

THIRD FIVE-YEAR REVIEW REPORT

for

RENTOKIL, INC.
SUPERFUND SITE

HENRICO COUNTY, VIRGINIA

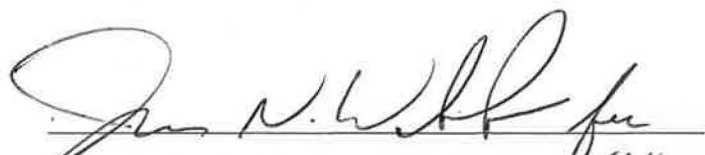
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List of Acronyms

ARAR	Applicable or Relevant and Appropriate Requirement
CCA	Copper Chromated Arsenate
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CZA	Chromium Zinc Arsenate
EPA	United States Environmental Protection Agency
FS	Feasibility Study
F&WS	Fish and Wildlife Service
mg/kg	milligrams per kilogram
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PAH	Polycyclic aromatic hydrocarbon
PCP	Pentachlorophenol
ppt	parts per trillion
RA	Remedial Action
RAO	Remedial Action Objectives
RBC	Risk Based Concentration

RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
USACE	United States Army Corps of Engineers
VDEQ	Virginia Department of Environmental Quality
VPI	Virginia Properties, Inc.

EXECUTIVE SUMMARY

Cleanup work at the Rentokil, Inc. Superfund Site in Henrico County, Virginia included a removal action and a remedial action. The objective of the removal action was to minimize the migration of contaminated soil from the Site to North Run Creek. This was accomplished by covering the source area (known as the CCA Area) with a temporary plastic liner and constructing a berm and a sediment trap along the northern border of the Site prior to the point where the surface water drainage entered the creek.

The remedial action included demolition and off-site disposal of the remaining structures at the Site; excavation and on-site disposal of the contaminated sediments from Wetland Area A and former Wetland Areas B, and C; removal of the former Site pond; excavation and off-site disposal of the CCA Area; construction of a slurry wall around the former process and storage areas; construction of a RCRA Subtitle C cap over the area encompassed by the slurry wall; installation of three directionally drilled wells within the containment area; construction of three divider wall structures; institutional controls; and ground water monitoring.

The Site achieved construction completion status with the signing of the Preliminary Close Out Report on September 2, 1999. The trigger for this five-year review was the date of the second Five-Year Review Report, September 22, 2008.

The assessment of this five-year review found that the remedy was constructed in accordance with the requirements of the 1993 Record of Decision (ROD) and the 1996 ROD Amendment. EPA finds that the remedy is protective of human health and the environment. All threats at the Site associated with ingestion or dermal contact with contaminated soil and sediments have been addressed through capping of the Site and excavation and consolidation of those areas of contaminated soil and sediments previously located beyond the extent of the cap. The capped area is presently fenced to protect the integrity of the cap.

The ground water clean-up goals selected for the Site are protective of human health and the environment. In the interim, exposure pathways that could result in unacceptable risks are being controlled. Even though no one currently uses the contaminated ground water, institutional controls have been implemented to prevent exposure to, or ingestion of, contaminated ground water.

Long-term protectiveness of the remedial action will be verified by obtaining ground water samples to fully evaluate potential migration of the contaminant plume downgradient of the slurry wall.

GPRA Measure Review

As part of this Five-Year Review the GPRA Measures have also been reviewed. The GPRA Measures and their status are provided as follows:

Environmental Indicators

Human Health: Current Human Exposure Controlled and Protective Remedy in Place (HEPR)
Groundwater Migration: Groundwater Migration Under Control (GMUC)

Sitewide RAU

The Site achieved Site-Wide Ready for Anticipated Use (SWRAU) on June 26, 2006.

Five-Year Review Summary Form

SITE IDENTIFICATION

Site name: Rentokil, Inc. Superfund Site

EPA ID: VAD0710400752

Region: 3

State: VA

City/County: Henrico County

SITE STATUS

NPL status: Final ☐ Deleted ☐ Other (specify) _____

Remediation Status (choose all that apply): Under Construction ☐ Operating ☒ Complete

Multiple OUs? ☐ YES ☒ NO

Construction completion date: 09/2/1999

Has site been put into reuse? ☐ YES ☒ NO

REVIEW STATUS

Lead agency: ☒ EPA ☐ State ☐ Tribe ☐ Other Federal Agency _____

Author(s) name: Andrew Palestini

Author(s) title: Remedial Project Manager

Author(s) Affiliation: U.S. EPA - Region 3

Review period: 09/13/2012 to 05/31/2013

Date(s) of site inspection: 03/11/2013

Type of review: ☒ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only
☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead

Review number: 1 (first) 2 (second) ☒ 3 (third) Other(specify) _____

Triggering action:

☐ Actual RA Onsite Construction at Site
☐ Construction Completion

☐ Actual RA Start at OU# _____
☒ Previous Five-Year Review Report

Triggering action date: 09/22/2008

Due date (five years after triggering action date): 09/22/2008

Five-Year Review Summary Form, continued

Issues:

High levels of pentachlorophenol (PCP) contamination are still present in the vicinity of VPMW-2, VPDW-3, and VPDW-4.

EPA plans to issue cancer component of the dioxin reassessment.

Ecological exposures were not evaluated in the ROD.

Former Wetland Area B has been sold to a developer.

Recommendations and Follow-up Actions:

EPA will issue a decision document to address the PCP contamination in the ground water in the vicinity of VPMW-2, VPDW-3, and VPDW-4.

Once dioxin standards are finalized by EPA, the Agency will evaluate whether VPI will need to perform dioxin sampling at the Site in accordance with the terms of the Consent Decree.

Evaluate surface soil data. Conduct additional sampling if needed.

In accordance with the terms of the Consent Decree, VPI will be required to assure that all future construction complies with the Restrictive Covenant and does not cause any damage to the existing remedy.

