# Five-Year Review Report

**Fourth Five-Year Review Report**

**for**

**Lockheed Martin Corporation The Dalles Facility**

**Formerly Martin Marietta Company Reduction Facility**

**The Dalles**

**Wasco County, Oregon**

**Covering January 2005 through December 2012**

Approved by: Date:

Cami Grandinetti 5/15/13

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# List of Acronyms

| | |
|---|---|
| ACL | Alternate Concentration Limit |
| ARAR | Applicable or Relevant and Appropriate Requirement |
| ARCADIS | ARCADIS,US.,Inc. (formerly ARCADIS Geraghty & Miller) |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| EPA | United States Environmental Protection Agency |
| CD | Consent Decree |
| CDS | Cyanide Destruction System |
| CEI | Compliance Evaluation Inspection |
| CFR | Code of Federal Regulations |
| FS | Feasibility Study |
| LCS | Leachate Collection System |
| LMC | Lockheed Martin Corporation |
| MCL | Maximum Contaminant Level |
| mg/L | milligrams per liter |
| µg/L | micrograms per liter |
| MOA | Memorandum of Agreement |
| MMC | Martin Marietta Corporation |
| MW | Monitoring Well |
| MWR | Monitoring Well Replacement |
| NAC | Northwest Aluminum Company |
| NCP | National Contingency Plan |
| NPDES | National Pollution Discharge Elimination System |
| NPL | National Priorities List |
| O&M | Operations and Maintenance |
| ODEQ | Oregon Department of Environmental Quality |

| | |
|---|---|
| OMI Report | Groundwater Operation and Maintenance Report |
| RCRA | Resource Conservation and Recovery Act |
| RD | Remedial Design |
| RI | Remedial Investigation |
| RI/FS | Remedial Investigation/Feasibility Study |
| ROD | Record of Decision |
| RP | Responsible Party |
| SAP | Sampling and Analysis Plan |
| SMCL | Secondary Maximum Contaminant Level |
| Specialty Metals | Northwest Specialty Metals |
| SOW | Scope of Work |
| WAD | Weak Acid Dissociable |

# Executive Summary

The Lockheed Martin Corporation (Lockheed Martin) facility, also known as the Martin Marietta Reduction Facility, is located in The Dalles, Wasco County, Oregon. Harvey Aluminum Incorporated began aluminum production activities at the Site in 1958 and became a wholly owned subsidiary of Martin Marietta Corporation. Martin Marietta Corporation continued aluminum production activities until 1984, when the plant was shut down. In 1986, Martin Marietta Corporation leased the aluminum production plant to Northwest Aluminum Company (NAC). NAC purchased the plant in 1990 and continued aluminum manufacturing until filing for bankruptcy in 2003. After a corporate merger in 1995, the Lockheed Martin Corporation became the successor to Martin Marietta at the Site. During facility operation, hazardous substances and contaminants including cyanide, fluoride, sodium, polynuclear aromatic hydrocarbons (PAHs), sulfates, and spent potliner waste (cathode waste high in cyanide compounds and a RCRA listed waste -K088) were generated and released to the environment. Facility operations and waste burial resulted in soil and groundwater contamination.

The Site was listed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priority List (NPL) in 1987 after cyanide compounds were detected in groundwater. In 1988, a Record of Decision (ROD) was signed documenting the selection of the remedy to clean up the Site. In 1989, the United States on behalf of the Environmental Protection Agency (EPA), the State of Oregon on behalf of the Oregon Department of Environmental Quality (ODEQ), and Martin Marietta entered into a Consent Decree (CD) which required Martin Marietta Company, now Lockheed Martin, to implement the remedial action selected in the ROD.

The CERCLA remedy for the Site consisted of excavating and consolidating spent potliner waste and contaminated soil into an existing unlined landfill, identified as the CERCLA landfill; capping the waste with a multi-media cover; construction of a soil cover over scrubber sludge ponds 2 and 3; plugging and abandoning nearby production wells and connecting users to the City of The Dalles water supply; collection and treatment of leachate generated from the landfill and from perched water east of River Road, and from former Cathode Waste Management Areas; recovery and treatment of contaminated water from the Unloading Area; and groundwater quality monitoring and a contingency plan to perform additional recovery of groundwater in the event that further contamination is detected above applicable and relevant or appropriate requirements (ARARs) or health-based standards. The remedy also included institutional controls such as deed restrictions and fencing to assure protection of human health and the environment.

During remedial action activities, three additional units, the Lined Pond, the Discharge Channel and the Recycle Pond were taken out of service and were added to remedial actions for the Site through an Explanation of Significant Differences (ESD) in 1994. As part of the additional activities, dewatered sludge from the Discharge Pond and Recycle Pond were consolidated in the northern portion of scrubber sludge pond 3. In addition, EPA determined that an upgrade to the leachate collection system (LCS) was needed and a Cyanide Destruction System (CDS), consisting of a 300,000 gallon tank (referred to as the CERCLA tank) was constructed to thermally treat the leachate.

In 1996, the Site was deleted from the NPL, but ongoing monitoring and operation and maintenance continues to the present date. It is anticipated the ongoing monitoring and operation and maintenance, consisting of maintenance of the existing units and soil cover, treatment of landfill leachate, groundwater monitoring and implementation of institutional controls to restrict groundwater and land use will continue indefinitely.

Following the deletion of the Site in 1996, response actions under CERCLA continued through the CD and ROD. A Memorandum of Agreement (MOA) between EPA and ODEQ allowed for the primary oversight of the CERCLA monitoring and operation and maintenance and related RCRA work to be carried out through a RCRA Post-Closure and Corrective Action Permit (RCRA Permit). ODEQ was responsible for oversight of these activities. Based on concerns identified by EPA concerning management of the Site, the MOA between ODEQ and EPA was terminated in October 2012.

Bioremediation treatment of cyanide replaced thermal treatment for the CERCLA landfill leachate in 2007 through a permit modification to the RCRA Permit. Through this five-year review, EPA has determined that the effectiveness of biotreatment of cyanide cannot be demonstrated and that a new treatment method is required. In August 2008, Lockheed Martin also conducted several voluntary actions under ODEQ oversight including removing a small area of capped waste near the CERCLA landfill, removing monitoring wells MWR-8S and MW-9S, and replacing the wells with downgradient well MW-42. This work was completed in October 2009.

Based on this review of the Site, EPA cannot make a determination that the remedy is functioning as intended. Protectiveness cannot be determined until further information is obtained. As such, EPA must make a Protectiveness Deferred finding. EPA is concerned that the groundwater conditions are not well understood at the Site and questions the effectiveness of the biological treatment of cyanide in the LCS and on the CERCLA Landfill. EPA is also concerned with whether the engineered controls, including constructed soil covers and access-restrictive fencing at the Scrubber Sludge Ponds are protective. As described in previous five-year review reports for this Site, diminished quantities of leachate and diminished levels of hazardous constituents have not been observed as anticipated.

The ROD currently identifies alternative contaminant level (ACL) concentrations for fluoride and sulfate. At the Site, the S aquifer is identified as discharging to the Columbia River. This discharge point is located beyond the boundary of the Site and acts as a potential point for human exposure. Based on EPA guidance and site conditions, EPA had identified a need to replace ACLs with the maximum contaminant level (MCL) for fluoride and the secondary MCL (SMCL) for sulfate. This will be done through an Explanation of Significant Difference (ESD).

Given the incomplete understanding of groundwater at the site, a comprehensive groundwater monitoring program is needed to allow the agencies to make decisions about current and future use of the property and the need for changes to the remedy or additions to institutional controls. Institutional controls need to be revised to ensure current and future protectiveness from direct contact with contaminants, particularly in groundwater.

**Five-Year Review Summary Form**

| SITE IDENTIFICATION | | |
|---|---|---|
| **Site name *(from WasteLan)*:** | **Martin-Marietta Aluminum Co. (Now Lockheed Martin)** | |
| **EPA ID *(from WasteLan)*:** | **ORD 052 221 025** | |
| **Region: 10** | **State: Oregon** | **City/County: The Dalles/Wasco** |

| SITE STATUS | | | |
|---|---|---|---|
| **NPL status:** | ☐ Final | ☒ Deleted | ☐ Other: _____ |
| **Remediation status** (choose all that apply): | ☐ Under Construction | ☒ Operating | ☒ Complete |
| **Multiple OUs?*** YES ☒ NO | **Construction completion date:** 02/10/1995 | | |
| **Has site been put into reuse?** | ☐ YES | ☒ NO | |

| REVIEW STATUS | |
|---|---|
| **Lead agency:** ☒ EPA ☐ State ☐ Tribe ☐ Other Federal Agency _____ | |
| **Author name: Emerald Laija** | |
| **Author title: Environmental Scientist** | **Author affiliation: USEPA** |
| **Review period:**** **01 / 01 / 2005** to **12/ 31 /2012** | |
| **Date(s) of site inspection: May 18, 2010; September 12, 2012** | |
| **Type of review:** | Post-SARA ☒ Pre-SARA ☐ NPL-Removal Only ☐<br>Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐<br>Regional Discretion ☐ |
| **Review number:** | 1 (first) ☐ 2 (second) ☐ 3 (third) ☒ Other (specify): 4 (fourth) |
| **Triggering action:**<br>☐ Actual RA Onsite Construction at OU #____<br>☐ Construction Completion<br>☐ Other (specify) _____ | ☐ Actual RA Start at OU#_____<br>☒ Previous Five-Year Review Report |
| **Triggering action date *(from WasteLAN)*:** | ***6 / 30 / 2005*** |
| **Due date *(five years after triggering action date)*:** | ***6 / 30 / 2010*** |

* [“OU” refers to operable unit.]

** [Review period should correspond to the actual start and end dates of the five-year review in WasteLAN.]

## Five-Year Review Summary Form, cont'd.

### Issues:

- ACLs identified in the ROD exceed MCL for fluoride and SMCL for sulfate.
- The effectiveness of biological treatment of cyanide is not fully understood.
- Groundwater movement and contaminant flow and transport are not fully understood.
- The effectiveness of soil covers around the Scrubber Sludge Ponds is not fully understood and ecological receptors are entering the area.
- Uncertainty surrounds institutional controls and protection of future land owners of the site and surrounding area.
- Data showed detections of hydrogen cyanide gas at the RCRA landfill, located adjacent to CERCLA units on the Site. Further air sampling is needed to determine the levels of any toxic, asphyxiating and explosive gases from the RCRA and CERCLA landfills.
- The remediation criteria identified in the ROD for polycyclic aromatic hydrocarbons (PAHs) exceeds risk-based standards.

**Recommendations and Follow-up Actions:**

- Apply MCLs at the Site through an Explanation of Significant Difference (ESD).
- Evaluate alternative treatment methods for cyanide present in leachate from the CERCLA landfill. Based on a feasibility study and any subsequent pilot and bench scale studies, select a different technology for treating leachate.
- Evaluate the current groundwater monitoring network and conduct a comprehensive groundwater investigation. Based on the investigation, implement a more comprehensive groundwater monitoring program across the Site.
- Conduct sampling of the soil cover over the Scrubber Sludge Ponds to determine cover integrity. Based on sampling results, repair the soil cover as necessary.
- Inspect and modify fencing as needed at all fenced areas of the Site to prevent exposure of human and ecological receptors to potential hazards.
- Long-term institutional controls need to be reestablished on a site-wide basis to restrict the use of groundwater, land use development and to establish and maintain a groundwater monitoring network to protect surrounding and potential future land owners, current land users and down-gradient receptors.
- Complete air/gas sampling at the RCRA and CERCLA landfill to determine the levels of any toxic, asphyxiating and explosive gases. Determine if any action is necessary based on results.
- Change the remediation criteria for PAHs identified in the ROD to a requirement to use risk-based screening levels to determine exposure point concentrations and PAH cleanup levels for any future soil remediation work. Identify this change through an ESD.

### Protectiveness Statement(s):

*Based on this review of the Site, EPA cannot make a determination that the remedy is functioning as intended. Protectiveness cannot be determined until further information is obtained. As such, EPA must make a Protectiveness Deferred finding, EPA has determined that MCLs need to be implemented through issuance of an ESD to replace ACLs at the Site, biotreatment of cyanide in leachate needs to be replaced with an EPA-approved treatment method, fencing around the Site needs to be reviewed and institutional controls must be reestablished. In order to help determine the effectiveness of the remedy, a comprehensive groundwater investigation followed by implementation of a more comprehensive monitoring program and sampling of the soil cover over the Scrubber Sludge ponds to determine cover integrity are needed.*

# Fourth Five-Year Review Report
# Lockheed Martin Corporation, formerly the Marin Marietta Reduction Facility Superfund Site
# The Dalles, Oregon

## I. Introduction

The purpose of the five-year review is to determine whether the remedy at this site is protective of human health and the environment, to identify any issues found during the review, and to make recommendations to address issues that are identified. This site-wide statutory five-year review for the Lockheed Martin Corporation, former Martin Marietta Reduction Facility Superfund Site (the Site) has been conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Contingency Plan (NCP). CERCLA §121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

This requirement is further specified in the NCP (40 CFR §300.430[f][4][ii]), which states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

EPA Region 10 conducted the first five-year review in December 1994 and the second five-year review in December 1999. In 2004, EPA and ODEQ entered into a Memorandum of Agreement (MOA) to coordinate regulation of the CERCLA and RCRA units at the Site. Under the MOA, ODEQ assumed primary oversight for the CERCLA and RCRA units at the Site. The third five year review report covered the period of December 1999 through June 2005, and was prepared in draft by ODEQ pursuant to the MOA. EPA finalized and approved the report on June 30, 2005. ODEQ prepared the initial draft of this fourth five-year review and EPA finalized the document. Based on concerns identified by EPA regarding management of the Site, the MOA between ODEQ and EPA was terminated in October 2012.

