FIVE-YEAR REVIEW REPORT FOR REYNOLDS METALS SUPERFUND SITE MULTNOMAH COUNTY, OREGON

Prepared by

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Date

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LIST OF ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirement
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
EPA	United States Environmental Protection Agency
CFR	Code of Federal Regulations
DEQ	Oregon Department of Environmental Quality
MCL	Maximum Contaminant Level
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
PAH	Polyaromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PRP	Potentially Responsible Party
RA	Remedial Action
RAO	Remedial Action Objective
RD	Remedial Design
RI/FS	Remedial Investigation/Feasibility Study
RI/RA	Remedial Investigation/Risk Assessment
ROD	Record of Decision
SDWA	Safe Drinking Water Act

EXECUTIVE SUMMARY

The remedy for the Reynolds Metals Superfund Site in Troutdale, Oregon included excavation and off-site disposal of contaminated waste, soil and debris, capping the western portion of the north landfill area and two small areas on the Company Lake shoreline, construction and operation of a focused extraction/production well optimization (FE/PWO) system to remove fluoride from groundwater and provide hydraulic containment to control plume migration, groundwater monitoring, and institutional controls. The interim Record of Decision (ROD) for the source areas was signed on Sept 30, 2002. A final ROD was signed on September 29, 2006. The site achieved construction completion with the signing of the Preliminary Close-Out Report on September 29, 2006. The trigger for the first five-year review was the initiation of remedial action in July 2003. The first five-year review was completed on July 12, 2008.

This review included the following components:

- Public notification
- Review of key project documents
- Review of groundwater monitoring data
- Assessment of effectiveness and protectiveness of institutional controls
- On-site inspection
- Five-year Review Report development and review

Based on the results of this five-year review, the EPA concludes that the remedy is short-term protective because (1) the remedy was constructed and is being completed in accordance with the requirements of the ROD, (2) the remedy is functioning as designed, and (3) the operation, maintenance and monitoring at the Site is being performed in accordance with the Operations and Sitewide Monitoring Plans and protects the integrity of the remedy. The findings of the five-year review indicate that the groundwater remedy has been implemented as designed, with some approved modifications to improve performance, and is currently being evaluated for its effectiveness. Data indicate that fluoride levels have been reduced in portions of the plume in the Company Lake area and the South Plant Area since the completion of the source control actions and initiation of the FE/PWO system operation, but other areas have not shown a significant reduction. The EPA will continue to evaluate system performance and opportunities for optimizing the FE/PWO system. Current land use is consistent with the controls and the ROD and Consent Decree. Institutional Controls are in place on the former plant site to protect those materials that were capped on site and to prevent the use of former plant site groundwater for drinking until such time as the remedy achieves cleanup goals in groundwater. Since the last five-year review Institutional Controls have also been established on adjacent properties that overlie the plume to ensure wells will not be installed and used for drinking water while the groundwater remains above cleanup levels.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Reynolds Metals		
EPA ID: ORD009412677		
Region: 10	**State:** OR	**City/County:** Multnomah

SITE STATUS	
NPL Status: Final	
Multiple OUs? No	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: EPA **If "Other Federal Agency" was selected above, enter Agency name:** 2T
Author name (Federal or State Project Manager): Chip Humphrey
Author affiliation: Remedial Project Manager
Review period: 4/14/2013 – 8/21/2013
Date of site inspection: 7/11/2013
Type of review: Statutory
Review number: 2
Triggering action date: 7/21/2003
Due date *(five years after triggering action date)*: 9/28/2013

Issues/Recommendations				
Issues and Recommendations Identified in the Five-Year Review:				
OU(s): Sitewide	**Issue Category: Remedy Performance**			
	Issue: The groundwater focused extraction and production well optimization system is being operated in accordance with operation maintenance and monitoring plans, and although monitoring data has shown some reductions in fluoride concentrations, the projected timeframe in the ROD appears to be overly optimistic.			
	Recommendation: EPA recommends that a review of the groundwater system be completed as part of the next groundwater monitoring annual monitoring and system operation report due in February 2014. The review should include an evaluation of the overall performance the FE/PWO system, including performance and capture zone of new extraction well FE06, and identifying other potential modifications to improve system performance, and updated projections for achieving groundwater RAOs			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	March 2014

Sitewide Protectiveness Statement (if applicable)	
For sites that have achieved construction completion, enter a sitewide protectiveness determination and statement.	
Protectiveness Determination: Short-term Protective	*Addendum Due Date (if applicable):* *2T*
Protectiveness Statement: The remedy at the Reynolds Metals Superfund Site currently protects human health and the environment because contaminated soils have been remediated, and the groundwater treatment system is operational and functioning as intended. Institutional Controls are in place at the site to protect those materials that were capped on site and to prevent use of site groundwater for drinking until such time as the remedy achieves cleanup goals in groundwater. There are no drinking water wells on the site or adjacent properties with access to contaminated groundwater. However, for the remedy to protective in the long-term, the following actions need to be taken to ensure protectiveness: 1) A review of the performance of groundwater system needs to be completed as part of the next groundwater monitoring annual monitoring and system operation report. 2) The review should include an evaluation of the overall performance the FE/PWO system, including performance and capture zone of new extraction well FE06, and identifying other potential modifications to improve system performance, and updated projections for achieving groundwater RAOs.	

Troutdale, OR
Five-Year Review Report

1. INTRODUCTION

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 methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and identify recommendations to address them.

The Agency is preparing this Five-Year Review report pursuant to 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.*

The Agency interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) 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.*

The United States Environmental Protection Agency (EPA), Region 10, conducted this statutory five-year review of the remedy implemented at the Reynolds Metals Company Superfund Site ("RMC Site" or "Site") in Portland, Oregon. A statutory review is required because the implemented remedy resulted in hazardous substances, pollutants or contaminants being left at the RMC Site. This review was conducted by the Remedial Project Manager (RPM) for the Site from April 2013 through August 2013. This report documents the results of the review.

