wah Chang performed source characterization to define the extent of soil flushing needed in the FMA. Wah Chang's source characterization included sampling a groundwater transect, in September 2011, to determine if low groundwater pH was reaching Second Lake. If Wah Chang detected low groundwater pH in the vicinity of Second Lake it was likely that COCs could also have been transported by the acidic groundwater and be present. From the results of the study, the EPA determined that low groundwater pH was not detected in groundwater entering Second Lake (Wah Chang 2011a). A treatability study for soil flushing is currently being prepared by Wah Chang and is

expected to be delivered to the EPA in 2012. Long term protectiveness of the remedy cannot be determined until the soil flushing remedy is implemented and evaluated.

South Extraction Area (SEA)

At the time of the January 2008 FYR the EPA determined from Annual Monitoring Data that an insufficient amount of groundwater existed in portions of the Site, thus limiting GETS ability to extract groundwater effectively. The EPA further concluded that groundwater CVOC concentrations in the South Extraction Area were not declining at a rate that would achieve RAOs within the timeframe called for in the ROD. Response actions that Wah Chang took to address this issue included bioaugmentation that was not considered by the EPA at the time of the ROD. Wah Chang and the EPA have evaluated the use of enhanced bioremediation as a new remedial action in the SEA through a pilot test under an approved EPA work plan. In March 2008 Wah Chang completed an enhanced in-situ bioremediation pilot test in the SEA (EPA_2008b). Since this application of EISB was in a small area of the Extraction Area in order to test the feasibility and effectiveness of the EISB technology for the site, the EPA determined that no ESD was required at that time in order to implement the pilot.

Approximately 30 months (Fall 2010) following the implementation of EISB through the SEA pilot, the EPA has determined that all wells in the SEA meet cleanup standards set forth in the Groundwater ROD. TCA was not detected in any SEA monitoring well and TCE was not detected in any well with the exception of EW-4 where a concentration of 0.58 µg/L was detected (method detection limit was 0.5 µg/L). Concentrations of CVOC daughter products indicated that breakdown of parent compounds were occurring suggesting that reductive dechlorination was active and progressing. Groundwater field parameter data indicated current conditions were conducive to survival and function of dechlorination microbes, which are necessary to breakdown COCs (Wah Chang 2011b). Based on the low concentrations in the SEA, the EPA approved suspending operation of area extraction wells by Wah Chang. However, given the lack of identification of the source area of the CVOC concentrations, Wah Chang will monitor wells biannually in the SEA for VOCs for a period of five years from the shutdown of extraction wells (operation was suspended in April 2011) to determine if rebound occurs. If rebound occurs and additional action is necessary, Wah Chang and the EPA will consider remedial action options to reduce VOCs in the SEA. Since data indicates that cleanup levels have been met, the EPA considers the SEA protective in the short term. No potential for exposures in the SEA are expected to occur and the ICs are still in place that restrict use of groundwater. A new protectiveness statement will be made in the next FYR based on the data collected up until then and the continued protectiveness can be assessed.

Fabrication Area

The Fabrication Area is approximately 50 acres in size and is the part of the Wah Chang facility where zirconium sponge and recycled material are consolidated into finished zirconium plates, tubes, wires and other forms. The EPA's selected remedy for the Fabrication Area included groundwater extraction using GETS from 7 wells, although Wah Chang's final implementation of the GETS resulted in only 6 wells, due to lack of groundwater in the aquifer in the vicinity of one well. In fall 2007, the EPA required Wah Chang to modify the system in order to enhance pumping capacity. As a response to the EPA's requirement, Wah Chang conducted an investigation into the feasibility of adding an extraction well in the Acid Sump Area. During Wah Chang's investigation, a drum containing solvent was encountered and product released into the subsurface. Cuttings removed by Wah Chang from a depth of 10 to 11 feet bgs displayed an oily sheen with a solvent-like odor. Wah Chang's analysis of a reconnaissance grab sample collected from a drum containing IDW from this depth, resulted in a TCA concentration of 1,420,000 µg/L, TCE concentration of 2,810 µg/L, and a 1,1-DCE concentration of 23,600 µg/L. The EPA concluded that the TCA concentration detected was greater than the compounds solubility limit,

and thus, TCA may be present as a non-aqueous phase liquid. The potential presence of NAPLs and/or the high concentrations of dissolved phase chlorinated organics in groundwater may stem from a release from an unidentified source and may affect the groundwater remedy. Therefore, the EPA determined that modification to the groundwater remedy in the Fabrication Area was necessary to achieve RAOs during the estimated 15-year time frame for cleanup. Protectiveness could not be determined in the January 2008 FYR.