This fourth five-year review covers the period between January 1, 2005 and December 31, 2012. This review was originally due in December 2010. The next review will be completed by December 2015 and will cover the time period from January 2010 to December 2015.

## II. Site Chronology

The Site is located in The Dalles, Wasco County, Oregon, just west of the Columbia River and east of the Union Pacific Railroad tracks, as shown in Figure 1. Harvey Aluminum, Inc. began aluminum reduction and smelting operations at the Site in 1958. Harvey Aluminum became a wholly owned subsidiary of Martin Marietta Corporation (Martin Marietta) in 1970. Martin Marietta continued operations until 1984, when the plant was shut down. In September 1986, Martin Marietta leased a portion of the property to Northwest Aluminum Company (NAC). NAC purchased the plant in 1990 and continued aluminum manufacturing until filing for bankruptcy in 2003. After a corporate merger in 1995, Lockheed Martin Corporation became the successor to Martin Marietta at the Site.

In spring 1983, cyanide compounds were detected in shallow groundwater at the Site. Consequently, the Site was proposed for inclusion on the National Priorities List (NPL) in October 1984. The NPL is a list compiled by EPA of uncontrolled hazardous substance releases in the United States that are priorities for long-term remedial evaluation and response. The site was formally listed on the NPL in 1987.

In September 1985, Martin Marietta and EPA entered into a Consent Order to conduct a Remedial Investigation/Feasibility Study (RI/FS) for the Site in order to determine the nature of contamination and identify options for cleaning up the area. The investigation concluded that 13 source areas and a portion of the shallow groundwater zone exhibited contaminant concentrations that exceeded government requirements or health-based standards. In addition to cyanide compounds, fluoride, sulfate, polynuclear aromatic hydrocarbons (PAHs), and arsenic were identified as hazardous substances and chemicals of concern in soils and groundwater.

In September 1988, EPA signed a Record of Decision (ROD) documenting the selection of the remedy that would be implemented to clean up the Site. In 1989, Martin Marietta, the United States on behalf of EPA, and the State of Oregon on behalf of ODEQ entered into a judicial Consent Decree which required Martin Marietta to implement the remedial action selected in the ROD. At approximately the same time, ODEQ instituted closure activities at an onsite Resource Conservation and Recovery Act (RCRA) landfill used for disposal of ongoing aluminum production listed hazardous waste (hazardous waste code K088).

Cleanup under the CERCLA ROD began in August 1989, and completion was documented in the December 1994 Remedial Action Construction Report. An Explanation of Significant Differences was signed in 1994 that described changes to the remedial action selected in the ROD, including the decision to forego treatment of Site groundwater, upgrade the landfill leachate processing system to accommodate unexpected volumes of collected liquid, and remove waste at disposal areas at the Site recently taken out of facility operation. Completion of the remedial action was certified in February 1995. In July 1996, EPA deleted the Site from the NPL. However, under CERCLA and the terms of the 1989 Consent Decree, operation and maintenance, long-term groundwater monitoring, and engineered and institutional controls, including deed restrictions, are required to be continued and the protectiveness of the remedy must be reviewed every 5 years. A brief chronology of significant milestones or events in the Site history is provided in Table 1.

*Source: MMRF, The Dalles, OR Combined 2011 Semiannual RCRA and Annual CERCLA Report*

**Figure 1. Site Map**

**Table 1. Chronology of Site Events at Lockheed Martin Corporation, Former Martin Marietta Reduction Facility Site**

| Event | Date |
|---|---|
| Harvey Aluminum began aluminum production at the Site. | 1958 |
| Harvey Aluminum became a subsidiary of Martin Marietta. | 1970 |
| Spent potliner was placed on site at two locations, currently the locations of the CERCLA and RCRA landfills. | 1971 – 1984 |
| Cyanide contamination was found in soils and groundwater throughout the Site. | Spring 1983 |
| The Site was proposed for inclusion in the NPL. | October 1984 |
| CERCLA Consent Order was issued to Martin Marietta. | 1985 |
| The Site was formally listed on the NPL. | 1987 |
| The Final RI Report for the Site was issued. | March 1988 |
| The ROD was signed. | September 1988 |
| Judicial Consent Decree for the Site was signed by the U.S. on behalf of EPA, the State of Oregon on behalf of ODEQ and Martin Marietta. | September 1989 |
| Cleanup operations began at the Site. | August 1989 |
| Construction activities were completed at the Site. | Fall 1990 |
| Explanation of Significant Differences for the Site was signed. | September 1994 |
| The first Five-Year Review Report was published for the Site. | December 1994 |
| EPA Region 10 certified completion of the remediation action. | February 1995 |
| Lockheed and Martin Marietta merged into Lockheed Martin Corporation. | March 1995 |
| Second Five-Year Review Report was published. | December 1999 |
| EPA and ODEQ finalize the MOA listing ODEQ as lead in coordinating RCRA and CERCLA activities related to the CERCLA Landfill, RCRA landfill, Scrubber Sludge Ponds, groundwater monitoring program, and preparing draft CERCLA documents | May 2004 |
| Third Five-Year Review Report was published. | June 2005 |
| Change implemented to change free cyanide thermal treatment to bioremediation. | September 2005 |
| Change implemented to include installation of a drainage sump to prevent surface water from entering the CERCLA LCS. | December 2005 |
| EPA issues action letter to restrict entry to capped areas, repair signage and fencing, and begin air sampling | July 2012 |
| EPA issues Unilateral Administrative Order to address actual or threatened releases of toxic, asphyxiating and explosive gases at the Site | September 2012 |
| MOA between EPA and ODEQ was terminated. | October 2012 |
| Fourth CERCLA Five-Year Review Report was published. | May 2013 |

# III. Background

## Physical Characteristics

The Lockheed Martin Site is located on approximately 350 acres, approximately 110 acres of which were used for industrial purposes. Widespread soil and groundwater contamination from aluminum production processes caused the Site to be listed on the NPL. Cyanide compounds, fluoride, sulfate, PAHs and arsenic were the primary hazardous substances and contaminants of concern at the Site. Cryolite, used in the aluminum reduction process, and spent cathode waste, a RCRA-listed hazardous waste, K088, were consolidated during remediation of soils and groundwater into capped units. Lockheed Martin sold most of the real property at the Site to NAC, subject to the CD and deed restrictions on land and groundwater use, but retained ownership of the portion of the Site containing primary units. The primary units include the CERCLA landfill, tank and containment area (open topped tank with a capacity of 300,000 gallons), and leachate collection system; Scrubber Sludge Ponds; and groundwater monitoring well network. A RCRA spent cathode waste unit was also retained by Lockheed Martin along with the unit's leachate collection system and associated equipment. The CERCLA and RCRA units and the Scrubber Sludge Ponds are fenced with locked gates and signage.

Land within the footprint of the Site is owned by multiple persons. Northwest Aluminum Company and Northwest Specialties, Inc., own parcels, as well as the Port of The Dalles, and others. A former golf course and Fort Dalles rodeo grounds located to the southwest, a railroad right-of-way and open land located to the west are within the footprint of the Site. A former municipal dump is also within the footprint of the Site. The closest residential areas are across the railroad tracks approximately 1,300 to 1,700 feet to the west of the landfill units. The nearest surface water bodies are the Columbia River (abutting the original footprint of the Site on the east) and Chenoweth Creek (on the north end of the Site). The facility is not within a 100-year floodplain. The CERCLA remedy addresses all of the land parcels within the footprint of the Site as originally listed.

## Land and Resource Use

The land in the vicinity of the RCRA and CERCLA landfills has been annexed as part of the City of The Dalles and is zoned for commercial and industrial use. In 1991, Martin Marietta Company sold much of the real property within the footprint of the Site to NAC, subject to deed restrictions and to the CD, but retained ownership of certain parcels including two landfills, the CERCLA and RCRA landfills, and associated tanks and leachate collection systems, the Scrubber Sludge Ponds (1 through 4), access roads and the groundwater monitoring well network.

Land use in the vicinity of the former NAC smelter has changed significantly since the last five-year review was completed. In 2008, the aluminum reduction smelter and many associated buildings and structures were demolished and removed. The reduction facilities have been demolished, but the alloy plant is still operating under Northwest Aluminum Specialties, Inc. The Northwest Aluminum Specialties building, a leased warehouse, and the administration building remain. Tenneson Engineering is believed to occupy the administration building. Several surrounding parcels of land previously owned by NAC have been sold and are being redeveloped. In addition, a light industrial park, located between River Road and the Columbia River, has filled in much of the property on the eastern portion of the Site. Density and land use have increased in areas surrounding the Site since the last five year review.

Groundwater is present in the S (shallow) aquifer at approximately 120 and 135 ft above mean sea level (approximately 20 to 50 ft below land surface). The observed potentiometric surface elevations in the S aquifer range from 136 to 92 feet above mean sea level. The S aquifer is thought to be separated from the underlying A aquifer by a low-permeability zone, however, uncertainty exists regarding the extent of communication between the S and A aquifers. Groundwater in the S aquifer generally flow towards and discharges to the Columbia River. The A aquifer is present at 85 to 95 feet above mean sea level. The third monitored aquifer is the B aquifer, at 25 to 35 feet above mean sea level. Currently, the Site and all local entities are connected to The Dalles municipal water distribution system and have been since remediation was complete. The City of The Dalles obtains most of its water from surface water from The Dalles Municipal Watershed. Three groundwater wells in the The Dalles Pool aquifer are used to augment the water supply when surface water is limited.

## History of Contamination

Widespread soil and groundwater contamination from aluminum production processes occurred at the Site. Spent potliner or "cathode waste", which contained cyanide, fluoride, sodium and sulfate, was generated during the aluminum production process. During Martin Marietta facility operation, these wastes were stored and disposed of on the property. Cyanide compounds, fluoride, sulfate, PAHs and arsenic were the primary hazardous substances and contaminants of concern identified at the Site.

Cathode waste was staged in Cathode Waste Management Areas just north of the Martin Marietta plant building as shown in Figure 2. The Cathode Waste Management Areas included the Old Cathode Waste Pile Area, the Potliner Handling Area, the Salvage Area, and the Bath Recovery Pad Area. Cathode waste was also deposited in the Unloading Area, which was located on the opposite side of the plant building. A landfill located north of the Cathode Waste Management Areas was used to dispose of construction debris and cathode waste. This landfill is referred to as the CERCLA landfill. Another landfill at the center of the site primarily contained spent potliner. This waste pile was closed as a RCRA landfill by ODEQ and was historically separate from the CERCLA cleanup process.

The plant air pollution control system was used to isolate fluoride. This system scrubbed particles from air emissions using water. The Recycle Pond was designed to recycle water back to the plant for reuse. The Scrubber Sludge Ponds consisted of four natural ponds located near the Recycle Pond. These four ponds were used to receive effluent and hold sludge that was formed during operation of the scrubber system. The Lined Pond was built to supplement the capacity of the Scrubber Sludge Ponds.

## Basis for Taking Remedial Action

During facility operation, hazardous substances and contaminants of concern generated included cyanide, fluoride, sodium, polynuclear aromatic hydrocarbons (PAHs), sulfates, and spent potliner waste. Much of this waste material was buried in a landfill in the northern part of the site and resulted in groundwater and soil contamination. Detection of cyanide compounds in the groundwater prompted the need for remedial action and resulted in the addition of the site to the NPL in 1987 when widespread soil and groundwater contamination were discovered.