This is the second five-year review for the RMC Site and addresses the entire site. The triggering action for this statutory review is the start of remedial action under the Interim ROD in July 2003. The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

2. SITE CHRONOLOGY

Table 1. Chronology of Site activities

Event	Date
EPA investigation documenting contamination	1993
NPL listing	December 1994
RI/FS Consent Order signed	August 1995
Removal Actions Conducted	1995 - 2000
RI/FS Reports	June 2000
Interim ROD signed	September 2002
Unilateral Order issued for Interim Remedial Action – Soil and waste areas	July 2003
Contractor mobilized to start site preparation	July 2003
Cleanup of waste areas	2003 - 2005
Second Unilateral Oder for RD and Remedial Action – Groundwater FE/PWO System Installation	August 2005
Groundwater system start-up	November 2005
Plant Demolition/additional soil cleanup	2003 - 2006
Post-Demolition Remedial Investigation and Baseline Risk Assessment Report	June 2006
Final ROD signed – Continued operation of groundwater system and institutional controls	September 2006
Construction Completion/Preliminary Closeout Report	September 2006
First five-year review	July 2008
Consent Decree filed with Court	January 2008
ICs completed for all properties	November 2011

3. BACKGROUND

3.1 Physical Characteristics

The Reynolds Metals Company (RMC) Site is located approximately 20 miles east of Portland, Oregon, and just over one mile north of the City of Troutdale. The property is bordered by the Columbia River to the north, the Sandy River to the east, the Troutdale Airport to the south, and Salmon Creek to the west. (Figure 1) RMC operated a primary aluminum reduction plant where aluminum was produced from the raw material alumina. Approximately 108 acres of the 800-acre site were occupied by the former plant area.

3.2 Land and Resource Use

The plant was constructed for the US Government in 1941 to produce aluminum for wartime operations. The Aluminum Company of America (now Alcoa) operated the plant for the federal government from approximately 1941 to 1946. RMC leased the plant from the government in 1946 and purchased it in 1949. RMC operated the plant until 2000. In May 2000, RMC was acquired by a wholly owned subsidiary of Alcoa. That subsidiary (RLM Acquisition Corp.) merged with RMC, with RMC the surviving corporation. Alcoa suspended operations at the Troutdale plant in the fall of 2000, and Alcoa later announced permanent closure of the facility. The plant buildings were subsequently demolished, with demolition taking place from 2003 through January 2006. Alcoa sold the property to the Port of Portland in 2008.

A US Army Corps of Engineers (COE) dike runs approximately east-west through the northern portion of the property, then turns south at the eastern property boundary. Site areas north and east of the dike are located within the 100 year floodplain. These areas are currently undeveloped and characterized by cottonwood-ash riparian forest and areas vegetated with blackberries and Scot's broom thickets.

The Site is mostly level, with less than 20 to 30 feet of variation in elevation. Geologically, the RMC Site is located in the eastern portion of the "Portland Basin," a term describing a 20 mile-wide by 45 mile-long northwest-southeast trending structural depression. The basin is filled with a complex system of unconsolidated and consolidated alluvial sediments containing important water-bearing zones.

3.3 Investigation Areas

<u>Soil and Debris Areas</u>

The RMC site was divided into four areas for the post-demolition investigation and evaluation of site soil conditions. These key site reference areas are shown in Figure 2.

- Outside the Dike
- Fairview Farms
- South Wetlands area
- East (former plant) area

The area Outside the Dike refers to the portion of the RMC site that is to the north and east outside of the US Army Corps of Engineers dike. This area is within the flood plain of the Columbia River, and includes Company Lake, East Lake and the western portion of the north landfill. The Fairview Farms area is 227 acres located west of Sundial Road. This area was used for cultivated crops and cattle grazing. Although this area was not used for historical plant operations, there were some stormwater overflows from the plant to an adjacent ditch.
The South Wetlands area is 28 acres located south of the former plant. This area was used as a settling pond for wastewater discharges during the early years of plant operations. It is a low-lying area with thick vegetation and some standing water. The East Area (Figure 3) is 254 acres and includes the area where the former RMC plant was previously located. The Port of Portland has installed utilities and infrastructure to support future development in this area. The FedEx Ground facility was constructed and is in operation in a portion of this area known as Lot 11. The south landfill, scrap yard, and east potliner waste areas were located within the East Area.

Groundwater

Groundwater generally discharges to the Columbia River in the northern portion of the Site and to the Sandy River in the eastern portion of the site. Two regional aquifer systems exist under the Site. The Sand and Gravel Aquifer (SGA) is the deeper unit. The Unconsolidated Sedimentary Aquifer (USA) is the uppermost aquifer and the focus of investigation and cleanup of this site. The unconsolidated sediments in this aquifer have been subdivided into four water-bearing zones for purposes of investigation:

- silt unit (generally 0-30 feet deep, and present mainly in the East Area)
- upper grey sand (up to 50 feet deep)
- intermediate sand (up to 100 feet deep)
- deep sand/gravel (greater than 100 feet deep)

3.4 History of Contamination/NPL Listing

The EPA conducted site investigations at RMC in 1994 that documented contamination in several former waste disposal areas at the site. Contaminants included fluoride, PAHs, cyanide, metals and PCBs. The EPA placed the Site on the Superfund National Priorities List (NPL) in 1994. On September 29, 1995, the EPA and RMC signed an Administrative Order on Consent (AOC) for RMC to prepare a RI/FS and perform early actions at the Site under EPA's oversight. RMC completed the early cleanup actions as well as the RI/FS, which presents the results of the site investigation and analysis of cleanup alternatives.