Since the January 2008 FYR year review, Wah Chang performed additional response actions in the Fabrication Area to reduce COCs in groundwater in two areas, the ASA and the Crucible Cleanup Area. Specific response actions included bioaugmentation that the EPA had not considered at the time of the ROD. The EPA signed an ESD in June 2009 to use enhanced bioremediation as a new remedial action in the Fabrication Area. In September 2009, Wah Chang completed EISB in the ASA. Approximately 12 months following EISB, monitoring results from Wah Chang's sampling indicated groundwater field parameter conditions conducive to dechlorination microbes, which are necessary to reduce COCs, had improved from the baseline conditions prior to injection (Wah Chang 2011c). Based on review of the September 2011 data summary, the EPA determined that some wells still remain above action levels. However, groundwater analytical data for VOCs indicates that TCA and TCE concentrations have been reduced and daughter compounds increased as a result of EISB. Wah Chang must continue monitoring to assess the continued effectiveness of parent compound dechlorination and to monitor changes in concentrations indicative of rebound conditions. The results of 18 and 24 month long term monitoring following EISB implementation are expected in 2012 and should reveal to the EPA how the remedy is progressing and if follow-up actions are needed.

In September 2010, Wah Chang completed EISB in the CCA and two additional monitoring wells were installed to support performance monitoring. Initial groundwater analytical results from Wah Chang show that VOC concentrations have been reduced (Wah Chang 2011d). Additional performance monitoring results are anticipated from Wah Chang in 2012. Due to continued monitoring of the persistence of the geochemical conditions necessary for the reductive dechlorination of the CVOCs in this area, the EPA is deferring the protectiveness of this remedy component until the 4th FYR.

Farm Ponds

At the time of the January 2008 FYR, the EPA determined, from annual monitoring reports, that natural attenuation processes monitored in groundwater in the Farm Ponds Area were limited in their ability to achieve RAOs and ROD cleanup levels. This determination was made based on the concentrations of PCE, TCE and VC in select wells seen from sampling. In late 2008, monitoring by Wah Chang indicated that concentrations of CVOCs in groundwater at the Farm Ponds significantly decreased to below ROD performance standards in all wells. However since the drop in CVOC concentrations remains unexplained by Wah Chang and the presence of source material exists and the possibility of rebound is likely, Wah Chang is currently planning additional actions at the Farm Ponds to eliminate the suspected source of contaminants. The EPA has approved the source material removal and excavating past the contaminated depth of the remaining pond's berms, with confirmation sampling. Wah Chang will need to monitor groundwater conditions at the site following berm removal.

Surface Water

Wah Chang conducted supplemental surface water sampling on a biannual basis at Truax Creek and Murder Creek and groundwater sampling from applicable perimeter wells so the EPA could evaluate the potential for exposure to human health and the environment via the surface water pathway. Based on the results from surface water sampling, the EPA has determined that VOCs have not been detected in surface water since the fall of 2008 in Truax Creek. However, the increased concentrations of CVOCs in well PW-78A (close to Murder Creek) have been observed by the EPA (Wah Chang 2011d). The EPA has determined that VOCs have not been detected in Murder Creek since fall 2009, but have been detected in historical surface water sampling. Wah Chang will need to collect additional surface water samples in the vicinity of PW 78A to evaluate the potential for release of contaminated groundwater to the creek. Because of this missing data, the EPA is deferring protectiveness for the surface water pathway.

In order to evaluate risk to human health and the environment from the consumption of fish and/or organisms at Second Lake, Wah Chang recently sampled (August 2011) a transect that was discussed in the FMA section above. Since low groundwater pH was not detected in groundwater entering Second Lake, the EPA concluded that constituents that would have been mobilized by the extremely acidic conditions would not be present in the lake as well. The EPA also determined that contaminants are not reaching surface water and therefore not adversely impacting potential risk to human health from the consumption of fish and/or organisms. The implementation of the FMA acidic groundwater treatability study will likely increase the pH in groundwater and reduce the potential for COCs to be released from the underlying soils and subsequently be transported by groundwater and reach surface water. Perimeter wells will continue to be monitored by Wah Chang and the results evaluated by the EPA.

Indoor Air

The EPA evaluated the potential exposure to current onsite workers from indoor air vapor intrusion associated with contaminated groundwater for three on-site buildings. The EPA selected four monitoring wells (PW-12, PW-42, PW-71, and PW-86) as indicators in monitoring potential vapor intrusion based on CVOC concentrations monitored in groundwater by Wah Chang. The EPA chose these wells because CVOC concentrations in groundwater exceeded the Oregon DEQ Risk Based Concentrations for the vapor intrusion exposure pathway. From monitoring data, the EPA has determined that the concentration of CVOCs in these wells have declined since 2008. In addition, DEQ edited the 2003 published values in which the original assessment for vapor intrusion was based in 2009. The EPA compared the concentration of CVOCs in all wells in the Fabrication area to the 2009 vapor intrusion RBC values for the occupational exposure scenario and no exceedances were noted. The EPA has reviewed monitored groundwater CVOC data from Wah Chang in the vicinity of these buildings to evaluate the potential for indoor air impacts. Based on observed decreasing concentrations of CVOCs in groundwater, the EPA decided that an indoor air evaluation through the collection of air samples is not necessary. The EPA does not consider indoor air to be impacted at this time.