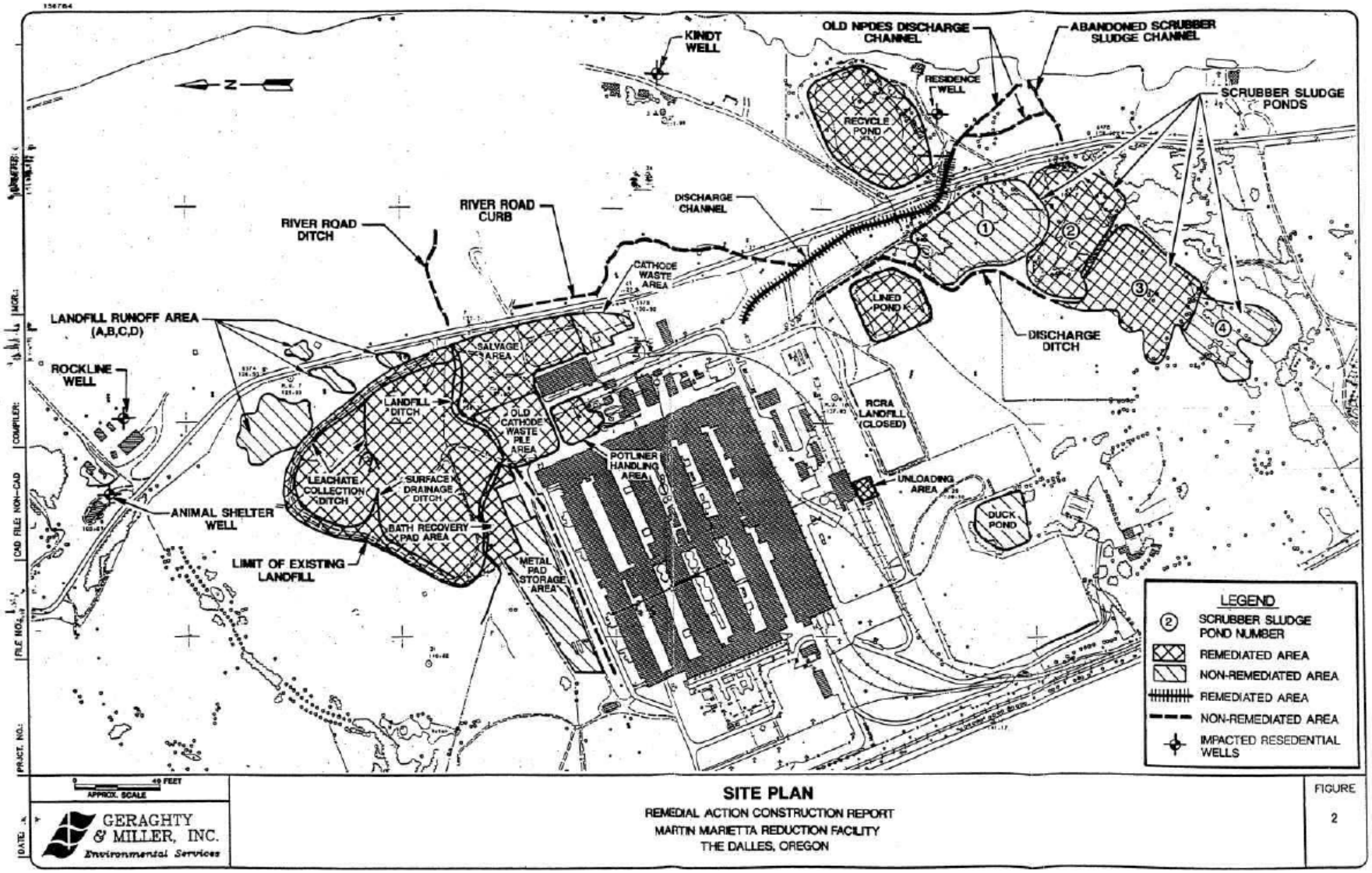



**Figure 2. Site Plan**

# IV. Remedial Actions

## Remedy Selection

Remedial objectives for the Site included both the control of sources of contamination as well as groundwater management for the protection of human health and the environment. Specific objectives in the 1988 ROD for source control at the Site included:

- Protection of human health and the environment from potential adverse effects caused by direct dermal contact with contaminants.
- Protection of human health and the environment from potential adverse effects due to exposure to airborne contaminants.
- Minimization of the migration of contaminants from the source areas to the groundwater system, surface water, or soils.

The selected remedy in the 1988 ROD included the following components:

- Consolidate the residual cathode waste material and underlying fill material from the former Cathode Waste Management Areas into the existing landfill.
- Consolidate the cathode waste material from the Unloading Area into the existing landfill.
- Cap the existing CERCLA landfill in place with a multi-media cap meeting RCRA performance criteria.
- Place a soil cover over the Scrubber Sludge Ponds 2 and 3.
- Plug and abandon nearby production wells and connect users to the City of The Dalles water supply system.
- Collect and treat leachate generated from the landfill, and perched water from east of River Road and from the former Cathode Waste Management Areas.
- Recover and treat contaminated groundwater from the Unloading Area.
- Prepare groundwater quality monitoring and contingency plans to perform additional recovery of groundwater in the event that further contamination is detected above required limits.
- Implement institutional controls including deed restrictions and fencing, to assure that the remedial action will protect human health and the environment during and after implementation.

Alternative concentration limits (ACLs) were specified in the S aquifer where concentrations of fluoride and sulfate exceeded Oregon's MCLs. The ACLs for the S aquifer were set at 9.7 mg/L for fluoride and 3,020 mg/L for sulfate. EPA Safe Drinking Water Act maximum contaminant level (MCL) of 4.0 mg/L

for fluoride and a secondary MCL of 250 mg/L for sulfate apply to the A and B aquifers. The groundwater contaminant limit for WAD cyanide is based on the EPA Health Advisory for life exposure for adults to on-site groundwater at 0.77 mg/L and longer-term exposure for children to off-site exposure at 0.22 mg/L. Table 2 lists the groundwater contaminant limits identified in the ROD.

**Table 2. Groundwater Contaminant Limits**

| Aquifer | Groundwater Contaminant Limits | | | |
|---|---|---|---|---|
| | Free/WAD Cyanide (mg/L) | | Fluoride (mg/L) | Sulfate (mg/L) |
| | Onsite | Offsite | | |
| S | 0.77 | 0.22 | 9.7 (ACL) | 3,020 (ACL) |
| A | 0.22 | 0.22 | 4 | 250 |
| B | 0.22 | 0.22 | 4 | 250 |

mg/L = milligrams per liter
ACL = Alternate Concentration Limit

An Explanation of Significant Differences (ESD) was issued in 1994 to address leachate issues and units that were taken out of active operations. The ESD included the following components:

- Modify the Leachate Collection System (LCS) to reduce groundwater infiltration into the system;
- Increase leachate treatment capacity of the Cyanide Destruct System (CDS) with a performance standard of .1mg/L free cyanide;
- Discontinue efforts to recover and treat contaminated groundwater from the Unloading Area due to low levels of fluoride, unless the five-year review process determines it necessary in the future;
- Remove sludge and liner from the Lined Pond and dispose of it in the existing landfill;
- Flush sediments in the upper portion of the Recycle Pond and Discharge Channel and remove surface waters under the existing National Pollutant Discharge Elimination System (NPDES) permit; and
- Remove sludge from the Recycle Pond and Discharge Channel for consolidation in the northern portion of Scrubber Sludge Pond 3.

## Remedy Implementation

Cleanup at the Site began in August 1989 and completion was documented in the December 1994 Remedial Action Construction Report. Following completion of the remedial action and subsequent monitoring to demonstrate the effectiveness of the remedy, EPA deleted the site from the NPL in 1996. Below is a description of the individual components of the cleanup.

### *Cathode Waste Management Areas/CERCLA Landfill*

Cleanup of the Cathode Waste Management Areas involved the excavation of the material down to basalt bedrock, consolidation of the material into the CERCLA landfill, and backfilling the excavated areas with silt. A multi-layer RCRA performance cover was placed over the waste consolidated in the CERCLA Landfill and a Leachate Collection System (LCS) was constructed around the perimeter. These activities were conducted from fall 1989 to spring 1991. Closure of the RCRA landfill was required by ODEQ during this same time period.

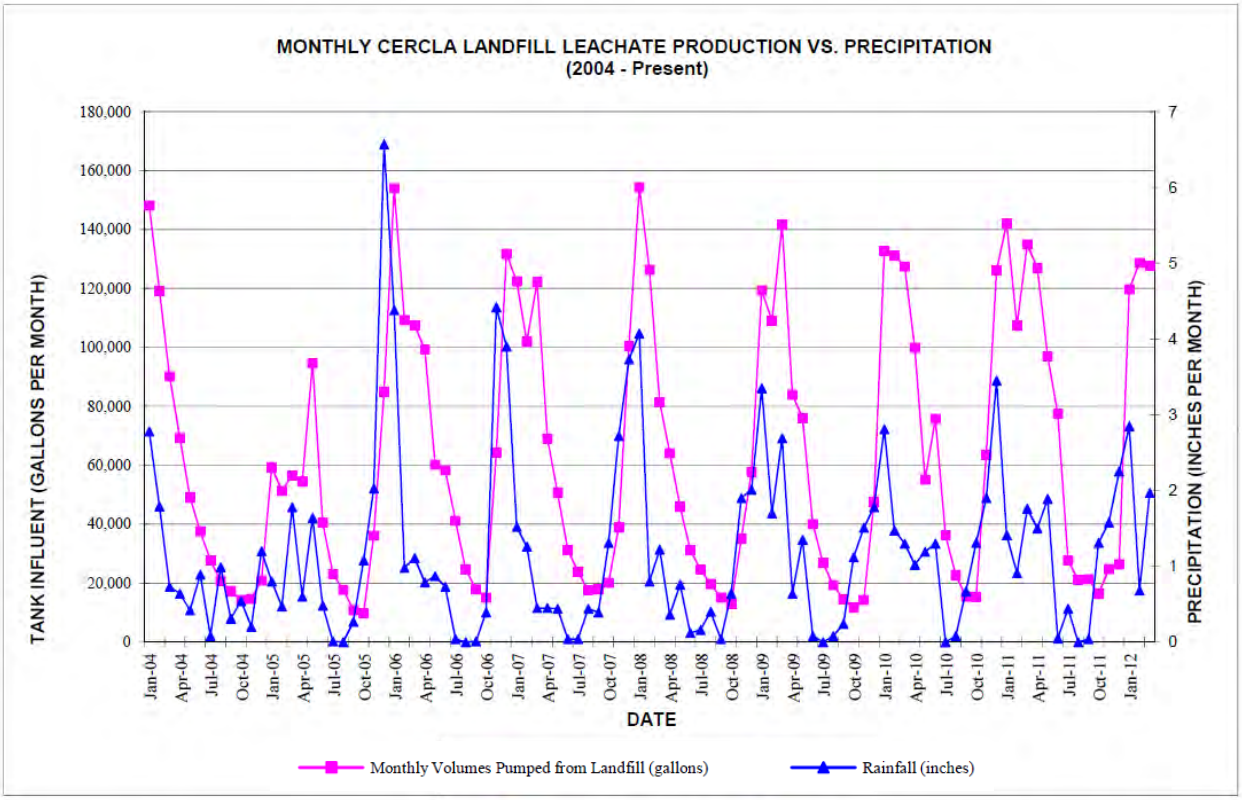
### *Collection and Treatment of Landfill Leachate*

The CERCLA landfill is unlined at its bottom. Its cap was designed and constructed in 1990 with a geosynthetic liner and it was anticipated that the relative drain-down curve for leachate production from the CERCLA landfill would generally diminish over time. Leachate volumes did decrease immediately after construction; however, when wet weather at the Site returned the following fall, leachate levels within the system began to increase. The source of the increased leachate flow was believed to be perched groundwater infiltrating through fractured basalt bedrock from south of the landfill into the LCS. Several construction projects were undertaken from fall 1992 through 1993 to divert perched and ponded waters from entering the LCS.

One early effort involved the construction of a dewatering trench to prevent perched water from flowing into the LCS while an underground pipe was installed to lower and divert ponded surface water around the landfill. The surface water drainage system was modified to increase drainage. These modifications were not successful at reducing the amount of infiltration of precipitation to the LCS. In 2009, ODEQ issued a temporary authorization to the RCRA post closure and corrective action permit which allowed for removal of the dewatering trench.

Leachate production has not decreased over time; furthermore, it is strongly correlated with precipitation as shown in Figure 3. The data in Figure 3 suggests that the majority of water produced by the LCS is shallow groundwater and stormwater infiltrating at the landfill perimeter. Because the landfill is not lined at the bottom, these sources of water will contribute to the LCS indefinitely. Average production rates are about 66,000 gallons per month, but can range up to 300,000 gallons per month during the rainy periods from December to March. Under the current LCS configuration and operating parameters, the volume of water being collected and treated is not expected to diminish.

The ROD identified use of a chemical oxidation unit for destruction of cyanide. During the remedial design stage, it was determined that the performance standard of 0.1 mg/L free/WAD cyanide could not be achieved through the use of this method. The method of treatment for cyanide was revised to a thermal cyanide destruction system (CDS). The CDS was brought online in 1990. Due to the increased volume of water entering the LCS, EPA recommended that capacity of the CDS be increased to address the higher water volume. In November 1994, a new CDS unit was installed upgrading the 2 gpm system to a 13.5 gpm system. The decision to upgrade the CDS was documented in the 1994 ESD.




*Source: MMRF, The Dalles, OR Combined 2011 Semiannual RCRA and Annual CERCLA Report*

**Figure 3. Monthly CERCLA Landfill Leachate Production vs. Precipitation**

In 2002, ODEQ issued a permit modification which allowed Lockheed Martin to modify leachate treatment to include the surface application of nutrients with supplemental batch treatment in the CDS tank through a corrective action process in the RCRA post closure and corrective action permit for the RCRA and CERCLA units. Surface applications were discontinued after the October 2007 application. After 2007, batch treatments continue to occur after primary treatment in the LCS with occasional "polishing" treatment in the tank.