3.5 Removal Actions

RMC conducted several early cleanup actions on the Site between 1995 and 2002 to remove contaminated soil and waste material. These actions targeted various waste disposal and spill areas, including areas that were sources of groundwater contamination. Over 42,000 tons of waste, soil and debris contaminated with fluoride, cyanide, PAHs and PCBs was excavated and removed to permitted off-site disposal facilities. The early actions were completed as time-critical removal actions under EPA oversight. A detailed description of the areas and removal actions is included in the ROD.

3.6 Remedial Investigation and Feasibility Study

RMC conducted an RI /FS under EPA and DEQ oversight from 1996 through 2000. The findings of the RI/FS, including the results of the baseline risk assessment, were the basis for the Interim ROD that was signed on September 30, 2002.

3.7 Basis for Remedial Actions

The RI/FS showed there were high levels of contamination in soil, waste and debris and in the eastern portion north landfill, south landfill, scrap yard area and high levels of contamination in the process residue that was located at the bottom of Company Lake. It also showed that there was a significant plume of fluoride in groundwater beneath the RMC facility. Exposures to waste, soils and debris and Company Lake sediments were associated with significant human health risks. The contaminated materials in these waste areas were considered to be the primary sources of groundwater contamination.

4. REMEDIAL ACTIONS

4.1 Interim Remedial Action

<u>Selected Remedy</u>

In September 2002, the EPA issued a ROD for Interim Remedial Action (Interim ROD). The selected remedy included the following:

- Removing contaminated process residue from Company Lake
- Excavating contaminated waste and soil from the south landfill area
- Excavating contaminated waste material from the eastern portion of the north landfill area, and installing a riprap (soil and rocks) cover over the western portion of the landfill
- Off-site disposal of excavated waste material at a permitted disposal facility
- Installing extraction wells in the east potliner and scrap yard areas to remove and contain groundwater contaminated with high levels of fluoride

- Modifying the operation of existing production wells to limit the further spread of fluoride in the groundwater
- Discharging groundwater from the combined production wells/focused extraction (FE/PWO) system to the Columbia River
- Monitoring groundwater to evaluate the effectiveness of source removal and focused extraction
- Limiting future use (through the use of engineering and institutional controls) of shallow groundwater and portions of the property to ensure the remedy remains protective.

Cleanup levels for soils and waste that were established in the Interim ROD for the individual waste areas are described below. The cleanup level for fluoride contaminated-groundwater established in the Interim ROD was 4 mg/l, the drinking water MCL.

The standard for fluoride established in the Interim ROD for discharge of groundwater from the FE/PWO system to the Columbia River was 5mg/l.

4.2 Remedy Implementation – Interim ROD

Remedial Construction Activities – Soils

Cleanup of the waste areas required by the Interim ROD was carried out under a Unilateral Order (UAO) issued by the EPA in 2003.

North Landfill – An estimated 10,509 tons of contaminated waste and soil from eastern portion was excavated and disposed off-site in a permitted landfill. The western portion was capped to prevent direct contact and to provide flood protection. Confirmation sampling was conducted to verify that cleanup levels for the eastern portion established in the ROD (4,000 mg/kg for fluoride, 36 mg/kg for carcinogenic PAHs) were met, with mean post-cleanup levels of 437 mg/kg for fluoride and less than 1 mg/kg for carcinogenic PAHs.

Company Lake - The lake was drained in 2003 and 2004 and an estimated 90,850 tons of the process residue and underlying sediment was excavated and disposed of at an off-site disposal facility. Small quantities of process residue could not be removed because of concerns over slope stability at portions of the west and southeastern ends of the lake, and these areas were capped. Cleanup goals established in the Interim ROD for Company Lake were 1,000 mg/kg for fluoride and 36 mg/kg for carcinogenic PAHs. Following cleanup, mean total fluoride was 481 mg/kg, and PAHs were 1.35 mg/kg.

South Landfill - Excavation and off-site disposal of 66,038 tons of waste and soil was completed for this area. Cleanup goals established in the Interim ROD for the south landfill were 4,000 mg/kg for fluoride and 36 mg/kg for carcinogenic PAHs. Following cleanup mean levels of fluoride were 427 mg/kg and carcinogenic PAHs were 1.9 mg/kg.

Remedial Construction Activities - Groundwater

Construction and start-up operation of the groundwater action was completed under a second UAO issued by the EPA in August 2005.

Construction of the FE/PWO system was completed in October 2005. The system is designed to provide hydraulic containment of contaminated groundwater and restore groundwater quality. Two extraction wells, FE02 and FE03, were installed in the scrap yard and east potliner areas. Production wells include PW07 and PW08, with backup capacity provided by wells PW03 and 05. Startup performance monitoring began in early November, 2005, followed by 5 months of operation and performance evaluation. The EPA reviewed the results of the startup performance evaluation, which is documented in the *Focused Extraction/Production Well Optimization System Startup Performance Monitoring Results and Conclusions Technical Memorandum (CH2M Hill June 2006),* and determined that the system is operating as designed. The ongoing monitoring and reporting program includes evaluation of changes in the fluoride plume over time and of plume containment. Groundwater monitoring, is described in the described in *Addendum 1 - Site-wide Groundwater Monitoring Plan (2006-2010),* which was updated in the 2010 Groundwater Monitoring Work Plan prepared by Ash Creek, 2010 to cover the groundwater monitoring program from 2010 through 2015.

4.3. Plant Demolition

The RMC facility was demolished from 2003 through January 2006. All of the plant structures and most of the foundations were removed as part of the demolition. The decision to demolish the plant was made by Alcoa based on its own business consideration and was not part of the cleanup activities under CERCLA. Alcoa chose to conduct the demolition, cleanup activities and dispose of contaminated materials that it removed consistent with the soil cleanup levels that were used in the Interim ROD and State soil cleanup levels and disposal requirements. The demolition activities provided the opportunity to complete additional investigation and cleanup of the area next to and beneath the plant. The EPA and DEQ provided oversight of the sampling, cleanup and disposal activities during site demolition.