Protectiveness Statement:

The remedy is protective of human health and the environment. All threats at the Site associated with ingestion or dermal contact with contaminated soil and sediments have been addressed through capping of the Site and excavation and consolidation of those areas of contaminated soil and sediments previously located beyond the extent of the cap. The capped area is presently fenced to protect the integrity of the cap.

The clean-up goals selected for the Site are protective of human health. The ground water remedy is still in progress but in the interim, exposure pathways that could result in unacceptable risks are being controlled. Even though no one currently uses the contaminated ground water, institutional controls have been implemented to prevent exposure to, or ingestion of, contaminated ground water.

Long-term Protectiveness:

Long-term protectiveness of the remedial action will be verified by continuing the ground water monitoring downgradient of the slurry wall. Current data indicate that the plume generally remains in the area of VPMW-2, VPDW-3, and VPDW-4 and is not expanding.

**Rentokil, Inc. Superfund Site
Richmond, Virginia
Five-Year Review Report**

I. 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 recommendations to address them.

The Agency is preparing this five-year review pursuant to CERCLA § 121 (the Comprehensive Environmental Response, Compensation and Liability Act, as amended) 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 a 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 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 National Contingency Plan (NCP); 40 C.F.R. § 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 3 has conducted a five-year review of the remedial actions implemented at the Rentokil, Inc. (Virginia Wood Preserving) Site in Henrico County, Virginia. This review was conducted from September 13, 2012 to May 31, 2013. This report documents the results of the review.

This is the third five-year review conducted at the Rentokil, Inc. Site (Site). The triggering action for this review is the date of the previous report, September 22, 2008. The five-year review is required because hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure. This review covers the entire Site as EPA did not divide cleanup at the Site into separate operable units.

For this five-year review, project managers from EPA and the Virginia Department of Environmental Quality (VDEQ) jointly inspected the Site on March 11, 2013.

II. Site Chronology

The purpose of this section is to list all important Site events and relevant dates.

Table 1: Chronology of Site Events

Event	Date
Placed on National Priorities List	March 1989
Wood treating operations ceased	January 1990
Consent Order for Removal Action signed	March 9, 1992
Sediment control devices installed	April 1992
Record of Decision (ROD)	June 22, 1993
Value Engineering Analysis completed	October 1995
ROD Amendment	August 27, 1996
VDEQ conditionally approves divider wall concept	January 1997
Final design completed	September 1997
Pre-final inspection	August 3, 1999
Preliminary Close Out Report	September 2, 1999
First Five-Year Review Report	September 17, 2003
Second Five-Year Review Report	September 22, 2008

II. Background

The purpose of this section is to describe the Site characteristics and to identify the threat posed to the public and the environment at the time of the initial ROD.

Physical Characteristics

The Site is located at the intersection of Peyton Street and Ackley Avenue in Henrico County, near Richmond, Virginia (see Figure 1 - Vicinity Map). The land immediately surrounding the Site is mostly open space/woodlands. Nearby development is comprised of light industrial, commercial, and low density residential uses. The Site and the immediate surrounding land are presently zoned for light and general industry.

The Site includes the former wood treating process area, the wood drying areas, Wetland Area A, and former Wetland Areas B and C. None of the wetland areas were used in the wood treating process; these areas became contaminated by runoff from the process/wood drying areas. Wetland Area A, the area immediately north of the former process area, is located within the flood plain of an unnamed tributary to North Run, referred to as North Run Creek. Surface water runoff from the northern portion of the Site flowed towards Wetland Area A and into North Run Creek (See Figure 2 – Topographic Map Showing Primary Surface Water Drainage Areas). North Run Creek flows into Talley's Pond, then to North Run, Upham Creek, and finally into the Chickahominy River. Prior to the remedial action, surface water runoff from the southern portion of the Site flowed towards former Wetland Area B, where it was retained and discharged to former Wetland Area C when flow was high. Site-related runoff was retained within former Wetland Area C because the culvert carrying surface water runoff from former Wetland Area C was about two feet above the normal elevation of former Wetland Area C.

Land and Resource Use

Wood treatment operations occurred at the Site from 1957 until January 1990. The initial operation was performed on a five-acre parcel of land. The land area for the wood treatment operations grew to ten acres over the years as the operations were expanded. The facility has been inactive since all operations ceased in January 1990.

The current use of the land surrounding the Site is light industrial, commercial, and low density residential. EPA anticipates that this same mix of land uses will continue into the future, with the majority of the light industrial/commercial uses centered near Parham Road, located approximately 0.1 mile from the Site. In establishing cleanup requirements for the Site, EPA anticipated the Site would remain light industrial/commercial. Most of the former wood treating operations area is currently fenced and the contaminated soils and sediments are contained within

the fenced area under an impermeable cap, including those soils and sediments which were located beyond the capped area.

The ground water aquifer underlying the Site is categorized as a potential drinking water source, but is currently not being used. The dominant ground water flow direction in the area of the Site is to the northwest, toward North Run Creek.

History of Contamination

Wood treatment operations were performed at the Site with different chemicals being used over the years. These included pentachlorophenol (PCP), chromium zinc arsenate (CZA), copper chromated arsenate (CCA), fire retardant, creosote, and xylene. Throughout the operational history of the Site, freshly treated wood was allowed to drip onto the soil and then stored in nearly all open areas of the Site. In addition, wastes from early operations were reportedly discharged to a blowdown sump. The previous owners replaced the blowdown sump in 1963 with a concrete holding pond and constructed a covered unlined lagoon. The concrete holding pond was linked to the covered unlined lagoon by an underground drainpipe. The drainpipe was closed and apparently abandoned in place in 1974, with no details given of any testing, sampling, or the method of abandonment (Figure 3 – Historical Facilities Map).

In 1976 or 1977, a batch of CCA precipitated in a process tank and was rendered unusable. This batch of approximately 1,100 to 1,400 pounds of CCA was disposed of in a surface pit in the northeastern quadrant of the Site in what has since been referred to as the CCA Area.