In January 2007, a Batch Discharge Protocol was created as part of a permit modification. Discharge of the treated wastewater to the Columbia River was allowed under a separate NPDES permit for Northwest Aluminum Specialties. Northwest Aluminum Company, Lockheed Martin, and ARCADIS were added as co-permittees to the NPDES permit in 2009. The NPDES permit allows leachate from the CERCLA Tank to be discharged through approved Northwest Aluminum Outfall point source discharge locations. The Northwest Aluminum NPDES permit specifies that leachate sampling and analysis from the leachate tank prior to discharge must be in accordance with the Batch Discharge Protocol. Discharge from the CERCLA Tank is initiated by cessation of all leachate inflow into the CERCLA Tank. Lockheed Martin or its contractors collect a compliance sample for analysis. When verification is received that the free/WAD cyanide compliance level of 0.1 mg/L has been achieved, the treated leachate is discharged to the Northwest Aluminum NPDES system.

As part of the January 2007 permit modification, ODEQ approved a plan that outlined the operation and maintenance, monitoring, and reporting associated with a remedy change from thermal to bioremediation treatment of cyanide at the CERCLA landfill. EPA has determined that the effectiveness of biotreatment of cyanide cannot be demonstrated and that a new treatment method is required. In August 2012, Lockheed Martin installed fencing around the CERCLA tank in response to a letter issued by EPA on July 20, 2012 which directed Lockheed Martin to secure access to the tank.

***Unloading Area Soil***

Cleanup of the Unloading Area involved the excavation of material down to basalt bedrock, consolidation of the material into the existing landfill (CERCLA landfill), and backfilling the excavated area with crushed rock. Approximately 2,000 cubic yards of potlining material and affected soil were removed. This cleanup took place in October 1989.

***Scrubber Sludge Ponds, Lined Pond, Recycle Pond, and Discharge Channel***

The soil cover over Scrubber Sludge Pond 2 and 3 consisted of placement of a minimum 2 feet of clean silt over the ponds and re-vegetation of the area. The soil cover was completed during the initial phase of cleanup. Scrubber Sludge Ponds 1 and 4 had been capped before the Site was placed on the NPL.

Cleanup of the Lined Pond took place during fall 1989. The pond liner with the sludge it contained was removed and placed in the CERCLA landfill. The Recycle Pond and Discharge Channel were cleaned up in fall 1991. The sludge from the Recycle Pond and lower portion of the Discharge Channel was removed and placed in Scrubber Sludge Pond 3. Six inches of crushed rock was then placed over the excavated areas and Scrubber Sludge Pond 3 was again covered and re-vegetated. The Recycle Pond and Discharge Channel were returned to use as part of the Northwest Aluminum modified waste water treatment system. The decision to perform additional work at the Lined Pond, Recycle Pond, and Discharge Channel was documented in the 1994 ESD.

***Groundwater Use Restrictions***

Groundwater use at the Site is restricted due to contamination. The City of The Dalles water supply was extended to users of the Rockline, Klindt, and Animal Shelter wells during July and August 1990. Drinking water wells were then closed or abandoned on the following dates: the Residence Well in September 1990; the Animal Shelter Well in November 1990; the Klindt Well in October 1992; and the Rockline well in April 1994.

Removal of perched water from east of River Road and from the former Cathode Waste Management Areas was completed by 1991. Perched water from former Cathode Waste Management Area was treated in the CDS.

Treatment of contaminated groundwater from the Unloading Area was required under the ROD. However, it was anticipated that concentrations of fluoride would decrease after the cathode waste was removed from the area. Consequently, EPA decided that groundwater in the Unloading Area would be evaluated under an Assessment Monitoring Program. This program required quarterly sampling at monitoring well MW-5S from 1989 to 1994. Results showed that the concentration of fluoride was decreasing quickly enough, so treatment of groundwater was not implemented. The decision to forego groundwater treatment at the Unloading Area was documented in the 1994 ESD. The ESD also stated

that the need for future recovery and treatment of groundwater in the Unloading Area will be analyzed during the CERCLA five-year review process.

***Institutional Controls***

Institutional controls, including engineered and land use controls at the Site, were a part of the remedy. Engineered controls were installed after cleanup was completed to restrict access to the capped CERCLA Landfill and the covered Scrubber Sludge Ponds. Direct access was restricted by the installation of a six foot high chain-link fence with three strands of barbed wire at the top and security gates. These access restrictions were constructed from July to October 1991. In addition, bilingual (Spanish and English) informational placards were posted. These safeguards have remained in place during the reporting period.

Deed restrictions were implemented when Martin Marietta property was sold to NAC. The deed restriction at the time of sale restricted the installation of wells and the use of groundwater in the upper aquifer on all property sold. Lockheed Martin retained ownership and control of approximately 48.74 acres of the property consisting of areas where remediated wastes were encapsulated, the closed RCRA Landfill, the CDS, and the interconnecting roadway system to all retained property. In addition, Lockheed Martin retained ownership of all wells within the Northwest Aluminum property that monitored groundwater at the Site. The deed is recorded as required in the Consent Decree (1989) and is in the records office of Wasco County. Since the records office may not be readily available to all potential future land owners, the deed restriction may need supplementation.

Since the last five-year review, the real property on which the Site is located has been annexed entirely into The Dalles. County and State records do not seem to clearly show the existence of deed restrictions restricting the use of groundwater or the installation of wells. In addition to reviewing existing deed restrictions and determining whether additional deed restrictions are needed, EPA has determined a need to identify the groundwater restrictions on the Site through use of signage indicating the presence of contaminated groundwater.

## Operation and Maintenance

Operating, maintenance, and monitoring (O&M) costs are borne by Lockheed Martin as the party responsible for the Site under the Consent Decree and as the owner of the CERCLA and RCRA units. The corporation has the financial and technical means to continue to implement the O&M activities at this facility.

Annual inspection of the CERCLA landfill is required and includes inspecting for: erosion, slumping, animal burrows, and woody vegetation on the landfill cap. The inspection includes checking the condition of fences and gates, gate locks, and warning signs. The condition of drainage system, water ponding, blockage of channels or culverts, silt deposits and monitoring wells are also inspected.

Quarterly inspection of the CERCLA LCS includes inspecting Pumps 1 and 2 and piping, checking the water levels between Pumps 1 and 2 between floats, alarm lights testing, and checking for obstructions in LCS piping.

Annual inspection of the Scrubber Sludge Ponds is required and includes inspecting the soil cover for erosion and animal burrows. If burrows are present, they are filled. The drainage system is inspected for the presence of ponded water, and blocked channels. Fences and gates are examined to ensure that they

are locked, in good order, warning signs are in place and that the fence is clear of trees. The area adjacent to the Scrubber Sludge Ponds is inspected to determine the need for vegetation control.

During the current reporting period, it has been necessary to fill in animal burrows and cut back Russian olive trees periodically from intruding on the fence line around the Scrubber Sludge Ponds. Additional signage on the fencing around the CDS was added since the last five-year review.

During this five-year review, EPA became concerned with the entrance of deer to the Scrubber Sludge Ponds Area and has identified a need to inspect and modify fencing as needed at all fenced areas of the Site to prevent exposure of human and ecological receptors to potential hazards. EPA has also identified a need to conduct soil sampling at the Scrubber Sludge Ponds to determine the integrity of the soil cover.

# V. Progress Since the Last Five-Year Review

### Protectiveness Statement from Last Five-Year Review

The protectiveness statement from the last five-year review stated that the remedy continued to control direct and airborne contact with contaminants through the CERCLA landfill and Scrubber Sludge Ponds caps, and fencing, signage, and on-site institutional controls, which afford additional protection. However, the last review identified concerns with contaminant migration from the source areas such that correct environmental standards are met in surface water and groundwater. Based on these concerns and a lack of information to address the issues, a protectiveness determination of the remedy at the Site was not made.

### Status of Recommendations and Action Items from Last Five-Year Review

A number of issues and recommendations were identified in the previous five-year review, issued in 2005. Table 3 summarizes eight issues from the last five-year review and actions taken to address those issues. The first issue concerned biotreatment of leachate at the Site through the surface application of nutrients. Land applications of nutrients were conducted from March 2002 to January 2005 and took place upgradient of Manhole 4. EPA does not believe the relationship between surface applications of nutrients and improvements in leachate treatment is fully understood and does not support future use of this method.

The second issue of whether there should be batch discharges (as opposed to continual discharges) from the CERCLA tank was resolved. A Batch Discharge Protocol was created and made enforceable as part of the RCRA post closure and corrective action permit.

The third issue of whether to keep the high temperature/high pressure cyanide destructions system (CDS) was resolved. Cyanide treatment was changed from thermal treatment to biotreatment. The CDS system has been removed from the facility with ODEQ approval. EPA has determined that the effectiveness of biotreatment of cyanide cannot be demonstrated and that a new treatment method is required.

The fourth issue was to identify the groundwater pathway at the CERCLA Landfill to determine if groundwater enters the LCS. As previously discussed, leachate production is strongly correlated with precipitation. It appears that the majority of water produced by the LCS is shallow groundwater and stormwater infiltrating at the landfill perimeter, resulting in large leachate volumes that are expected to

continue. Because groundwater is not understood at the Site, a Site-wide comprehensive groundwater investigation is needed and additional groundwater wells and increased monitoring intervals of existing wells is anticipated.

The fifth issue was to conduct additional groundwater monitoring and improve institutional controls to address fluoride levels. Lockheed's contractor (ARCADIS) had requested a less stringent fluoride ACL. The ACL was not changed and EPA identified a need to replace ACLs with MCLs at the Site. ACLs have not been changed to meet MCLs and the current five-year review identifies the need for this change as an action item to be accomplished through an Explanation of Significant Difference (ESD).

The sixth issue of whether monitoring well MW-29S in the Scrubber Sludge Ponds should be sampled annually to determine trends of fluoride and sulfate was resolved at the time by adding an annual sampling requirement to the RCRA post closure and corrective action permit.

**Table 3. Issues from Third Five-Year Review and Action Taken**

| Issues from Previous Review | Recommendations/ Follow-Up Actions | Action Taken and Outcome |
|---|---|---|
| 1. Biotreatment: Surface Application of Nutrients | Complete pilot studies and incorporate into treatment approach | Surface applications were done from 2002 to 2007. EPA does not believe this improved leachate treatment and does not support future use of this method. |
| 2. Batch Discharge | Batch protocol should be finalized and made enforceable | A Batch Discharge protocol was implemented and incorporated into the RCRA permit. |
| 3. CDS Treatment System | Complete pilot studies and incorporate treatments that will become permanent | Cyanide treatment was changed from thermal treatment to biotreatment. EPA has major concerns with biotreatment of cyanide at the Site and has identified a need for an alternative treatment method. |
| 4. Groundwater Pathway at CERCLA Landfill | Identify if groundwater pathways end up in the LCS | Data shows shallow groundwater enters the LCS. Large leachate volumes are expected to continue. EPA has identified a need for a Site-wide comprehensive groundwater investigation. |
| 5. Change Fluoride ACL | Additional groundwater monitoring and improved institutional controls | The ACL has not been changed. EPA has identified a need to replace ACLs with MCLS and intends to complete this action through an ESD. |
| 6. Scrubber Sludge Ponds | Increase sampling at MW-29S from every 5 years to an annual basis to determine trends of fluoride and sulfate | MW-29S is sampled annually as required by the RCRA permit. |
| 7. Unloading Area/RCRA Landfill | Resume sampling at MW-3 and MW-4S on an annual basis to determine if groundwater is above the MCL | These wells have not been sampled. EPA expects MW-3 and MW-4 to be incorporated into the Site-wide comprehensive groundwater monitoring program. |
| 8. CERCLA Landfill | Sampling of wells MW-38S, MW-39S, MW-40S, and MW-41S should continue to determine if groundwater is above the MCL | These wells are sampled annually and are part of the groundwater monitoring program enforced by the RCRA permit. |

The seventh issue of whether monitoring wells MW-3 and MW-4 in the Unloading Area should be sampled annually to delineate groundwater above the MCLs at the Site is not resolved. MW-3 and MW-4 have not been sampled annually. EPA expects MW-3 and MW-4 to be incorporated into the groundwater investigation. Groundwater movement at the Site is not understood and a Site-wide comprehensive groundwater investigation is needed.

The eighth issue to continue monitoring at monitoring wells MW-38S, MW-39S, MW-40S, and MW-41S was resolved by adding the wells to the groundwater monitoring program enforced by the RCRA post closure and corrective action permit.

# VI. Five-Year Review Process

The five-year review process generally consists of community involvement, document review, data review, site inspections, and interviews. Each of these steps is described in more detail below.

## Community Notification and Involvement

During the five-year review process, the community should be notified that a five-year review will be conducted and that the five-year review has been completed. The notification of the completion of a five-year review should inform the community how to access the five-year review results. A fact sheet will be published on the findings of this review. A newspaper ad will also be published to inform the public of the completion of this review. As part of the five-year review process, community members can be interviewed to get their views about current site conditions, problems, or related concerns.