4.4 Post Demolition RI/RA

A post-demolition Remedial Investigation (RI) was conducted during plant demolition and completed after post-demolition sampling of the plant area. The Risk Assessment (RA) for the RMC site was updated in June 2006 to reflect post-demolition site conditions.

The post-demolition RI was a comprehensive data gathering and analysis program that evaluated Site conditions following the plant demolition. Soil investigations, including surface and subsurface sampling, were conducted at 56 assessment areas. In addition, geophysical techniques, such as electromagnetic and resistivity surveys, were completed to identify buried material. Soil samples were analyzed for fluoride, PAHs, cyanide, PCBs, pesticides, metals,

VOCs, and semivolatile organic compounds (SVOCs). The assessment areas were combined into four general areas for investigation and evaluation: outside the dike, Fairview Farms, the south wetlands and the East (former plant) area.

The Post-Demolition RA concluded that noncarcinogenic health impacts did not exceed 1.0 for the Fairview Farms Area, Outside the Dike Area, East Area, or the South Wetland Area. The results of the Human Health Risk Assessment confirmed that the soils at the site are within EPA's acceptable risk range, and within DEQ's acceptable risk range for all contaminants except for a minor exceedance for one chemical, benzo(a)pyrene, in the East Area.

4.5. Final ROD

Selected Remedy

The final ROD for the RMC Site was signed on September 27, 2006 and selected the following remedial actions:

- Institutional controls (IC) to ensure protection of future users of the Site and that future uses of the Site, including groundwater use, are compatible with the cleanup levels achieved. ICs are necessary to restrict residential use of the Site, restrict the use of groundwater that exceeds MCLs as a drinking water source, and protect the integrity of the cap. The ICs include:
    - A legal description of the property with a corresponding map to identify the property where the ICs will be implemented.
    - A restrictive easement or covenant that runs with the land to prohibit residential use of the property, and identify conditions (i.e., additional protective measures, such as capping or special soil handling requirements) under which non-industrial site uses would be considered. For groundwater, the restrictions include a prohibition on use of Site groundwater that exceeds MCLs for drinking water, prohibition of other groundwater uses that would interfere with the successful operation of the groundwater FE/PWO system, and access for inspection and continued operation of the system.
    - Use restrictions on the capped areas to protect the integrity of the existing cap or require suitable capping to allow for intended use of the area.
- Continued operation of the groundwater focused extraction/production well optimization (FE/PWO) system until groundwater cleanup levels are achieved or the EPA approves modification, reduction or suspension of the operation of the system. Groundwater from the FE/PWO system will continue to be discharged pursuant to the fluoride standard established in the Interim ROD and the existing Oregon DEQ NPDES permit # 100757 or as modified by DEQ.

- Maintenance and monitoring of capped areas to ensure protection of human health and the environment, including inspections of the capped areas to verify cap integrity and making repairs when problems are observed. A cap inspection and maintenance plan will be required to be submitted to the EPA for approval and implementation, and will be implemented in accordance with the approved plan.
- Monitoring groundwater to evaluate the effectiveness of the completed and ongoing cleanup actions.

The ROD further concluded that the shallow silt zone in the South Plant area is not a usable source of drinking water because of low yields in this portion of the aquifer, and attainment of groundwater cleanup levels is not required for this area. The completed source control actions and the focused extraction system are expected to reduce and control the migration of fluoride from the silt zone to the underlying portions of the aquifer.

4.6 Remedy Implementation

The EPA and RMC/Alcoa signed a Consent Decree on October 1, 2007 that requires RMC to implement the remedy that was selected in the final ROD. The Consent Decree was filed in Oregon District Court in January 2008 which requires RMC to operate and maintain the FE/PWO and conduct groundwater monitoring at the site, institutional controls and the cap maintenance and monitoring program.

4.7 Operation and Maintenance

Cap inspections and necessary repairs are being completed in accordance with the Operation and Maintenance Plan. The purpose of the inspection established in the final O&M Plan was to evaluate land use, vegetation, cap integrity and previous repairs.

RMC conducted groundwater remediation and long-term monitoring and maintenance activities according to the approved Operations Plan to protect the integrity of the remedy. The Port of Portland, under an agreement with RMC, assumed operations and maintenance of the FE/PWO system in January, 2008.

4.8 Attainment of Groundwater Cleanup Levels

The purpose of completed source control actions and the groundwater FE/PWO extraction is to expedite the attainment of site-wide groundwater cleanup levels. The cleanup level is 4 mg/l, the drinking water MCL for fluoride. The projected time frame in the ROD for extraction is an estimated 10 to 15 years beginning with the implementation of FE/PWO system in November 2005. RMC has completed some modifications to FE/PWO system, including installation of new extraction wells to replace wells with marginal performance limited by iron bacteria fouling or poor capture. Progress towards attainment of groundwater cleanup levels was initially evaluated as part of the *2007 Annual Groundwater Monitoring and FE/PWO System Operation Report (CH2M Hill December 2007)* and *Addendum 1 to the Sitewide Groundwater Monitoring Report*

(2006-2010). Information in these reports was updated in the 2012 Groundwater Monitoring and FE/PWO System Operation Report (Ash Creek Associates, February 2013).

4.9 Groundwater Extraction System Monitoring

Groundwater extraction system monitoring is conducted through periodic sampling and analysis of groundwater samples from extraction wells, selected monitoring wells, and the discharge to confirm that the system performance objectives are being achieved.
Performance is evaluated with respect to the following:

- Hydraulic response to pumping
- Water quality and concentration trends
- Water levels
- Total contaminant mass removed and mass removal rate

Results from these evaluations are presented in annual reports and activities are summarized in monthly progress reports in accordance with the requirements of the Sitewide Groundwater Monitoring Plan. Groundwater quality data are compared to Safe Drinking Water Act MCLs which were established as the cleanup levels for the UGS, intermediate and deep groundwater zones. Discharge data is compared to NPDES permitted discharge levels.