Initial Response

Because of fish kills in Talley's Pond, the blowdown sump was cleared, cleaned, and replaced with the concrete holding pond in 1963, under the direction of the Virginia State Water Control Board. In 1987, the contents of the covered holding lagoon were removed and transported to off-site treatment/disposal facilities. However, no soil or water samples were collected. Because the area was not backfilled, an open excavation containing a combination of rainwater and ground water reformed into a ponded area.

After discontinuing treatment operations, Virginia Properties, Inc. (VPI, a wholly owned subsidiary of Rentokil, Inc.) constructed a roof over the concrete holding pond and installed a polyvinyl chloride cover over the drip pad to prevent storm water from falling on the surface. In the spring of 1991, VPI arranged for the removal of all wood treatment equipment from the Site. All eight aboveground storage tanks and the three treatment cylinders were dismantled and disposed of off-site. Clean compacted clay was placed over the area where the cylinders were

located to prevent surface water infiltration and subsequent transport of Site-related contaminants. A roof was also built over the former tank farm area.

Because of the high levels of inorganics detected in the surface water and sediments in North Run Creek, EPA and VPI entered into an Administrative Order By Consent for Removal Action in March 1992. The Order called for VPI to design, construct, and maintain sediment control structures to prevent additional migration of arsenic, copper, chromium, and zinc into North Run Creek. The work, consisting of covering the CCA Area with heavy plastic and constructing a berm and sediment trap, was completed in June 1992 and removed as part of the remedial action.

Basis for Taking Action

Contaminants

Hazardous substances that have been released at the Site include:

Arsenic	Benzoic acid
Chromium	2,4-dimethylphenol
Copper	2-methylphenol
Zinc	4-methylphenol
Benzene	Pentachlorophenol
Ethylbenzene	Phenol
Styrene	Polyaromatic Hydrocarbons
Toluene	Dioxins
Xylenes	Furans

Exposures to soil and ground water at the Site pose significant human health risks, due to exceedance of EPA's risk management criteria for the average exposure scenario. The carcinogenic risks were highest for exposures to the perched ground water due to the high concentrations of carcinogenic polyaromatic hydrocarbons (PAHs). Non-carcinogenic hazards were also highest for exposure to the perched ground water due to the high concentrations of arsenic and one of the PAHs. Carcinogenic risks from exposure to saprolite ground water were

significant due to the presence of PCP and dioxins. Non-carcinogenic risks from exposure to soil were significant due to the presence of arsenic, chromium, PCP, and one of the PAHs.

III. Remedial Actions

The purpose of this section is to discuss initial plans, implementation history, and current status of the remedy.

Remedy Selection

The ROD for the Rentokil, Inc. Site was signed on June 22, 1993. Remedial Action Objectives (RAOs) were not specifically listed in the ROD. However, as can be inferred from the list of the major components of the remedy listed below, the objectives of the remedy are:

Source Control Response Objectives

- Reduce risks to human health by preventing direct contact with, and ingestion of, contaminants in the Site soil, wetland sediments, and pond sediments, and by preventing potential ingestion of contaminated ground water;
- Reduce risks to the environment by preventing direct contact with, and ingestion of, contaminants in the wetland sediments; and
- Minimize the migration of contaminants from Site soil and wetland sediments that could result in surface water concentrations in excess of Ambient Water Quality Criteria.

Management of Ground Water Migration Response Objectives

- Eliminate or minimize the threat posed to human health and the environment by preventing exposure to the contaminants in the ground water; and
- Contain contaminated ground water to protect human health and the environment.

The major components of the remedy selected in the ROD include the following:

- Demolition, decontamination, and off-site disposal of the remaining structures.
- Excavation and on-site carbon adsorption treatment of surface water from the unlined lagoon, with discharge of treated water to North Run Creek.

- Excavation and off-site incineration treatment of approximately 70 cubic yards of K001 waste from the unlined lagoon.
- Construction of a RCRA Subtitle C cap over the area of the Site where the surface soil exceeds the site-specific cleanup levels as far into the wetlands as possible.
- Construction of a slurry wall around the perimeter of the area encompassed by the cap. Installation of a dewatering system within the confines of the cap/slurry wall to produce an intragradient condition, with on-site treatment of the collected ground water and discharge to North Run Creek. The dewatering system consisted of two vertical caissons constructed to the bedrock with horizontal laterals installed on top of the hardpan and on top of the bedrock. Off-site disposal of any drums encountered in the Fill Area during the installation of the slurry wall.
- Excavation, on-site low temperature thermal desorption treatment, and on-site disposal of approximately 5,150 cubic yards of soil in the following "hot spots": CCA Disposal Area, Fill Area, and DNAPL-contaminated soils between the surface and the hardpan which occur within 25 feet of the concrete drip pad, the unlined pond, and the former blowdown sump.
- Consolidation of surface soils that lie outside the area to be capped (generally occurring in Wetland Areas A, B, and C) and that exceed any site-specific cleanup level to the area of the Site to be capped.
- Excavation and on-site disposal of sediments in the oxbow of North Run Creek that exceed the site-specific cleanup levels. Sampling of sediments in Talley's Pond and the sediments that were previously dredged by the owner of the pond, with excavation, treatment, and off-site disposal of any sediments that exceed the site-specific cleanup levels.
- Re-vegetation of the excavated wetland areas and mitigation for the loss of wetlands by the creation of wetlands of equal or better value.
- Implement institutional controls to prohibit residential development of the Site to prevent exposure to the untreated soil at the Site and to prevent residential exposure to the treated soil that meet the cleanup levels established for the future light industrial use scenario for the Site. Institutional controls will also prohibit use of the ground water at the Site.

- Perform long-term ground water monitoring for at least 30 years.