## Document Review

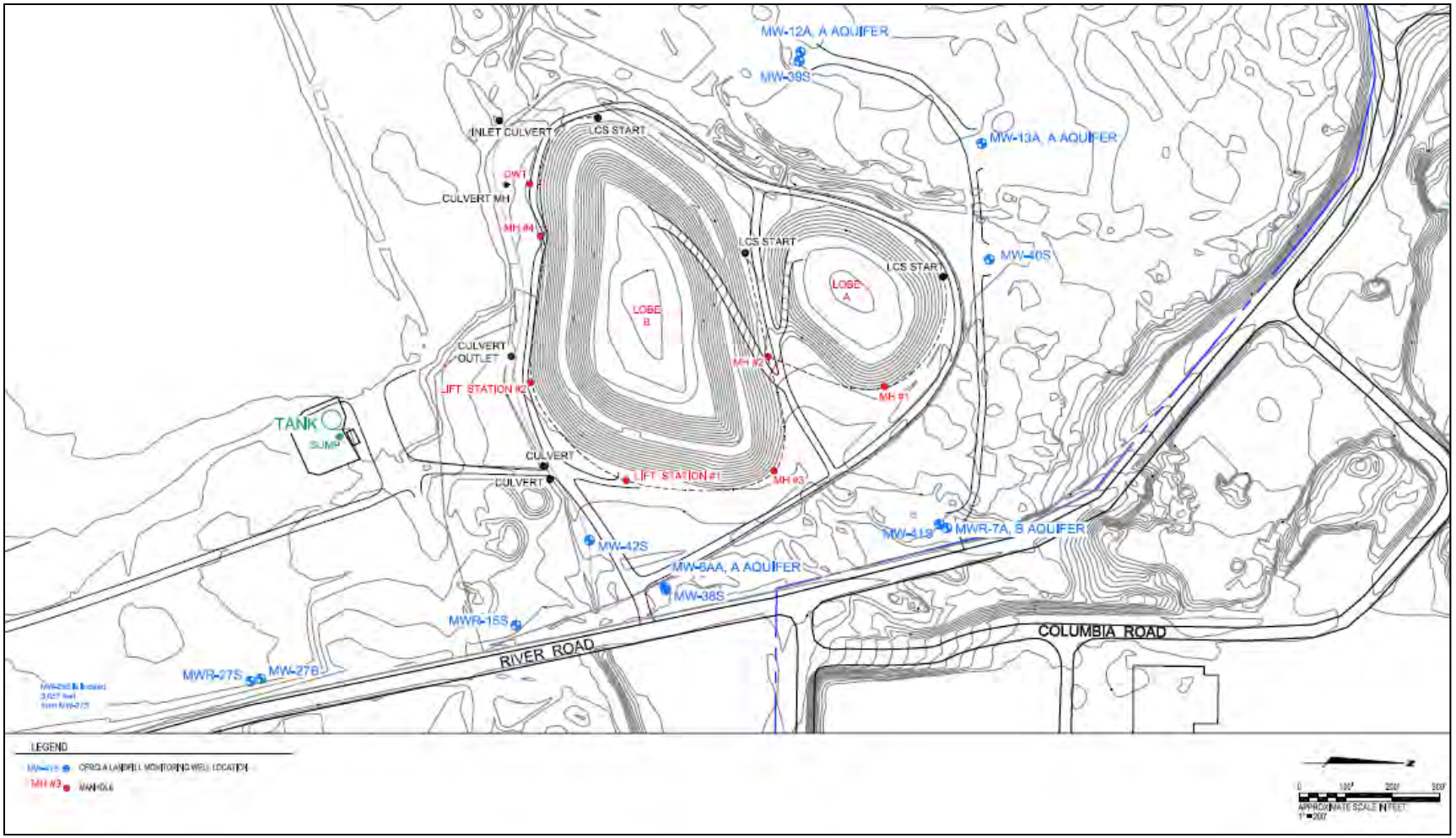
The next step in the five-year review process is to review decision documents and identify the remedial action objectives, review the selected remedy, and identify the current status of the remedy.

## Data Review

After the remedial action objectives are identified, the next step is to review the available data to evaluate the effectiveness of the remedy. For this Site, the 2005 through 2012 CERCLA and RCRA groundwater monitoring reports were important sources of information.

### *Groundwater Monitoring Program*

Annual CERCLA groundwater monitoring reports were submitted by Lockheed Martin to ODEQ. In order to meet CERCLA requirements, these reports will now be submitted to EPA. Figure 4 shows the locations of groundwater monitoring wells around the CERCLA landfill. Groundwater is sampled once each year to monitor for cyanide, fluoride, sulfate, pH, specific conductance, and temperature. ACLs were established in the ROD for fluoride at 9.7 mg/L and sulfate at 3,020 mg/L in the S aquifer at the Site. The federal MCL for drinking water for fluoride is 4.0 mg/L and the secondary MCL (SMCL) for sulfate is 250 mg/L. Guidance issued by EPA in 2005 clarified that MCLs rather than ACLs were to be used for CERCLA remedies, particularly when the affected groundwater is a potential drinking water source or if it discharges to surface water. Based on the guidance, EPA determined a need to replace ACLs at the Site with the MCL for fluoride and SMCL for sulfate and intends to accomplish this action through an ESD.




*Source: MMRF, The Dalles, OR Combined 2011 Semiannual RCRA and Annual CERCLA Report*

**Figure 4. Groundwater Monitoring Wells Around the CERCLA Landfill**

A Groundwater Compliance Monitoring Plan was developed that lists steps to be taken if the ACLs are exceeded at the CERCLA monitoring wells. This plan will need to be changed to a Groundwater Compliance Monitoring Plan for MCLs. EPA has identified a lack of understanding of the groundwater movement and contaminant transport on the Site. EPA has also identified the need for a Site-wide comprehensive groundwater investigation to be conducted at the Site. The results of groundwater monitoring results for WAD cyanide, fluoride, and sulfate for the S, A, and B aquifers are presented in Figures 5 through 10.

***S Aquifer Groundwater Monitoring Results***

Groundwater is present in the S (shallow) aquifer at approximately 120 and 135 ft above mean sea level. The S aquifer is thought to be separated from the underlying A aquifer by a low-permeability zone. Groundwater in the S aquifer is thought to generally flow towards and discharge to the Columbia River. Figures 5 through 7 display the results for groundwater monitoring of WAD cyanide, fluoride, and sulfate in the S aquifer.

Monitoring results from wells in the S aquifer show that WAD cyanide has been below the 0.2 mg/L MCL since 2006. Well MW-29S historically had fluoride above the 4 mg/L MCL and continued to be slightly over the MCL from 2006 to 2010. Since 2010, fluoride levels in MW-29S have decreased to below the 4 mg/L MCL. Fluoride levels in MW-38S have also exceeded the MCL since 2005 and levels continue to fluctuate around the MCL value. No monitoring results from the other wells were above the MCL.

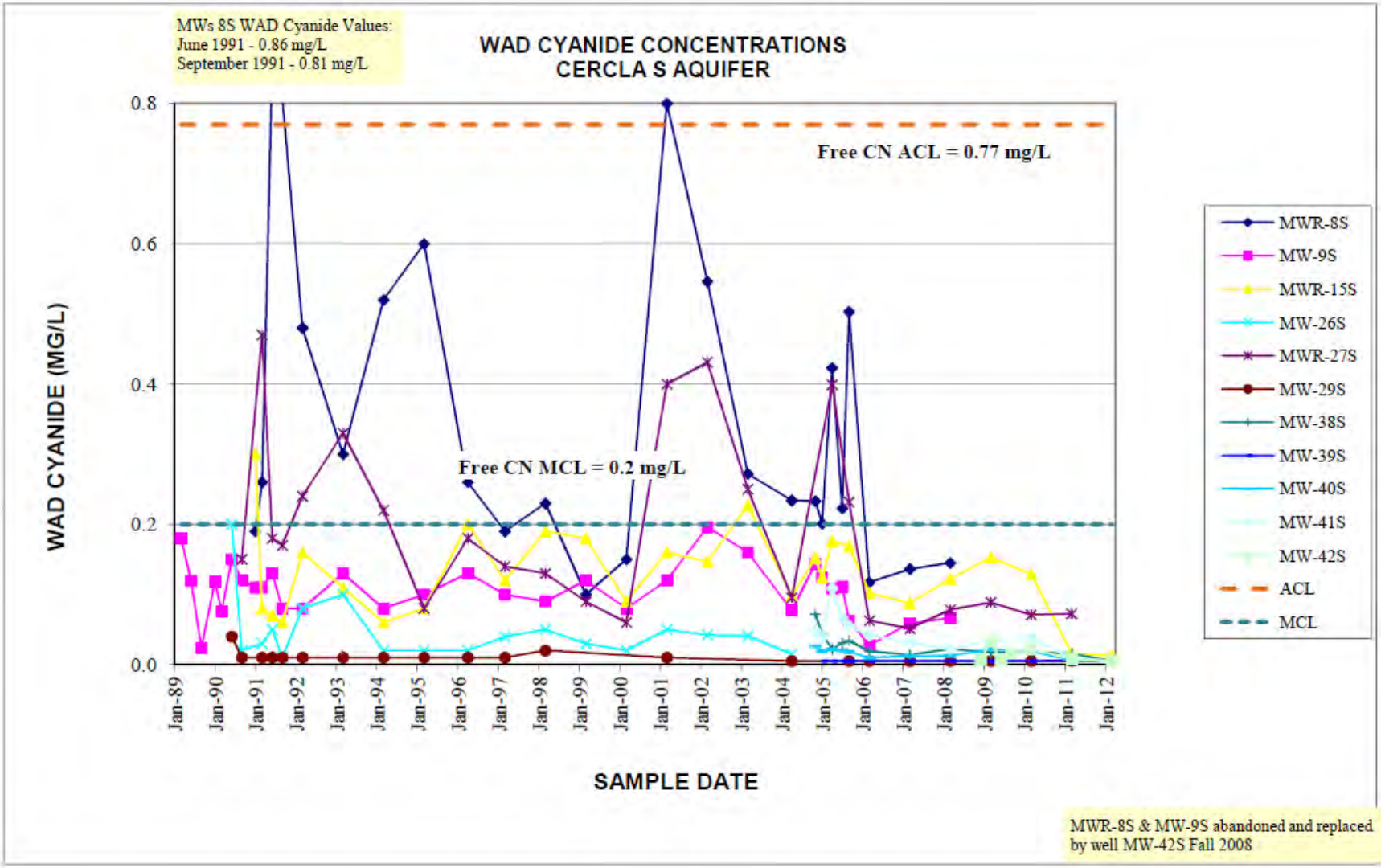
MW-29S has historically had sulfate values well above the SMCL of 250 mg/L. From 2010 to 2012, sulfate values in this well have been between 200 and 250 mg/L. No monitoring results from the other wells were above the SMCL.

***A and B Aquifer Groundwater Monitoring Results***

The A aquifer is located at 85 to 95 feet above mean sea level while the confined B aquifer is located at 25 to 35 feet above mean sea level. The potentiometric elevations in the A and B aquifer are currently near an elevation of 70 feet above mean seal level. The monitoring results from WAD cyanide, fluoride, and sulfate in the A and B aquifers have been below the below the 0.2 mg/L MCL for cyanide, the 4 mg/L MCL for fluoride, and the 250 mg/L SMCL for sulfate since 1990.

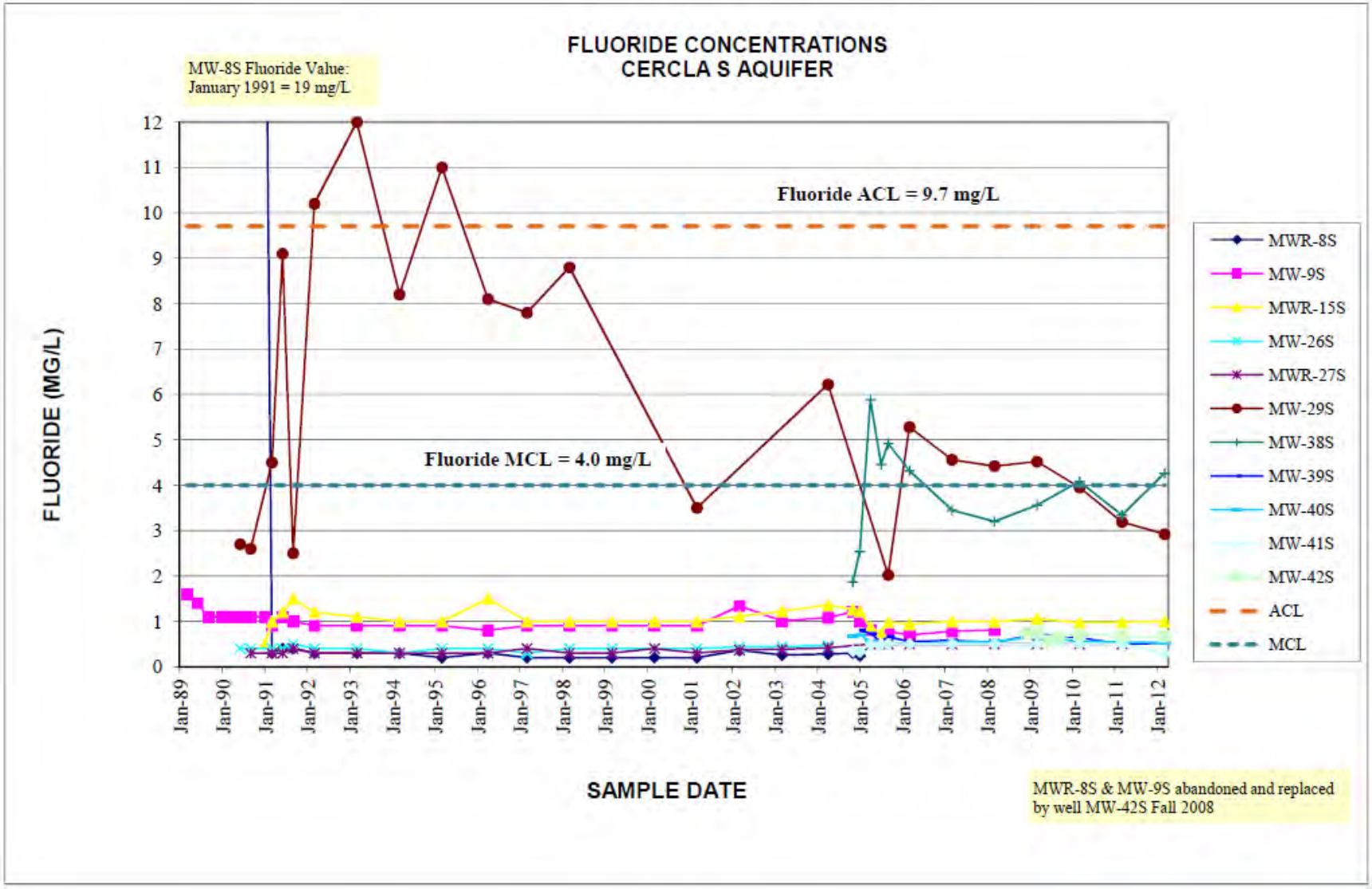
***Conclusions from Groundwater Monitoring Results***