Water quality samples were collected from 39 wells during each of the February and August 2012 monitoring events. Of the wells included in the monitoring program, 18 monitor the silt zone (6 of which were sampled), 24 are located in the upper gray sand (UGS; 20 of which were sampled), 10 are in the intermediate zone (5 of which were sampled), and 10 monitor the deep zone (8 of which were sampled).

North Plant Area
Monitoring wells in this area provide data for assessment of groundwater conditions north of the Corps of Engineers dike. Company Lake and north landfill were the historic sources of groundwater contamination in this area. Water quality data from wells MW23-025, MW27-045, MW57-025, MW27-081, and MW29-090 are being used to evaluate the effectiveness of the source control actions in Company Lake and north landfill and progress towards achieving the groundwater RAOs.

South Plant Area
The south plant area is east of the former location of the main plant. Removal actions were completed in the east potliner area in 1996 and the scrap yard areas in 2004 to address sources of fluoride that was leaching into the underlying groundwater. The FE/PWO system, including extraction wells FE02 and FE03 with target pumping rates of 20 gallons per minute (gpm) each, were installed in this area and began operation in November 2005 to further decrease fluoride concentrations and prevent downward migration of fluoride contamination into the intermediate and deep zones.

Seventeen wells provide information that is used to assess groundwater quality in the south plant area: four wells in the silt unit, MW11-017, MW 10-23, MW13-022, MW 59-019, and 13 wells in the UGS unit, MW 33-033, MW34-038, MW35-038, MW58-042, MW02-034, MW55-046, MW56-046, MW 59-038, FE01-046, and FE02-046, FE03-045, FE 04—071, and FE 05-074.

South Landfill Area

Three wells are used to monitor compliance with water quality criteria: MW19-013, MW26-012 (silt), and MW26-050 (UGS). Soil contaminated with fluoride was removed from this former landfill area, and fluoride does not exceed the MCL in the UGS zone groundwater.

Central Plant Intermediate and Deep Groundwater Zones

The intermediate and deep groundwater zones include areas of groundwater contamination in the central portion of the site. The migration of fluoride to these zones is believed to be a result of historical production well pumping. The focused extraction wells are designed to cut off the downward migration of fluoride to these zones. The following wells are used for performance and water quality monitoring: MW10-90, MW10-165, MW29-179, MW32-040, MW33-095, MW 33-165, MW48-165, PW3, PW5, PW7, and PW8.

4.10 Discharge of Extracted Groundwater

Effluent water from the FE/PWO system is discharged directly to the Columbia River under NPDES permit No. 100757. The NPDES permit for the discharge from the groundwater system limits cyanide levels in the discharge to 0.025 mg/l monthly average and 0.05 mg/l daily maximum. There is no permit limit for PAHs, as this constituent was dropped from the list of parameters based on data that showed that PAHs were not being detected in the discharge. The NPDES permit limits fluoride levels to 5 mg/l. Discharge Monitoring Reports for the five-year review period were reviewed, and it was confirmed that the discharge was in compliance with the permit limits and monitoring requirements.

5. PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the second five year review for the RMC Site. Progress since the last five year review is described below.

Institutional Controls

The first five-year review noted that ICs still needed to be implemented at four additional properties surrounded by or adjacent to the RMC Site. The properties have groundwater beneath their property that exceeds the MCL for fluoride. ICs to prohibit the use of groundwater for drinking water are required under the Consent Decree to ensure that the remedy remains protective.

Institutional Controls were put in place for all properties adjacent to or surrounded by the Site with groundwater contamination. ICs were completed between 2009 and 2011 through Easement and Equitable Servitudes with the State of Oregon for three properties: Pacific Power, Georgia Pacific (formerly James River), and Knife River (formerly Morse Brothers). ICs for the Bonneville Power Administration property were completed on May 25, 2011 through a Memorandum of Agreement with EPA.

FE/PWO system

Operation of the FE/PWO system has been underway since November 2005. The first five-year review reported that 40,467 lbs of fluoride had been removed from groundwater at the Site by May 2008. An additional 50,000 lbs of fluoride has been removed since the last report. Well FE 04 was also replaced in 2013 to improve performance.

6. FIVE-YEAR REVIEW PROCESS

6.1 Administrative Components

The EPA notified representatives of the RMC, DEQ and the natural resource trustees of the initiation of the five-year review in May, 2013. Chip Humphrey, the EPA Remedial Project Manager, conducted this five-year review.

6.2 Community Notification

Activities to involve the community in the five-year review process were initiated in May 2013. A notice announcing initiation of the five-year review process and soliciting information about the Site was published in the Oregonian newspaper on May 19, 2013.

The results of the review and the report will be available to the public at the EPA Oregon Operations Office and the EPA Region 10 website.

6.3 Standards Review

The remedies selected in the 2002 and 2006 RODs are intended to be protective of human health and the environment and to comply with ARARs. The ARARs have been reviewed to identify any new or updated state or federal regulatory standards that might affect the protectiveness of the remedy. No new or updated ARARs were identified in the course of this five year review.

6.4 Document Review

This five-year review consisted of a review of relevant documents including the ROD, O&M plan, groundwater monitoring and FE/PWO system operations reports, and the easements and protective covenants for the individual properties. Attachment 1 shows a complete listing of the documents reviewed.

6.5 Data Review

The Port of Portland provides an annual report of groundwater monitoring activities and results. The 2012 Groundwater Monitoring and FE/PWO System Operation Report includes a summary of most recent groundwater results as well as historical results.

The EPA reviewed the data from current and historical groundwater monitoring and the results of the NPDES permit discharge monitoring conducted through April 2013. The conditions of the permit continue to be met.

Groundwater Quality

Concentration trend plots for each individual well are included in Appendix B of the annual groundwater report. The summary of the average concentrations for each zone and evaluation of trends in concentration reduction is provided below.