Following issuance of the ROD, EPA and VPI entered into a Consent Decree (CD) where VPI agreed to perform the remedial design and remedial action of the remedy selected in the ROD. In conjunction with the preparation of the 60% design documents, VPI conducted a Value Engineering Analysis of the ROD remedy. Two major issues were addressed in the Value Engineering Analysis: (1) the technical practicability of low temperature thermal desorption treatment of the Site soil with a non-combustive air pollution control system (as selected in the ROD), and (2) the value of treating the “hot spot” soil with low temperature thermal desorption, given the then most current information on geological conditions and contaminant fate and transport in the ground water.

Treatability tests for the low temperature thermal desorption indicated new and more toxic constituents, primarily dioxins and benzene, could be produced during the treatment process and that these residuals could be impossible to dispose of either on or off-site due to regulatory constraints.

The ground water fate and transport modeling demonstrated that the containment system selected in the ROD (construction of a cap and slurry wall and operation of a dewatering system within this containment area) would effectively prevent migration of the existing contamination under the former wood treating area and that treatment of the “hot spots” would not be warranted.

EPA evaluated the ground water modeling and agreed with its conclusions. EPA issued a ROD Amendment on August 27, 1996 to remove the requirement for treatment of the “hot spots” in light of the treatability study finding that low temperature thermal desorption could produce dioxins and benzene and that the ground water modeling showed that the containment system effectively prevented migration of contamination without treatment.

Remedy Implementation

The Remedial Design, initiated in November 1993, was conducted in accordance with the ROD and the ROD Amendment. Primarily because of the delay caused by the need to issue the ROD Amendment and the lengthy review of the pre-final (95%) design, the final design was not submitted for regulatory review until September 1997.

During the pre-final design effort (November 1996 to April 1997), VPI requested approval to revise the alignment of the north slurry wall. This request was made to accommodate a future rail spur to service potential development of the Site. Because arsenic was the principal contaminant in the surface soil in that area, EPA directed VPI to sample the northern portion of the Site property to determine whether surface soil arsenic concentrations exceeded the site-

specific cleanup levels. The analytical results indicated that surface soils on the northern portion of the property had levels of arsenic below the site-specific cleanup level. As such, EPA and VDEQ agreed with the modified alignment of the northern slurry wall.

In addition, VPI suggested several other modifications to the remedy in the pre-final design:

1. Revise treatment and disposal of extracted ground water from on-site treatment and disposal to an off-site facility.
2. Modify construction of the cap to accommodate future development of the Site.
3. Install directionally drilled laterals in lieu of caissons for ground water extraction.
4. Eliminate the removal of material from the bottom of the unlined lagoon.

EPA and VDEQ agreed to: off-site treatment and disposal of the ground water; modifying construction of the cap, as explained below; using directionally drilled laterals; and an inspection of the lagoon after it was drained to determine whether the lagoon material was K001 waste. One result of these modifications is that no wastes were treated on-site and there were no discharges to North Run Creek. In addition, an agreement was reached between EPA, VDEQ, VPI, the U.S. Army Corps of Engineers (USACE), and the U.S. Fish and Wildlife Service (F&WS) to mitigate the remediated wetlands at an off-site location and to place a restrictive covenant on the area known as Wetland Area A.

In an effort to accommodate future commercial/light industrial re-development of the Site, VPI proposed to EPA and VDEQ the construction of three structures they termed "divider walls." Because the Site was to be capped, the idea was to only allow re-development of the process/wood drying areas to the land inside of the divider wall structure. The divider walls are rectangular concrete structures constructed vertically into the cap, with the cap liner attached to both the inside and outside of the concrete walls using embedded LDPE strips in the walls. These structures allow for a total area of approximately 50,000 square feet of potential re-development. Waterstops were inserted in each concrete construction joint for future foundation construction. Utilities were also placed inside the divider wall structure to avoid disrupting the cap if development occurred. Because this deviated from the design of the typical RCRA cap and because the RCRA program is delegated to VDEQ, implementing this change required state approval of the concept. VDEQ conditionally approved the installation of divider wall structures for use in potential future re-development of the Site in January 1997.

VPI awarded the construction contract to Dames & Moore, Inc, the prime contractor, on January 16, 1998. OHM Corporation was selected by Dames & Moore as the major Site

remediation subcontractor. NewFields, Inc. conducted quality assurance activities and was VPI's owner's agent for the construction project. Mobilization of the construction contractor began on May 18, 1998. Work at the Site was scheduled for a winter shutdown from the end of November 1998 to the end of April 1999. However, work at the Site did not stop during the winter in order to make up for the time lost at the beginning of the remedial action (RA). By continuing work during the winter, the contractor was able to demobilize from the Site on August 10, 1999, approximately four weeks prior to the original construction completion date.

EPA, VDEQ, USACE, VPI, and VPI's contractors conducted a pre-final inspection on August 3, 1999. The inspection resulted in a punch list of minor construction items for correction by the contractor prior to final EPA approval. After completing the punch list, EPA and VDEQ determined that all RA construction activities were performed according to specifications. The Site achieved construction completion status when the Preliminary Close Out Report was signed on September 2, 1999. It is expected that cleanup goals for all ground water contaminants will not be reached for many years. The Final Close Out Report cannot be issued until all ground water cleanup goals have been met.

System Operation/Operation and Maintenance

VPI's long-term monitoring and maintenance activities, performed under the direction of NewFields, include the following:

- Check the cap three to four times per year with regard to vegetative cover, settlement, stability, and any need for corrective action. All areas of erosion will be promptly re-graded (where needed), patched, and re-seeded. In addition, the cap vegetation is mowed as necessary during the growing season;
- Occasionally inspect the storm water collection trenches around the perimeter of the cap for debris and sediment buildup. Debris and sediment are removed as needed to keep the trenches clear;
- Perform semi-annual ground water monitoring (Figure 4 – Groundwater Monitoring Network);
- Take ground water level measurements monthly;

One aspect that is no longer required is inspecting the plantings in Wetland Area A and submitting monitoring reports on the status of re-vegetating this area. To mitigate the damages on Wetland Area A, VPI was required to re-vegetate the wetland and submit monitoring reports for years 1, 2, 3, 5, 7, and 10 following the first growing season after planting. The area was first re-vegetated with F&WS approved species in December 1999. In 2001, EPA and the F&WS

determined that additional plantings were necessary to comply with the requirements of the approved Operation and Maintenance Plan. The plantings that did not survive the initial year were replanted in 2002 with replacement vegetation. The 10th and final monitoring report was submitted November 30, 2011. There are no further monitoring events contemplated for the area. In general, Wetland Area A provides wetland habitat and function.