The limited groundwater monitoring data indicates that groundwater quality is static. There is no clear indication of significant impacts from the CERCLA landfill leachate to the S or A aquifers. However, insufficient data exists to fully understand groundwater at the Site. A site-wide comprehensive groundwater investigation needs to be implemented to make data-supported assessments of the groundwater quality. No new groundwater supply wells have been drilled in the vicinity of the Site since the last five-year review.



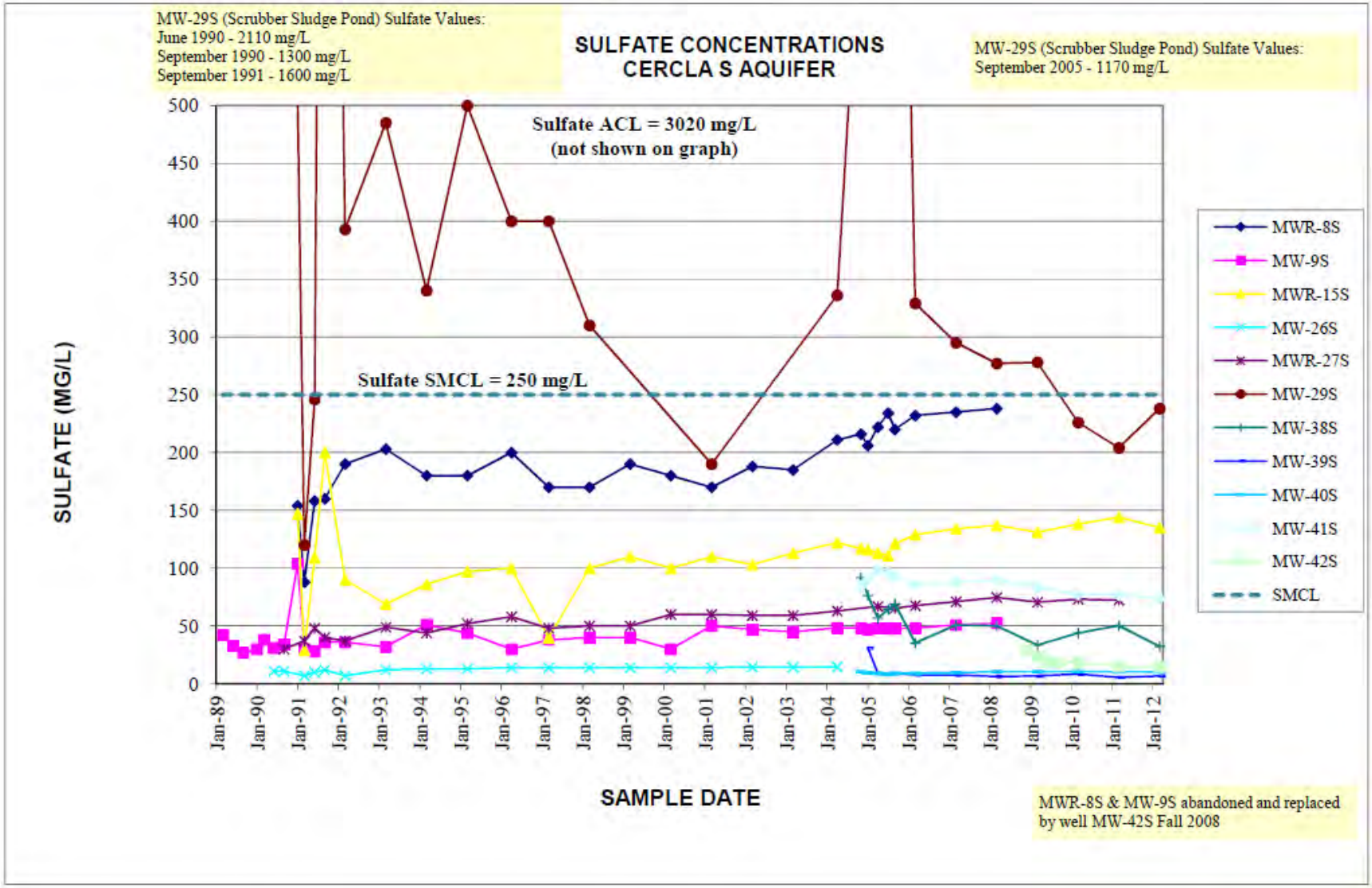

*Source: MMRF, The Dalles, OR Combined 2011 Semiannual RCRA and Annual CERCLA Report*

**Figure 5. WAD Cyanide Concentrations at CERCLA S Aquifer from 1989 to 2012**



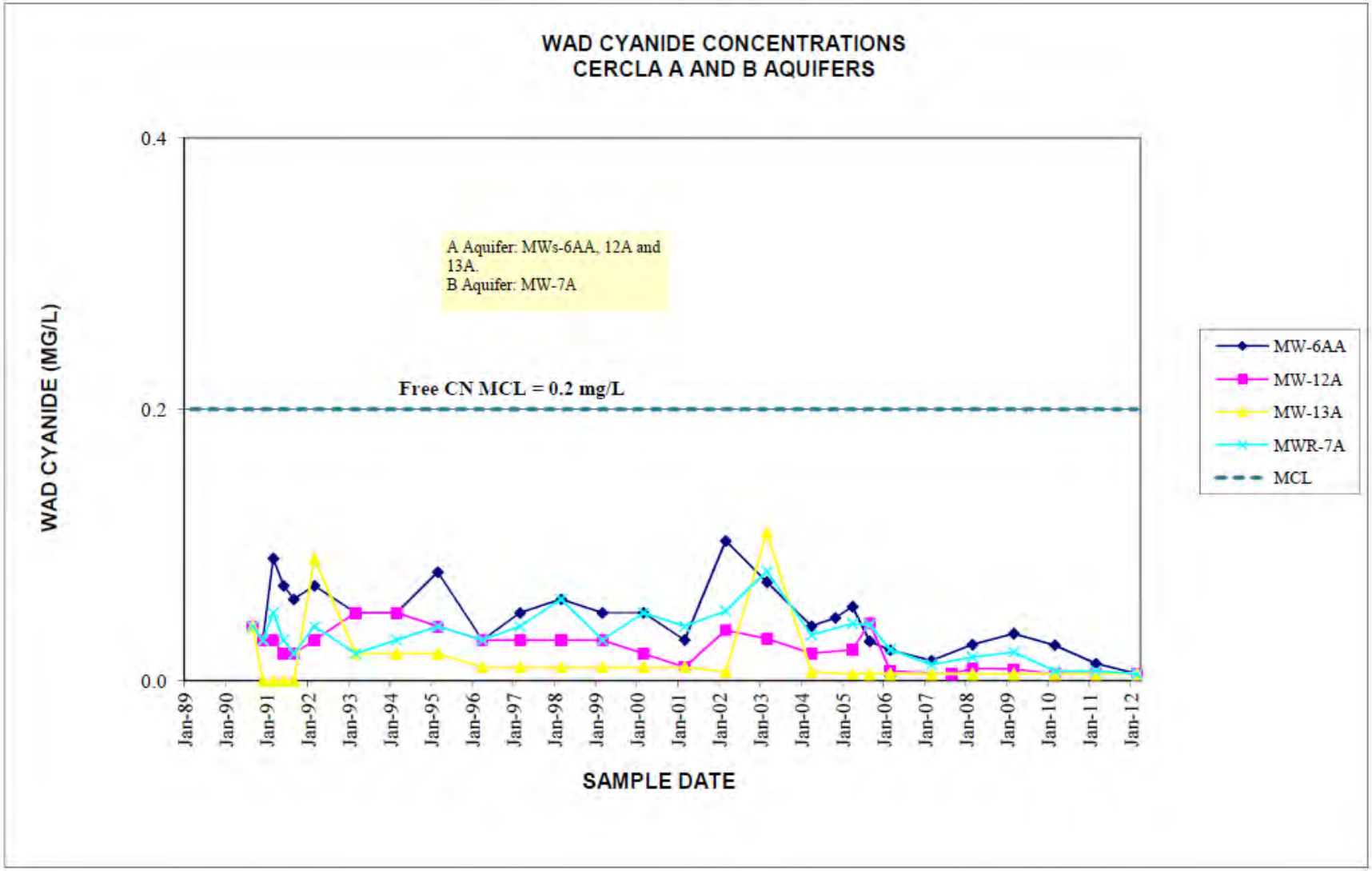

*Source: MMRF, The Dalles, OR Combined 2011 Semiannual RCRA and Annual CERCLA Report*

**Figure 6. Fluoride Concentrations at CERCLA S Aquifer from 1989 to 2012**



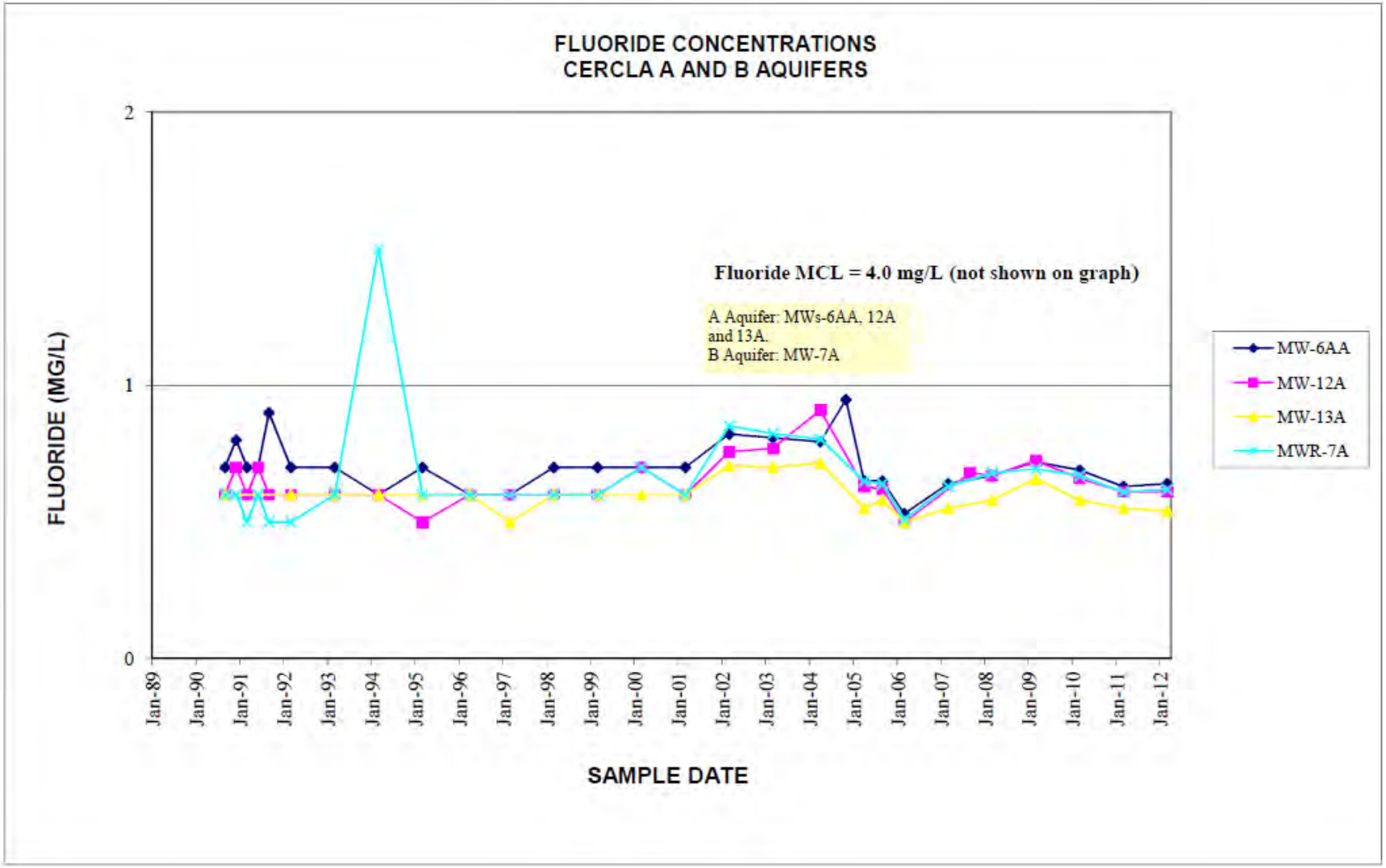

*Source: MMRF, The Dalles, OR Combined 2011 Semiannual RCRA and Annual CERCLA Report*