PCBs

Wah Chang conducted a soil excavation in the early 1990s to remove PCBs in soil in the vicinity of the Emergency Services Building. Groundwater is being monitored in PW-30 and PW-46 to assess future impacts to groundwater that might come from sources in the soil of PCB contamination. Protectiveness in this area is deffered until the groundwater monitoring data can be evaluated.

New Issues and Recommendations

The following summarizes new Issues and Recommendations since the Jan 2008 Five Year Review.

Issues	Recommendations Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Current Protective-ness (Y/N)	Affects Future Protective-ness (Y/N)
Extraction Area						
Implementation of EISB in the SEA was effective at reducing concentrations of CVOCs to below ROD performance standards. The operation of GETS extraction wells in the SEA has been suspended due to the implementation of bioaugmentation in this area. Since CVOC concentrations have declined below cleanup levels, extraction may be discontinued in these wells. Monitoring for rebound will continue.	Continue to monitor groundwater concentrations in SEA wells to evaluate if rebound of CVOCs occurs. If rebound does not occur within 5 years, remedy in SEA will be considered complete. Should rebound occur and groundwater concentrations remain above cleanup levels, additional remedial actions will be considered.	Wah Chang	EPA	April 2016 Annual Ground-water Monitoring Reports will need to be evaluated.	NO	YES
GETS does not appear likely to reduce concentrations of fluoride and radium in the FMA to below ROD cleanup levels within the 15-year time frame. Contaminants in the FMA are likely mobilized by acidic conditions. Acidic conditions are not effectively addressed by GETS.	Identify additional remedial actions to address acidic groundwater conditions. Wah Chang is currently developing a weak base groundwater flushing treatability study.	Wah Chang	EPA	January 2014 Annual Ground-water monitoring reports will need to be evaluated.	NO	YES

Issues	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Current Protective-ness (Y/N)	Affects Future Protective -ness (Y/N)
Fabrication Area						
Since the last FYR, implementation of EISB has been conducted in the CCA. The remedial action has only recently been used and further evaluation is necessary to determine if the remedy will prove to be effective.	Continue to monitor groundwater concentrations in CCA wells to evaluate progress of the EISB remedy.	Wah Chang	EPA	2014 Annual Ground-water monitoring report will need to be evaluated	NO	YES
Farm Ponds						
Since the last FYR, increasing CVOCs concentrations in groundwater indicate that ROD performance standards may not be met. Recent declines in concentrations have been observed. However, remedy protection efforts are being planned to remove berm material that could act as a source and impact groundwater in the future.	Complete the removal of the berm and evaluate the effectiveness of the removal on concentrations of CVOCs in groundwater.	Wah Chang	EPA	2013 Completion report will need to be evaluated.	NO	YES
Surface Water						
CVOCs have been detected in surface water at the site sporadically in recent years. However, since the last FYR, increasing concentrations of CVOCs observed in PW-78A may indicate migration of contaminated groundwater to Murder Creek.	Add surface water sample location in the vicinity of PW-78A in Murder Creek to evaluate potential for contaminated groundwater to be released to surface water.	Wah Chang	EPA	2013. Annual monitoring data will need to be evaluated.	NO	YES

Protectiveness Statements

Based on new information and/or actions taken since the FYR completion date, the protectiveness statement for OU2 is being revised as follows:

Groundwater and Sediment – OU2

The EPA still cannot make a long term protectiveness determination for the remedy at OU2 at this time until further information is obtained from EISB remedy augmentation, implementation of in-situ soil washing in the FMA and data that will inform surface water protectiveness (i.e., sampling from PW-78A). Further information will be obtained when Wah Chang takes the actions described in the table above. It is expected that Wah Chang's implementation of response actions in the FMA will occur in 2013 and monitoring data from the FMA response actions as well as continued monitoring data from EISB will be submitted by Wah Chang in 2013 and 2014. The 2014 FMA monitoring data will not be submitted in time to be included in the 4th FYR, since the remedy modification is expected to be completed after the 4th FYR is signed. A protectiveness determination will be made in the 4th FYR. If there is still insufficient information at that time, the EPA may make another deferred protectiveness statement with the 4th FYR.

Sitewide Protectiveness

Until the EPA can make a protectiveness determination for the Groundwater and Sediment Operable Unit 2, a site-wide protectiveness determination will also be deferred until the next FYR because this unit is integral to the overall protectiveness of actions taken to date at the Site.

Next Five-Year Review

The EPA will complete the next FYR on January 8, 2013, five years after the signature of the Third FYR report.

Approval

Date 3/28/2012

Daniel D. Opalski
Director
Office of Environmental Cleanup

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