In addition to the on-site mitigation, 6.81 acres of off-site prior converted cropland is being converted back to wetlands as mitigation for disturbing Wetland Area A and former Wetland Areas B and C. In compliance with its obligations under the Consent Decree, VPI entered into an agreement with the owner of the cropland who is responsible to restore the property to a wetland. This means that the land owner will perform the initial plantings as well as inspecting and monitoring the progress of this work. Under the agreement, all corrective action on the property will be performed by the land owner. The F&WS assists EPA with oversight of the mitigation activities.

Inspections of the cap revealed no erosion problems on the surface. The grass cover remains competent and provides a high level of erosion protection for the capping elements. The cap is routinely cleared of excess vegetation and tree growth that might pose a threat to the integrity of the liner materials.

Each year, the security fence is cleared of all vegetation and growth and repairs are made to the fence wiring wherever needed.

In July 2005, EPA approved VPI's request for a one-year moratorium on the extraction and treatment of ground water from within the containment system. The moratorium was extended each year until December 2008 when EPA and VDEQ agreed to an indefinite continued moratorium. Because of the moratorium, VPI discontinued inspecting the ground water pumping system.

O&M costs include cap and drainage structure maintenance, sampling and monitoring efforts, monitoring well maintenance, and monitoring, maintenance and reporting associated with Wetland Area A. O&M activities are being performed by VPI under the terms of the Consent Decree; they have not provided detailed information regarding actual expenditures for O&M.

V. Progress Since the Last Review

The purpose of this section is to discuss the progress taken on follow-up actions included in the previous five-year report.

This is the third five-year review for the Site. In the second Five-Year Review Report, EPA determined that the remedy at the Rentokil Site is protective of human health and the environment and that all threats at the Site associated with ingestion or dermal contact with contaminated soil and sediments have been addressed through capping of the Site and excavation and consolidation of those areas of contaminated soil and sediments previously located beyond the extent of the cap.

In addition, EPA also determined in the previous report that the ground water clean-up goals selected for the Site are protective of human health and the environment; that in the interim, exposure pathways that could result in unacceptable risks are being controlled; and, even though no one currently uses the contaminated ground water, institutional controls have been implemented to prevent exposure to, or ingestion of, contaminated ground water. Finally, long-term protectiveness of the remedial action would be verified by obtaining ground water samples to fully evaluate potential migration of the contaminant plume downgradient of the slurry wall. Ground water data at the time of the second Five-Year Review Report indicated that the plume remained in the area of VPMW-02 and was not expanding.

The following table lists the recommendations and follow-up actions listed in the second Five-Year Review Report and describes the progress made toward accomplishing them.

Table 2: Actions Taken Since Last Five-Year Review					
Issues from Previous Review	Recommendations/ Follow-Up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date(s) of Action
VPI's long-term monitoring and maintenance activities no longer follow the frequency in the approved O&M Plan	Notify VPI to update the Operation and Maintenance Plan	EPA	October 2008	EPA notified VPI that the Operation and Maintenance Plan required an update to reflect actual frequency of Site activity	December 2008
Former Wetland Area B has been sold to a developer	Assure all future construction complies with Restrictive Covenant and does not damage the existing remedy	VPI	October 2009	Developer has not initiated construction on former Wetland Area B	
Continue monitoring Wetland Area A until criteria for successful mitigation is met	VPI to continue monitoring Wetland Area A re-vegetation and submitting end-of-year reports to EPA and US F&WS until criteria are met	VPI	November 2008	VPI performed vegetation monitoring for the Year 10 report	October 2008 November 2011
High levels of PCP contamination still present at monitoring well VPMW-2	Additional investigations are necessary to determine the most appropriate remediation for the contamination	VPI	August 2008	VPI performed additional investigations to define source and extent of PCP contamination	October 2011 February 2012 June 2012

As can be seen in the table above, work progressed on all of the issues identified in the second Five-Year Review Report.

In a meeting in December 2008 with VDEQ, EPA notified VPI that the Operation and Maintenance Plan required updating since the frequency of Site activities no longer reflected actual timeframes. In response, VPI submitted the Updated Groundwater Monitoring Plan – Rentokil Facility report in July 2009, which adequately modified the existing plan.

EPA inspected former Wetland Area B every year since the last five-year review report when visiting the Site and found that construction on this area has not begun. The last inspection of former Wetland Area B occurred on March 11, 2013.

As directed by EPA and FWS, monitoring of the re-vegetation of Wetland Area A was planned to occur according to the following schedule: Year 1, Year 2, Year 3, Year 5, Year 7, and Year 10. The purpose of the monitoring was to quantify whether the plantings in Wetland Area A satisfy the established vegetation cover and stem density success criteria. Since the last five-year review report, mitigation monitoring events of Wetland Area A were conducted in October 2008 (Year 7) and November 2011 (Year 10). The monitoring reports were submitted to EPA in November of each year. As established at the beginning of this effort, if the vegetation criteria were met at each of the scheduled monitoring events, no additional monitoring is required. Based on the results of the 2011 vegetation assessment, Wetland Area A satisfied vegetation cover and stem density success criteria. In addition, site performance criteria were satisfied during all monitoring years. As such, this requirement has been satisfied and no future monitoring is required. Overall, Wetland Area A provides wetland habitat and function.