**Figure 7. Sulfate Concentrations at CERCLA S Aquifer from 1989 to 2012**



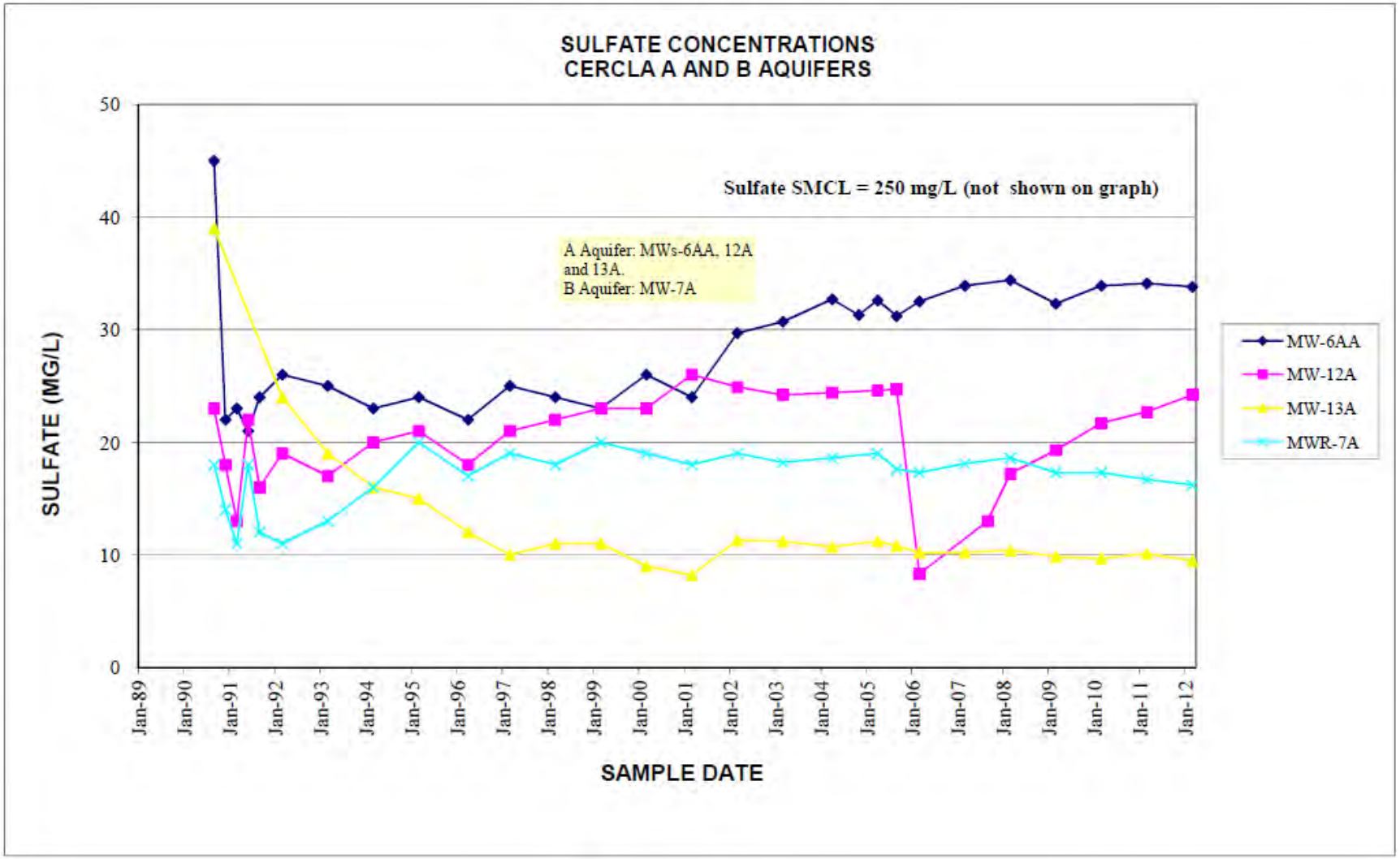

*Source: MMRF, The Dalles, OR Combined 2011 Semiannual RCRA and Annual CERCLA Report*

**Figure 8. WAD Cyanide Concentrations at CERCLA A and B Aquifers from 1989 to 2012**




*Source: MMRF, The Dalles, OR Combined 2011 Semiannual RCRA and Annual CERCLA Report*

**Figure 9. Fluoride Concentrations at CERCLA A and B Aquifer from 1989 to 2012**




*Source: MMRF, The Dalles, OR Combined 2011 Semiannual RCRA and Annual CERCLA Report*

**Figure 10. Sulfate Concentrations at CERCLA A and B Aquifers from 1989 to 2012**

## Site Inspections

ODEQ conducted both CERCLA and RCRA site inspections in 2006 and 2008 and found no violations. ODEQ conducted a CERCLA and RCRA site inspection on May 18, 2010. Results of that inspection show that both the RCRA and CERCLA operations at the Lockheed Martin facility to be in compliance with the hazardous waste permit. ODEQ centered its inspection of the Site on the units owned by Lockheed Martin.

EPA conducted a Site visit on May 9, 2012 after encountering data from 2004 which showed detections of hydrogen cyanide gas at the RCRA landfill unit. During that Site visit, EPA observed a need for improvement to Site access control to prevent human and ecological receptors from entering the Site. Based on the Site visit, EPA issued a letter to Lockheed Martin on July 20, 2012 to take steps to secure the Site, in particular the CERCLA and RCRA units and Scrubber Sludge Ponds, and to plan to sample gases at the CERCLA and RCRA units for toxic, asphyxiating and explosive gases. Lockheed Martin responded rapidly by repairing and replacing existing fencing and constructing new fencing to secure access to the 300,000 gallon open leachate collection tank. EPA issued a 106(a) Unilateral Order to Lockheed Martin to conduct air /gas sampling at the Site and to ensure the Site was secured. A round of air/gas sampling was conducted in September 2012 in compliance with the unilateral order. Based on the results of this round of monitoring, Lockheed Martin recommended additional sampling using automated instrumentation to allow for logging of data at regular time intervals. EPA also recommended another round of sampling to confirm conditions at the CERCLA landfill. The next round of air/gas sampling is scheduled for May 2013. The results from air sampling activities will be included in the next five-year review.

In September 2012, EPA conducted an inspection to check on the fencing, soil covers and CERCLA tank. Inspection activities included examining fence structures, checking the readability of signage, and visually inspecting soil covers and the CERCLA tank. EPA identified areas of the surrounding fence that required modification and areas where additional signage (in Spanish and English) was needed.

## Interviews

Public interest in the Site has increased over time as development in the surrounding area and redevelopment of portions of the Site has taken place. In August 2008, when a Class 2 permit modification public hearing proposing to remove small covered waste material in the CERCLA landfill area was held, public interest was evident. Lockheed Martin conducted the public hearing at that time and individuals from the Port of The Dalles, city officials and others came to inquire and voice support for the complete removal of wastes at the Site. For the purpose of interviews for this five year review, ODEQ, who at the time was the lead agency for the Site through an MOA with EPA, sent out an email questionnaire to some of those who attended the public hearing. In addition, the city planning department and the local watermaster were contacted regarding local groundwater use. An email questionnaire was sent to the following:

- Andrea Klaas, Port of The Dalles
- Dan Ericksen, Wasco County Commission
- Nolan Young, The Dalles City Planning
- Galen May, Northwest Aluminum Co.
- Jerry Frazier, Wasco County Development
- Roger Prowell, Chenowith Water District

ODEQ received 2 written email responses to the questionnaire. These responses came from Roger Prowell and Ben Beseda with the local engineering firm of Tenneson Engineering. In addition, Fredrick Moore with ODEQ had a phone conversation with Dan Ericksen, Chair of the County Commission. The feedback received from those individuals was that generally the Site is well operated and maintained, and, in their opinion, there was low community concern with the Lockheed Martin property. The three individuals did express the opinion that the landfills are a hindrance to economic development for the Northwest Aluminum property. Local government agencies have continued to express an interest in seeing the Site fully redeveloped.

## VII. Technical Assessment

The purpose of the five-year review is to determine whether the remedy at a site is protective of human health and the environment. The following three questions are asked to help determine remedy protectiveness: "Is the remedy functioning as intended by the decision documents?"; "Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection still valid?"; and "Has any other information come to light that could call into question the protectiveness of the remedy?". These questions are addressed below.

### Question A: Is the remedy functioning as intended by the decision documents?

**CERCLA Landfill/Leachate Capture and Treatment:** The CERCLA Landfill cap is in place and appears to be functioning as intended. The cap shows no signs of deterioration. Landfill leachate is captured and treated by the LCS as intended, but the volume of leachate has not decreased as was anticipated by the ROD. Studies suggest that shallow groundwater may be entering the LCS. The original treatment for cyanide identified in the ROD was thermal treatment. The change from a thermal method to biotreatment is not supported by EPA. The effectiveness of biotreatment of cyanide is not fully understood, particularly given that an open-top tank which may allow for volatization of contaminants is used as part of the process. EPA has identified a need to use a different treatment method for cyanide in leachate.

**Unloading Area:** The decision to forego groundwater treatment at the Unloading Area was documented in the 1994 ESD. The ESD also stated that the need for future recovery and treatment of groundwater in the Unloading Area will be analyzed during the CERCLA five-year review process. EPA has identified a need to continue to closely monitor fluoride levels in this area. EPA has also identified a need for an ESD to change the ACLs for fluoride and sulfate to the appropriate fluoride MCL and sulfate SMCL.

**Scrubber Sludge Ponds:** The Scrubber Sludge Ponds soil cover is in place; however, EPA is unable to determine if the cover is functioning as intended. Monitoring well MW-29S at times shows a level of fluoride above the MCL of 4.0 mg/L although below the alternate concentration limit of 9.7 mg/L. An ESD to replace the fluoride ACL with the MCL is necessary. The fenced areas of the Site need to be inspected and modified as needed to prevent exposure of human and ecological receptors to potential hazards. Soil sampling needs to be conducted to determine the integrity of the soil cover.

**Groundwater Monitoring:** The limited groundwater monitoring data indicates that groundwater quality is static. There is no clear indication of significant impacts from the CERCLA landfill leachate to the S or A aquifers. However, insufficient data exists to fully understand groundwater at the Site. A Site-wide

comprehensive groundwater investigation needs to be implemented to make data-supported assessments of the groundwater quality. No new groundwater supply wells have been drilled in the vicinity of the Site since the last five-year review.

**Institutional Controls:** The institutional controls intended to impose restrictions on groundwater need to be further evaluated to confirm if they are functioning as intended. A deed restriction was implemented at the CERCLA and RCRA units providing an institutional control prior to the annexation into The Dalles of the real property on which the Site is located. The deed restriction, a special warranty deed filed with Wasco County, restricts the use of the land through prohibitions on the use of land for residential purposes and the use of groundwater and surface waters for any use. The deed is recorded as required in the Consent Decree (1989) and is in the records office of Wasco County. Since the records office may not be readily available to all potential future land owners, the deed restriction may need to be supplemented. In addition to reviewing existing deed restrictions and determining whether additional deed restrictions are needed, EPA has determined a need to identify the groundwater restrictions on the Site through use of signage indicating the presence of contaminated groundwater.

### Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

There have been no changes in the exposure assumptions, toxicity data, or remedial action objectives used at the time of remedy selection at the Site. The cleanup levels for fluoride and sulfate identified in the 1988 ROD are no longer valid. There have been no changes to the physical conditions of the Site that would have the potential to affect the protectiveness of the remedy. However, several surrounding parcels of land previously owned by Northwest Aluminum Company have been sold and are being redeveloped. In addition, a light industrial park, located between River Road and the Columbia River, has filled in much of the property on the eastern portion of the Site. Density and land use have increased in areas surrounding the Site since the last five-year review.

In 2005, EPA issued guidance that clarified policy on the use of alternate concentration limits (ACLs) in CERCLA cleanup. CERCLA Section 121(d) generally provides that remedial actions shall meet applicable or relevant and appropriate requirements (ARARs), unless those requirements are waived pursuant to section 121(d)(4) under appropriate site-specific circumstances. Section 121(d)(2)(B)(ii) also addresses ACLs and limitations concerning their use by stating a process for establishing ACLs to those otherwise applicable for hazardous waste constituents in groundwater under subparagraph (A) may not be used to establish applicable standards if the process assumes a point of human exposure beyond the boundary of the facility.