North Plant Area
North plant wells in the upper grey sands (UGS) zone continue to exceed the MCL with an average concentration of 12.1 mg, and are within the historically observed range. The average of the north plant area UGS wells do not show a statistically significant concentration trend. The north plant area intermediate zone wells also exceed the MCL with an average concentration of 15.2. Although one intermediate depth well shows a downward trend, the average of the wells does not show a statistically significant concentration trend.

South Plant Area
The former South Plant area is defined as the silt and UGS groundwater zones in the area near the former scrap yard and former east potliner area. Water quality performance criteria for the former South Plant area depend on the expected effectiveness of the source control actions completed in the former scrap yard and former east potliner area, as well as the groundwater remedy implemented in this area. The remedial objective for the silt zone does not include a numeric cleanup goal but is tied to the protection of the underlying aquifer units.

On average, the South Plant silt zone wells exhibit a statistically significant downward concentration trend, with a current average concentration of 74 mg/l. The silt zone in portions of the south plant area are considered to be a source to deeper groundwater and the underlying zones. The South Plant UGS wells exceed the drinking water MCL for fluoride (an average of about 25 mg/L in 2012). The wells on average also show a statistically significant downward concentration trend.

South Landfill Area
The former south landfill area is not a significant source of constituent migration to the UGS, intermediate, or deep groundwater zones. Low soil permeability in the silt unit limits the ability of fluoride to migrate from the silt to the underlying UGS.

On average, the South Landfill Silt wells exceed the fluoride MCL (an average of 59.4 mg/L in 2012), and shows a statistically significant downward concentration trend. The fluoride concentrations in this UGS well in this area have been consistently below the MCL of 4.0 mg/L since March 2005.

Former Plant Interior (Central Site)
The central site intermediate and deep groundwater zones have been defined as those areas of groundwater in the central portion of the Site where fluoride concentrations in these aquifer units exceed the MCL

On average, the Central Site Intermediate wells exceed the fluoride MCL (an average of 8.8 mg/L in 2012). In 2012, the average concentrations in these wells increased slightly from 7.3 mg/L in February to 10.4 mg/L in August, and were lower than the average observed in 2011 (which was 12.3 mg/L). The average of the Central Site Intermediate wells shows a statistically significant downward concentration trend

On average, the Deep wells exceed the fluoride MCL (an average of 9.9 mg/L in 2012). In 2012, the average concentrations in these wells was similar between February and August (a decrease of about 1 percent), and were higher than the average observed in 2011 (which was 8.8 mg/L). The average of the Deep wells show a statistically significant upward concentration trend and has an average 2012 concentration that is significantly higher than the overall average observed since 2005.

The average fluoride concentrations in both the intermediate and deep zones continue to exceed the MCL of 4.0 mg/L (and the Deep wells are exhibiting a statistically significant upward concentration trend). The PWO system is successfully reducing off-site migration of intermediate and deep groundwater plumes to the Sandy River. The data also indicate that significant fluoride mass is being removed from the intermediate and deep zones. Fluoride distribution in the deep zone for August 2012 is shown on Figure 5 together with the distribution from 1997 to 1998 (prior to implementation of the remedy). The production wells have extracted more than 71,000 pounds of fluoride from the intermediate and deep zones since November 2005 (8,380 pounds removed in 2012). The average concentrations in the intermediate zone are exhibiting a statistically significant downward trend, and while the average concentrations in the deep zone show an upward trend, the groundwater gradients induced by the PWO pumping wells suggest that they are contained within the PWO system capture zone.

Mass Removal

As of September 2012 the FE/PWO system has removed an estimated total of 99,000 lbs of fluoride from groundwater at the Site. Well FE04 was recently replaced to improve mass removal. The EPA will continue to assess the trends for the FE/PWO wells to determine if further modifications are needed to improve the performance of wells in removing fluoride**.**

FE/PWO Hydraulic Containment and Capture

Groundwater contour maps, comparison of data to groundwater flow models prepared for the Feasibility Study, and sampling results from selected monitoring wells are presented in the report *Addendum 1 – Sitewide Groundwater Monitoring Plan (2006 through 2010) at RMC Troutdale.* Based on the evaluation for the period since the FE/PWO system was placed into operation in November 2005, it appears that the FE/PWO system is providing hydraulic containment, although recent data indicates that the FE wells do not contain the entire fluoride plume in the UGS zone in the South Plant area. Well FE04 was recently replaced with a new extraction well which should improve capture in this area. The EPA will continue to evaluate the annual groundwater monitoring reports to determine if any modifications to the system are needed in the future to ensure that the degree of control groundwater movement is consistent with the cleanup objectives.

6.6 Site Inspection

A five-year review inspection at the Site was conducted on July 11, 2013 by Chip Humphrey, the EPA RPM. Representatives of DEQ (Erin McDonnell and Dan Hafly) RMC/Alcoa (Michele Maidman) and the Port of Portland (David Breen) and the PRP consultants (Pat Hines and Thomas Nadermann) participated in the on-site inspection. The purpose of the inspection was to assess current site conditions, the protectiveness of the remedy, including the capped areas, operation of the groundwater focused extraction/production well optimization system, groundwater monitoring, and current and planned uses of the site.

No significant issues were identified during the inspection. The following observations were noted:

- The Port of Portland, the current owner of the Site, is conducting operation and maintenance at the Site under an agreement with RMC. This included mixing and injecting a chlorine/surfactant mixture to protect the pumps and intake screens from biofouling/scaling from iron bacteria.
- The institutional controls that are in place include prohibitions on the use or disturbance of capped areas (North landfill and the two small areas adjacent to Company Lake), and any other activities or actions that might interfere with the implemented remedy. Although significant portions of the site have been redeveloped since the last 5 year review, no activities were observed that are inconsistent with the institutional controls. The controls were determined to be effective in preventing unacceptable exposures. The former plant property and the surrounding area uses were consistent with land use assumptions and restrictions identified in the 2006 ROD, and no new uses of groundwater were observed.
- No issues were identified based on observation of the capped areas. The capped areas Items noted in the inspection (burrow holes in the capped areas and minor settlement) have been repaired.