The bulk of the work performed since the last five-year review centered on determining the extent and source of the PCP contamination detected at VPMW-02 and to determine the most appropriate remedy to address this contamination.

Prior to issuing the second Five-Year Review Report, VPI performed a ground water extraction study on wells VPMW-02, VPDW-01, and VPDW-03, the three wells that persistently exhibited high concentrations of PCP. The work consisted of pumping 30,000 gallons of ground water from these three wells and taking ground water samples before the start of extraction, weekly during the projected four weeks of extraction, and weekly for an additional four weeks after the completion of the extraction. Ground water extraction started on November 12, 2007 but was not completed until April 7, 2008 (21 weeks) because of the extremely slow recovery rate of the wells. The recovery rate over this timeframe averaged less than 0.10 gallons/minute in each well. Because the extraction report was submitted on June 25, 2008, EPA, VDEQ, and VPI were still in the process of reviewing the trend analysis of the analytical data when the second Five-Year Review Report was issued (September 22, 2008). After careful analysis of the data, it appears that the contamination detected in the area north of the existing containment system (in

the vicinity of monitoring well VPMW-2) is not emanating from the interior of the containment system; that it is part of the contamination from past operations that was always outside the slurry wall. Also, pumping from the saprolite geological formation is not a viable treatment remedy because of the extremely slow recovery rate.

Because the concentrations of PCP in these wells remained several orders of magnitude above the clean-up level, EPA notified VPI on March 3, 2011 that a comprehensive remediation strategy was required to address the problem and that this strategy must be developed within the framework of a focused feasibility study (FFS). VPI agreed to perform the FFS on March 21, 2011 and submitted a work plan on May 10, 2011. EPA approved the work plan on October 13, 2011.

The purpose of the FFS is to present and evaluate remedial alternatives to control exposure and migration of the PCP contamination in the area north of the containment system. However, this required additional field work in the area. In October 2011, VPI installed two additional delineation wells, VPDW-04 and VPDW-05, which are located approximately 120 feet downgradient of VPMW-2 and took soil samples from 25 locations. Besides the soil and ground water data collected that month, VPDW-4 was sampled again in February 2012 to confirm the unexpected high levels detected there. These samples are in addition to the semi-annual ground water sampling which took place in June and December. All of this data was used to evaluate impacts to ground water from PCP concentrations in soil as well as to define the nature and extent of PCP ground water and saprolite contamination located north of the containment area.

Because the soil data indicated that concentrations of PCP in soil in the FFS Area are well below the ROD clean-up level of 48 mg/kg, the alternatives in the FFS did not need to consider a direct contact exposure evaluation for PCP in soils. As such, the alternatives developed in the FFS only consider ground water. The remediation goals developed for the FFS are:

1. Prevent human ingestion of, and direct contact to, ground water containing concentrations of PCP above the MCL of 1 µg/L.
2. Prevent migration of PCP in the shallow aquifer to assure no additional degradation of the shallow aquifer.

VI. Five-Year Review Process

The purpose of this section is to describe the activities performed during the five-year review process as well as providing a summary of findings, when appropriate.

Administrative Components

The kick-off meeting for the third five-year review was held in the EPA Region 3 office in Philadelphia on September 13, 2012. Attending the meeting were Andy Palestini, the EPA Remedial Project Manager and the leader of the Five-Year Review Team, Bruce Pluta, the EPA biologist, Linda Watson, the EPA toxicologist and Herminio Concepcion, the EPA hydrogeologist. The purpose of the meeting was to discuss the steps necessary to complete the five-year review report and to work out a schedule for completing the work.

Community Involvement

A notice was placed in the *Style Weekly* on February 27, 2013 to inform the public that EPA was conducting a five-year review of the Site. In the newspaper ad, EPA informed the public what a five-year review was, inquired whether anyone had any concerns or information about a change in current site conditions, and provided points of contact for information on the Site. In addition, EPA indicated how the public can obtain information about the Site and where they can obtain copies of the five-year review report.

No feedback was received from the community as a result of the advertisement.

Document Review

The five-year review consisted of a review of relevant documents including the ROD and ROD Amendment; the Preliminary Closeout Report; the Operation, Maintenance, and Monitoring Summary Reports for 2008, 2009, 2010, 2011 and 2012; the biannual Ground Water Monitoring and Site Evaluation Reports for 2008, 2009, 2010, 2011, and 2012, and the FFS Soils Evaluation/ Semi-Annual Groundwater Monitoring Report dated November 2012. Applicable ground water cleanup standards, as listed in the 1993 ROD, were also reviewed.

Data Review

For this Five-Year Review, EPA reviewed the following data:

- the monthly ground water level measurements
- the analytical results of all of the semi-annual ground water sampling events to date of the six monitoring wells installed as part of the remedial action

- the analytical results of the ground water monitoring of the three delineation wells installed as part of the supplemental PCP investigation, and
- the analytical results of the soil sampling and ground water monitoring of the additional two delineation wells installed to implement the FFS.

The purpose of the cap/slurry wall containment system and the horizontal wells within this boundary was to cause an inward gradient across the slurry wall so that any contamination within the containment system would not migrate beyond the slurry wall. To measure the ground water levels at the Site, there are seven pairs of piezometers (VPPZ-1 thru VPPZ-14) with one piezometer from each pair located within the cap/slurry wall and its partner piezometer located directly opposite but outside the slurry wall (Figure 4 – Groundwater Monitoring Network). Ground water level measurements are taken monthly at each of the piezometers to determine whether the inward gradient exists. Results to date indicate a mostly flat gradient across the Site in the saprolite (shallow) aquifer.

Semi-annual ground water sampling has been conducted at the Site since July 2001. All of the six monitoring wells were installed in 1999 as part of the remedial action. The monitoring wells are located outside of the slurry wall, in the saprolite aquifer. The location of these monitoring wells was determined using the ground water modeling results performed during the remedial design.