At the Site, the S aquifer is identified as discharging to the Columbia River. This discharge point is located beyond the boundary of the Site and acts as a potential point for human exposure. Based on this information, EPA has identified a need for an ESD to change the ACLs for fluoride and sulfate to the appropriate fluoride MCL and sulfate SMCL. Table 4 identifies the cleanup levels from the ROD and the applicable MCLs relevant to this issue.

**Table 4. Comparison of ROD Cleanup Levels and Applicable Requirements**

| Contaminant | Media | ROD S Aquifer Cleanup Levels (mg/L) | ROD A and B Aquifer Cleanup Levels (mg/L) | Applicable Or Relevant and Appropriate Requirements (ARARs) (mg/L) |
|---|---|---|---|---|
| Fluoride | Groundwater | 9.7 (ACL) | 4 | 4 (MCL) |
| Sulfate | Groundwater | 3,020 (ACL) | 250 | 250 (SMCL) |
| Free/WAD Cyanide | Groundwater | Onsite: 0.77<br>Offsite: 0.22 | Onsite: 0.22<br>Offsite: 0.22 | 0.2 |

## Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Northwest Aluminum Company initiated a voluntary cleanup at the Site under ODEQ's oversight in 2008. The work was completed using less protective cleanup levels for fluoride than the levels established in the ROD. The ROD established a fluoride ACL of 9.7 mg/l and a recommendation in this five-year review and in the preceding five-year review is to change this value to the MCL of 4.0 mg/l. ODEQ established a groundwater screening level for the S aquifer of 72 mg/l for fluoride, which is greater than the ACL and MCL. The voluntary cleanup consisted primarily of excavation and offsite disposal of contaminated soil; however, concrete rubble from demolished buildings used as backfill was screened against the 72 mg/l fluoride value. Samples of concrete rubble show the concrete contained levels of fluoride that could potentially leach to groundwater at levels above the ACL and MCL. The contamination left in place may impact the groundwater component of the CERCLA remedy.

EPA encountered data from 2004 which showed detections of hydrogen cyanide gas at the RCRA landfill unit, which is located adjacent to the CERCLA units. EPA issued a 106(a) Unilateral Order to Lockheed Martin to conduct air/gas sampling at the Site and to ensure the Site was secured. A round of air/gas sampling was conducted in September 2012 in compliance with the Unilateral Order. Based on the results of this round of monitoring, Lockheed Martin recommended additional sampling using automated instrumentation to allow for logging of data at regular time intervals. EPA also recommended another round of sampling to confirm conditions at the CERCLA landfill. The next round of air/gas sampling is scheduled for May 2013. The results from air sampling activities will be used to determine if additional actions are needed to ensure protectiveness of the remedy.

## Technical Assessment Summary

Insufficient data exist to determine if the remedy is generally functioning as intended by the ROD. The landfill cap appears to be intact at the CERCLA landfill. Leachate is still being captured and treated but has not diminished to a level of low flow. EPA does not support the use biotreatment to treat cyanide in leachate from the CERCLA landfill and had identified the need for an alternative treatment method. The

CERCLA landfill remains fenced and a new fence was installed to restrict access to the 300,000 gallon tank.

Insufficient data exist to determine if the remedy at the Unloading Area is functioning as intended. EPA will need to assess the groundwater and fluoride levels in this area as part of the Site-wide comprehensive groundwater investigation that is needed. That investigation should provide data to determine if a need for recovery and treatment of groundwater exists.

Insufficient data exist to determine if the soil cover at the Scrubber Ponds is functioning as intended. EPA has determined a need for soil sampling to determine the integrity of the soil cover. Monitoring well MW-29S at times shows a level of fluoride above the MCL of 4.0 mg/L although below the ACL of 9.7 mg/L. EPA has identified that an ESD to replace the ACLs with MCLs is necessary. The Scrubber Sludge Ponds remains fenced. EPA has identified a need to inspect and modify fencing as needed at all fenced areas of the Site to prevent exposure of human and ecological receptors to potential hazards.

Insufficient data exist to fully understand groundwater at the Site. EPA has identified a need for implementation of a Site-wide comprehensive groundwater investigation to make data-supported assessments of the groundwater quality.

The institutional controls intended to impose restrictions on groundwater need to be further evaluated to confirm if they are functioning as intended. In addition to reviewing existing deed restrictions and determining whether additional deed restrictions are needed, EPA has determined a need to identify the groundwater restrictions on the Site through use of signage indicating the presence of contaminated groundwater. In order for these controls to provide protection, all of the property owners within the footprint of the Site as it is defined in the Judicial Consent Decree and ROD should place deed restrictions on the use of groundwater. Deed restrictions which continue to name Martin Marietta as the holder of the restriction should be modified to name Lockheed Martin Corporation, successor to Martin Marietta. The plat on record with the Wasco County Clerk's office should include a restriction to ensure that groundwater is not extracted from the S, A and B aquifers and should be updated as changes occur.

## VIII. Issues

Based on the review of data and inspection of the Site, five main issues have been identified for the Site. These issues are summarized in Table 5.

**Table 5. Issues from the Fourth Five-Year Review**

| Issues | Currently Affects Protectiveness (Yes/No/Other) | Affects Future Protectiveness (Yes/No/Other) |
|---|---|---|
| 1. The ACLs identified in the ROD exceed the MCL for fluoride and SMCL for sulfate. | Yes | Yes |
| 2. The effectiveness of biological treatment of cyanide is not fully understood. | Yes | Yes |
| 3. Groundwater movement and contaminant flow and transport are not fully understood. | Yes | Yes |
| 4. The effectiveness of soil covers around the Scrubber Sludge Ponds is not fully understood and ecological receptors are entering the area. | Yes | Yes |
| 5. Uncertainty around protection of current and future land owners of the site and surrounding area. | Yes | Yes |
| 6. Data showed detections of hydrogen cyanide gas at the RCRA landfill, located adjacent to CERCLA units on the Site. Further air sampling is needed to determine the levels of any toxic, asphyxiating and explosive gases from the RCRA and CERCLA landfills. | Yes | Yes |
| 7. The remediation criteria identified in the ROD for polycyclic aromatic hydrocarbons (PAHs) exceeds risk-based standards. | No | Yes |

# IX. Recommendations and Follow-up Actions

Recommendations to address the identified issues are discussed in this section. Table 6 summarizes the recommendations and follow-up actions, responsible parties, and milestone dates. The first recommendation is to apply the fluoride MCL and sulfate SMCL at the Site through issuance of an ESD. The ESD will address the issue of having ACLs which are above the 4.0 mg/L MCL for fluoride and the 250 mg/L SMCL for sulfate.

The second recommendation is to evaluate alternative treatment methods for cyanide present in leachate from the CERCLA landfill. Based on the evaluation, a different method will be implemented to treat leachate. The implementation of a new treatment method will also address the issues surrounding the question of effectiveness of biotreatment of cyanide in an open-top tank.

The third recommendation is to implement a Site-wide comprehensive groundwater investigation. Insufficient data exists to fully understand groundwater at the Site. A comprehensive investigation should be developed through collaboration between Lockheed Martin and EPA. Although EPA has no jurisdiction over groundwater restrictions beyond the limits of the Site, nearby properties should be notified of drinking water well closures that took place as part of the CERCLA remedy. A notice to these properties will preserve institutional knowledge about historical drinking water well abandonment that occurred as a precaution against direct human contact with contaminants.

The fourth recommendation is to inspect and modify fencing as needed at all fenced areas of the Site to prevent exposure of human and ecological receptors to potential hazards. As part of this recommendation, soil sampling should be conducted to determine the integrity of the soil cover over the Scrubber Sludge Ponds.

The fifth recommendation is to improve long-term institutional controls against use of groundwater to protect surrounding and potential future land owners and down-gradient receptors. These improvements include listing Lockheed Martin on deeds for all parcels of property retained by Lockheed Martin, updating the survey plat, and identifying deed restrictions on-site. These actions will help address uncertainty around the protection of future land owners of the site and surrounding area.

This sixth recommendation is to complete air/gas sampling at the RCRA and CERCLA landfills to determine the levels of any toxic, asphyxiating and explosive gases. Based on the results of this sampling, it will be determined if further action is necessary to ensure protectiveness of the remedy.

The seventh recommendation is to change the remediation criteria for PAHs identified in the ROD to a requirement to use risk-based screening levels to determine exposure point concentrations and PAH cleanup levels for any future soil remediation work. This recommendation is not intended to alter the selected remedy at the CERCLA landfill or Scrubber Sludge Ponds. Rather, it would apply to any future remediation work, including voluntary work that may be conducted on the Site. This change will be identified through an ESD.

**Table 6. Recommendations and Follow-Up Actions from Fourth Five-Year Review**

| Issue | Recommendations/ Follow-up Actions | Party Responsible | Oversight Agency | Milestone Date | Affects Protectiveness? (Yes/No) | |
|---|---|---|---|---|---|---|
| | | | | | Current | Future |
| 1. The ACLs identified in the ROD exceed MCL for fluoride and SMCL for sulfate. | Apply MCL and SMCL at the Site through an ESD. | EPA | EPA | December 2013 | Yes | Yes |
| 2a. The effectiveness of biological treatment of cyanide is not fully understood. | Evaluate alternative treatment methods for cyanide present in leachate from the CERCLA landfill. | Lockheed | EPA | December 2013 | Yes | Yes |
| 2b. The effectiveness of biological treatment of cyanide is not fully understood. | Based on the evaluation of alternative treatment methods for cyanide present in leachate, implement a different method to treat leachate. | Lockheed | EPA | September 2014 | Yes | Yes |
| 3a. Groundwater movement and contaminant flow and transport are not fully understood. | Evaluate the current effectiveness of the groundwater monitoring network. | Lockheed | EPA | December 2013 | Yes | Yes |
| 3b. Groundwater movement and contaminant flow and transport are not fully understood. | Address data gaps to implement a comprehensive groundwater investigation on a Site-wide basis. | Lockheed | EPA | June 2014 | Yes | Yes |

| Issue | Recommendations/ Follow-up Actions | Party Responsible | Oversight Agency | Milestone Date | Affects Protectiveness? (Yes/No) | |
|---|---|---|---|---|---|---|
| | | | | | Current | Future |
| 4a. The effectiveness of soil covers around the Scrubber Sludge Ponds is not fully understood and ecological receptors are entering the area. | Conduct soil sampling to determine integrity of soil cover. Repair and/or modify the soil cover as necessary to prevent exposure of human and ecological receptors to potential hazards. | Lockheed | EPA | June 2014 | Yes | Yes |
| 4b. The effectiveness of soil covers around the Scrubber Sludge Ponds is not fully understood and ecological receptors are entering the area. | Inspect and modify fencing as needed at all fenced areas of the Site to prevent exposure of human and ecological receptors to potential hazards. | Lockheed | EPA | Continue as part of O&M | Yes | Yes |
| 5. Uncertainty around protection of future land owners of the site and surrounding area. | Reestablish institutional controls to prevent use of groundwater to protect surrounding current and potential future land owners and down-gradient receptors. | Lockheed | EPA | December 2013 | Yes | Yes |
| 6. Data showed detections of hydrogen cyanide gas at the RCRA landfill, located adjacent to CERCLA units on the Site. | Complete air/gas sampling at the RCRA and CERCLA landfills to determine the levels of any toxic, asphyxiating and explosive gases from the RCRA and CERCLA landfills. Determine if any action is necessary based on results presented in the sampling report. | Lockheed | EPA | August 2013 | Yes | Yes |

| Issue | Recommendations/ Follow-up Actions | Party Responsible | Oversight Agency | Milestone Date | Affects Protectiveness? (Yes/No) | |
|---|---|---|---|---|---|---|
| | | | | | Current | Future |
| 7. The remediation criteria identified in the ROD for polycyclic aromatic hydrocarbons (PAHs) exceeds risk-based standards. | Change the remediation criteria for PAHs identified in the ROD to a requirement to use risk-based screening levels to determine exposure point concentrations and PAH cleanup levels for any future soil remediation work. Identify this change through an ESD. | EPA | EPA | December 2013 | No | Yes |

## X. Protectiveness Statement

Based on this review of the Site, EPA cannot make a determination that the remedy is functioning as intended. Protectiveness cannot be determined until further information is obtained. As such, EPA must make a Protectiveness Deferred finding. EPA has determined that MCLs need to be implemented through issuance of an ESD to replace ACLs at the Site, biotreatment of cyanide in leachate needs to be replaced with an EPA-approved treatment method, fencing around the Site needs to be reviewed and institutional controls must be reestablished. In order to help determine the effectiveness of the remedy a comprehensive groundwater investigation followed by implementation of a more comprehensive monitoring program and sampling of the soil cover over the Scrubber Sludge ponds to determine cover integrity are needed.

## XI. Next Review

The next five year review will cover the time period from January 2010 to December 2015 and is due by December 2015.

## XII. References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