6.7 Institutional Controls Review

RMC/Port of Portland Property

The ROD and Consent Decree (CD) require institutional controls (Easement and Equitable Servitudes) that implement environmental restrictions which run with the land on the property that the Port of Portland purchased from Reynolds. Reynolds provided to the EPA advance notice of the sale of the property to the Port of Portland on December 11, 2007 and provided documentation to the EPA that the Easement and Equitable Servitudes were recorded with Multnomah County on December 21, 2007.

The restrictions on the disturbance of capped areas and prohibition on residential use of the property and drinking water use of contaminated groundwater are described in the Consent Decree Appendix B, Exhibit 4. The Port's deed contains explicit prohibitions on disturbing the capped contaminated areas, and restricts residential development and drinking water use of fluoride-contaminated groundwater. According to the Special Warranty Deed [Multnomah County recording number 2007-216750] provided by the Port of Portland, the property was conveyed to the Port subject to the special exceptions shown in Exhibit B of the document ("Permitted Encumbrances"), including the Notice to Successors in Title, Easement and Equitable Servitudes.

The Easements and Equitable Servitudes were reviewed by the EPA and are consistent with the requirements of the ROD and Consent Decree. The ICs for the plant site appear to be functioning as intended in the ROD. The Consent Decree also required that IC's for specific adjacent properties (see third party properties below) be established.

Third Party Properties

The first five-year review noted that ICs still needed to be implemented at four additional properties surrounded by or adjacent to the RMC Site. The properties have groundwater beneath their property that exceeds the MCL for fluoride. ICs to prohibit the use of groundwater for drinking water are required under the Consent Decree to ensure that the remedy remains protective.

ICs were completed between 2009 and 2011through Easement and Equitable Servitudes with the State of Oregon for the three properties: Pacific Power, Georgia Pacific (formerly James River), and Knife River (formerly Morse Brothers). ICs for the Bonneville Power Administration property were completed through a Memorandum of Agreement with the EPA.

7. Technical Assessment

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

Yes. The results of the Site inspection and review of documents, ARARs, and risk assumptions, indicate that the remedy is functioning as intended by the Final ROD. The excavation and off-site disposal of contaminated waste, soils and debris from the Site has achieved the remedial objectives to prevent direct contact with or ingestion of contaminants. The groundwater FE/PWO system has been installed and has been operational since November 2005. It will continue to be evaluated to determine of modifications are needed to improve performance.

The Remedial Action Objectives (RAOs) for the final Remedial Action at this Site as stated in the Final ROD are:

Soils/Direct Contact RAOs

- *Reduce human exposure through direct contact (ingestion, inhalation, and dermal contact) with contaminated soil and debris that would result in unacceptable excess lifetime cancer risk or above a Hazard Index of 1.0 for the reasonably anticipated (non-residential) future land uses.*

Soil and debris removals were conducted to meet this objective. Based on the results of the post-demolition RI and RA, the Final ROD concluded that reduction of human exposure through direct contact with contaminated soil and debris has been achieved. The Site no longer poses an unacceptable risk based on the exposure scenarios evaluated. However, future Site use will need to be restricted to non-residential uses to meet this objective, and the north landfill cap and the two small capped areas in Company Lake will need to be maintained.

The capped areas provide protection from direct contact exposures. Institutional controls limit future use of the Site to uses compatible with the industrial cleanup levels selected and achieved for this Site. Observed uses of the Site during the five-year review were compatible with the cleanup levels selected and achieved.

Access is provided and future use of the property is limited to industrial or other uses compatible with the cleanup under the terms of the Easement and Equitable Servitudes that were granted by property owners. The Easements and Equitable Servitudes were finalized and recorded with Multnomah County for the RMC property, which was subsequently sold to the Port of Portland. The Easements and Equitable Servitudes are in effect for the Port of Portland property. Current land use is consistent with the assumptions used and restrictions required by the Amended ROD.

Groundwater RAOs

- *Restore and maintain use of the groundwater (except the shallow silt zone) as a drinking water source. The restoration goal is the federal and state safe drinking water standard (MCL).*

- *Minimize the migration of contaminants from waste and soils to groundwater at concentrations that are protective for underlying drinking water, reduce the fluoride mass in shallow and intermediate groundwater, and control migration of fluoride and other constituents of concern in groundwater.*

- *Reduce and control the migration of fluoride in groundwater to the Sandy River.*

Sources of potential groundwater contamination were addressed through the removal and remedial actions that were completed prior to and as a part of the 2002 Interim Action ROD. The FE/PWO system is operational and is controlling the migration of fluoride contamination in groundwater to the Sandy River. Operation and maintenance of the groundwater system and groundwater monitoring appears to be effective, in the short term, in removing fluoride mass reducing fluoride levels and containing the spread of the fluoride plume in Site groundwater, although the projected timeframe for achieving restoration of the aquifer to the MCL appears to be overly optimistic based on progress to date.

RMC is maintaining the remedy in accordance with the final ROD, the Operations Plan, and the Sitewide Groundwater Monitoring Plan. The ROD estimated annual operation and maintenance costs of $231,000 for 10 years, and $88,000 for monitoring only costs for an additional 5 years. Costs for groundwater monitoring were based on sampling and analysis of the monitoring wells as described in the Site-wide Groundwater Monitoring Plan (2006-2010). An additional $50,000 in the first year costs was included as a contingency for modifications to the monitoring well network and institutional controls.

Current O&M costs are $164,000 per year, including NPDES monitoring and reporting and utilities costs. Annual costs do not include costs for Well FE04, which was recently replaced with a new well, FE06, to improve capture zone efficiency and increase contaminant mass removal.