VPMW-1 was situated outside, but immediately adjacent to, the western extent of the modeled plume to determine if the plume was migrating in this direction. VPMW-2 and VPMW-3 are situated inside the modeled plume to monitor the advection and dispersion of Site contaminants over time and their migration to the north. VPMW-2 was located on the western edge of the modeled plume, and VPMW-3 was located in the central portion of the modeled plume. Based on the model projected plume migration, concentrations of PCP over time in wells VPMW-2 and VPMW-3 should decrease as the plume dissipates towards the north.

The remaining three monitoring wells (VPMW-4, VPMW-5, and VPMW-6) were placed along the down-gradient boundary of the modeled plume for the purpose of monitoring the potential migration of the plume. According to the model, the plume could enlarge, over time, in a northerly direction. In this event, sampling results from VPMW-4 and VPMW-5 may indicate slight increases in PCP concentrations. VPMW-6 is situated outside of the northern most extent of the modeled plume at year thirty.

Delineation wells VPDW-01, VPDW-02, and VPDW-03, installed in 2004 as part of the supplemental PCP investigation, are located cross and down gradient of VPMW-2. These wells are situated within approximately 100 feet of VPMW-2, the monitoring well with the highest levels of PCP detected at the Site. The purpose of these delineation wells is to determine the extent of the PCP contamination detected at VPMW-2.

Delineation wells VPDW-04 and VPDW-05, installed in 2012 as part of the investigation for the FFS, are located approximately 120 feet down gradient of VPMW-2.

In accordance with the ROD, the ground water samples are analyzed for the site-related contaminants listed below:

- Polynuclear Aromatic Hydrocarbons (PAHs) using EPA Method 8270
- Arsenic (Dissolved) using EPA Method 6010
- Copper using EPA Method 6010
- Chromium using EPA Method 6010
- Zinc using EPA Method 6010
- Pentachlorophenol using EPA Method 8270

The PCP clean-up level for the Site has been set at 1 ug/L, which is the Maximum Contaminant Level (MCL). Because EPA Method 8270 has a detection limit of 10 ug/L, samples with non-detect or J-flagged concentrations of PCP were also analyzed using the Single (Selected) Ion Method (SIM) with a detection limit of 1 ug/L.

According to the analytical data from the sampling events in 2012 (semi-annual sampling in June and December and additional sampling for the FFS which took place in February), five organic contaminants have been detected at levels exceeding the EPA's Regional Screening Levels (RSLs) in the monitoring network: Carbazole, Dibenzofuran, 1,4 Dioxane, 2-Methylnaphthalene, and Naphthalene (none of these contaminants have an MCL established by EPA). 1, 4 Dioxane was detected only at VPMW-4 and VPDW-5 in the December sampling event. This is the only time 1,4 Dioxane was ever detected in the ground water. The remaining four contaminants were detected at these same locations: VPMW-2, VPDW-1, VPDW-3, and VPDW-4. According to the analytical results from 2012, Benzo(a)pyrene, Arsenic, and PCP were the only contaminants detected in ground water samples from the monitoring network at levels exceeding their respective MCLs. The lone Benzo(a)pyrene detection was at VPDW-3 in June. Arsenic was detected at VPDW-1 and VPDW-2 in June and VPDW-1 in December. PCP was detected at concentrations above its MCL in VPMW-1, VPMW-2, VPDW-1, VPDW-2, VPDW-3, VPDW-4, and VPDW-5 (Figure 5 – MCL Exceedances of PCP in Groundwater, June

2012). PCP is the one contaminant which has exceeded the clean-up level every sampling event to date, and the spatial distribution of the PCP detections during this sampling event is consistent with previous sampling events. Table 2 below shows the analytical results for PCP in the monitoring wells of all of the sampling events to date. Table 3 shows the analytical results for PCP in the delineation wells. The data for the monitoring wells is far more extensive since they were constructed as part of the remedy in 2001 while the delineation wells were constructed as part of the PCP investigation (2004) and the FFS (2012).

Table 2 - Monitoring Well Results for PCP (ug/L)

DATE	VPMW-1	VPMW-2	VPMW-2 (duplicate)	VPMW-3	VPMW-4	VPMW-5	VPMW-6
7/2001	11	4,200	4,400	--	--	--	--
1/2002	9.4	6,500	5,500	26	72	0.46	65
7/2002	19	5,900	5,900	25	0.79	--	*
1/2003	11	10,000	5,800	4	--	--	--
7/2003	4	5,200	4,200	--	--	--	--
1/2004	1.1	3,600	4,500	--	--	--	--
7/2004	8.3	3,900	3,600	--	--	--	--
6/2005	3.2	3,500		30	3.2	*	*
11/2005	5.5	4,100	3,300	1.3	--	*	*
6/2006	1.3	7,000	7,500	--	--	--	--
1/2007	20	6,000	5,000	--	--	2.2	--
7/2007	4.3	4,400	4,800	--	--	--	--
4/2008	2.5	8,600	2,100	--	--	--	--
12/2008	3.8	5,700	5,600	--	--	*	*
7/2009	--	3,700	3,900	--	--	--	--
2/2010	2.5	5,700	5,900	120	.05	--	.06
8/2010	2.5	4,800	5,000	.06	.25	.08	.11
1/2011	1.8	4,300	5,100	.06	.04	.25	.12
10/2011	1.3	6,400	1,200	3.7	.15	--	.09
6/2012	2.4	1,100	700	--	--	*	*
12/2012	0.97	5900	6000	--	--	*	*

-- = below laboratory detection limits

* = not sampled

As stated in the previous FYR report, PCP was detected at VPMW-4 and VPMW-6 at levels exceeding the MCL during the January 2002 sampling event. It is thought these data are the result of the sampling crew not properly following the approved protocol in the Sampling and Analysis Plan. The samples at these monitoring wells were inexplicably collected after taking the sample at VPMW-2 (the most contaminated monitoring well), thus possibly cross contaminating these samples. Since then, VPMW-2 has been sampled last and the analytical results show that PCP was only detected once above the MCL at monitoring well VPMW-4 (3.2 ug/L in June 2005). PCP has never again been detected at VPMW-6 above the MCL.