The institutional controls that are in place include prohibitions on the disturbance of the capped areas, and any other activities or actions that might interfere with the implemented remedy and are adequately meeting the RAOs. The ICs were implemented by means of Easements and Equitable Servitudes that were recorded for the properties. A title search report for the Port of Portland was recently completed to confirm that the covenants and easements are in effect and have no compromising encumbrances that would make them ineffective. No activities were observed that would have violated the institutional controls or result in unacceptable exposures.

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?*

Yes. The exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection are still valid. No significant changes to the remedial action objectives or cleanup levels are necessary based on the results of the five-year review.

Portions of the Site have been redeveloped since the ROD with construction and operation of the FedEx facility. This use is consistent with the exposure assumptions in the ROD. There have been no changes in the physical conditions of the Site that would affect the protectiveness of the remedy. As required by the remedy, groundwater monitoring is being conducted to evaluate groundwater quality relative to the Safe Drinking Water maximum contaminant level of 4 mg/l of fluoride. The EPA will continue to review monitoring data and annual reports evaluate progress towards meeting the groundwater cleanup goal.

Discharge monitoring data from the FE/PWO system showed that monthly average fluoride levels were at or below 2 mg/l from October 2011 through December 2012.

There have been no significant changes in ARARs and no new standards affecting the protectiveness of the remedy.

There have been no significant changes to the standardized risk assessment methodology since the completion of the Post-Demolition Residual Risk Assessment Report in June 2006. No significant changes in the exposure pathways or toxicity that could affect the protectiveness of the remedy were identified during the five-year review.

The remedial action objectives described in A above are still valid for this Site.

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

No other information that calls into question the protectiveness of the remedy was identified during the five-year review.

Technical Assessment Summary

According to the Site inspection and documents and data reviewed, the remedy for site soils has been completed and the groundwater remedy is operational and is functioning as intended by the ROD. Although there have been a number of changes in the physical conditions of the Site, the changes have not affected the protectiveness of the remedy. ICs are in place and are expected to effectively prevent exposure to residual contamination remaining on Site. ICs for the property that was not owned by RMC (or currently owned by the Port of Portland) were completed since the last five year review in accordance with the Consent Decree. ARARs for groundwater are being addressed through continued operation of the groundwater FE/PWO system as required by the 2006 ROD. No changes in the toxicity factors for the contaminants of concern were identified since the ROD was issued. No other information was identified during the five-year review that calls into question the protectiveness of the remedy.

8. Issues

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
The groundwater extraction and treatment system is being operated in accordance with operation maintenance and monitoring plans, and although monitoring data has shown some reductions in fluoride concentrations, the projected timeframe in the ROD appears to be overly optimistic.	**N**	**Y**

9. Recommendations and Follow-Up Actions

Issue	Recommendations Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
Projected timeframe to achieve groundwater RAO	The EPA recommends that a review of the groundwater system be completed as part of the next groundwater monitoring annual monitoring and system operation report due in February 2014. The review should include an evaluation of the	PRPs	EPA/DEQ	3/2014	N	Y

	overall performance the Focused Extration Production Well Optimization system, including performance and capture zone of new extraction well FE06, and identifying other potential modifications to improve system performance, and updated projections for achieving groundwater RAOs.					

10. OU and Sitewide Protectiveness Statement

The remedy at the Reynolds Metals Superfund Site currently protects human health and the environment because contaminated soils have been remediated, and the groundwater treatment system is operational and functioning as intended. Institutional Controls are in place at the site to protect those materials that were capped on site and to prevent use of site groundwater for drinking until such time as the remedy achieves cleanup goals in groundwater. There are no drinking water wells on the site or adjacent properties with access to contaminated groundwater. However, for the remedy to protective in the long-term, the following actions need to be taken to ensure protectiveness:

1) A review a review of the performance of groundwater system needs to be completed as part of the next groundwater monitoring annual monitoring and system operation report.

2) The review should include an evaluation of the overall performance the FE/PWO system, including performance and capture zone of new extraction well FE06, and identifying other potential modifications to improve system performance, and updated projections for achieving groundwater RAOs..

11. Next Review

The next five-year review for the Reynolds Metals Superfund Site is required by the end of

September 2018, five years from the date of this review.

ATTACHMENT 1

List of Documents Reviewed

Interim Action Record of Decision, Reynolds Metals Superfund Site (US Environmental Protection Agency, September 2002)

Final Record of Decision, Reynolds Metals Superfund Site (US Environmental Protection Agency, September 2006).

Operations Plan-Focused Extraction Production Well Optimization System for the RMC-Troutdale Facility (CH2M Hill, August 2005).

Contaminated Media Management Plan for the Former Reynolds Metals Company Facility in Troutdale, Oregon (CH2M Hill, October 2007)

Cap Maintenance and Monitoring Plan at RMC-Troutdale (CH2M Hill, May 2007)

Addendum 1 - Sitewide Groundwater Monitoring Plan (2006 through 2010) at RMC-Troutdale (CH2M Hill, May 2007)

2012 Groundwater Monitoring and FE/PWO System Operation Report (Ash Creek Associatesl, February 2013)

Consent Decree for Settlement Between the United States and Reynolds Metals Company and Alcoa, Inc., regarding the Reynolds Metals Superfund Site, Troutdale Oregon (October 2007)

Environmental Protection Easements and Declaration of Restrictive Covenants, Multnomah County Recording Number 2007-216745, December 21, 2007.

Easement and Equitable Servitudes for the following properties:

- Port of Portland (2009)
- Knife River Corporation (2011)
- Pacific Corp (2009)
- Georgia Pacific (2009)

Memorandum of Agreement between USEPA and Bonneville Power Administration (2011)

Status of Record Title Report, Chicago Title Insurance Company, report to the Port of Portland, August 16, 2013.

FIGURES

Site Location Map
Site Plan
Fluoride Mass Removal figure
UGS Zone Fluoride Concentrations 1997/98 Versus 2012
Deep Zone Fluoride Concentrations 1997/98 Versus 2012