Table 3 - Delineation Well Results for PCP (ug/L)

DATE	VPDW-1	VPDW-2	VPDW-3	VPDW-4	VPDW-5
4/2004	1,000	110	3,400		
11/2004	380	--	4,600		
6/2006	880	170	4,700		
1/2007	560	7.1	3,000		
7/2007	510	84	2,500		
4/2008	2,300	--	2,500		
7/2009	1,300	4	3,000		
10/2011	4,800	27	3,700	2,200	40
2/2012	*	*	*	1,900/1,300	--
6/2012	240	43	2,100	1,300	1.4
12/2012	670	8.1	4700	1200	--

-- = below laboratory detection limits

* = not sampled

As stated in the previous Five-Year Review Reports, the sampling data to date at VPMW-4 indicate the analytical results for thallium exceeded the MCL during the July 2001 sampling event. This lone detection of thallium in the entire monitoring well network probably was the result of using the Inductively Coupled Plasma (ICP) analytical method. On January 31, 2001, EPA issued an alert which indicated that the ICP analytical method could result in a false positive detection of arsenic, lead, and/or thallium above their respective MCLs. Once the RPM notified VPI of this possibility, they stopped using the ICP analytical method and thallium has not been detected since.

Because of the high levels of PCP detected at VPMW-2, EPA requested that VPI define the extent of the contamination in the area of the monitoring well. VPI initially began that process by installing the three delineation wells (VPDW-1, VPDW-2, and VPDW-3). Based on the ground water sampling results from these three wells, VPI proposed a soil boring and five direct-push sampling locations to further determine the extent of the PCP contamination. EPA agreed with these locations but requested that six additional direct-push sampling locations be added.

An analysis of the sampling data and ground water elevations in the area seem to indicate a flat or reverse ground water gradient in the area of VPMW-2. Evaluation of the spatial distribution of the PCP detections during this sampling event indicates that the

distribution of PCP concentrations in the area is random in nature, but confined to that limited area outside of the slurry wall and cap containment system. Even though there are elevated concentrations of PCP in some sampling locations, the data from the other sampling points over time supports the argument that the elevated concentrations of PCP stem from localized conditions and not from contaminant migration from within the capped area and that the bulk of the contamination is limited to the immediate area of VPMW-2, VPDW-3, and VPDW-4.

A review of the data also shows several instances when sampling results exceed the MCL for arsenic, especially at VPMW-2.

Site Inspection

A Site inspection was conducted on March 11, 2013 by the RPM and Robert Nicholas, the VDEQ Project Manager. Representing VPI at the Site inspection was Randy Grachek from NewFields.

During the Site inspection, the entire area of the cap and wetland area was inspected. The cap appeared to be well maintained, with no areas of erosion of the cap soil cover observed. The vegetation on the cap was well established. The fence enclosing the capped area was also in good condition. However, several locations of vegetation growing either in, or too close, to the fence were observed and pointed out to Mr. Grachek for removal.

The water building and loading dock appeared to be in good condition. During previous site visits, VPI has indicated that they would like to remove the tanks and loading equipment from the Site if EPA were to make the moratorium of ground water extraction permanent.

Interviews

No specific interviews were conducted as part of the five-year review process. As indicated previously, a notice was placed in the *Style Weekly* on February 27, 2013 to inform the public that EPA was conducting a five-year review of the Site, but no feedback was received from the community.

VII. Technical Assessment

The purpose of this section of the five-year review is to answer the following three questions:

- Is the remedy functioning as intended by the decision documents?
- Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?
- Has any other information come to light that could call into question the protectiveness of the remedy?

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

The review of documents, ARARs, and the results of the Site inspection indicates that the entire remedy is functioning as intended by the ROD and ROD Amendment.

Excavating the contaminated wetland sediments has met the remedial objective of reducing risk to human health and the environment by preventing direct contact with this material. Capping of the Site has achieved the remedial objectives to control off-site contaminant migration by containment of contaminated soil and excavated wetland sediments; to prevent dermal contact and incidental ingestion; and, to prevent continued leaching of precipitation through the contaminated soil. Construction of the slurry wall and cap has met the remedial objective of protecting human health and the environment by containing the contaminated ground water. Implementing institutional controls has met the remedial objective of prohibiting residential development and preventing exposure to the contaminants in the ground water.

O&M of the cap, drainage system, and replacement wetlands have been effective. EPA did not identify any issues during the Site inspection that would call into question the integrity or protectiveness of the landfill cap.

From the investigations performed by VPI since the first Five-Year Review Report, it appears the contamination detected in the general area of monitoring well VPMW-2, and delineation wells VPDW-3 and VPDW-4 is not emanating from the interior of the containment system; i.e., it was always outside the slurry wall. Because of the continued elevated levels of PCP in the ground water in the area north of the slurry wall, EPA requested that VPI perform an FFS to evaluate alternatives to address the contamination. EPA is presently reviewing the FFS report and plans to issue a decision document in 2013.

A portion of the Site known as Wetland Area A was disturbed during the remedial action. This area was re-vegetated with F&WS approved wetland plant species in 2000. In

2001, the F&WS determined that additional plantings were necessary to comply with the requirements of the O&M Plan approved by EPA. The area was replanted with replacement vegetation for the 2000 plantings that did not survive the initial year. In accordance with the O&M Plan, Wetland Area A was monitored for years 1, 2, 3, 5, 7, and 10, beginning the first full growing season after the Site was planted to assure that the criteria stated in the O&M Plan were met. The first monitoring event was conducted in October 2002. Even though the area experienced official drought conditions during the 2002 growing season, hydrophytic vegetation was exhibited throughout Wetland Area A. On September 18, 2007, the F&WS visited the Site to evaluate the success of the wetland restoration. According to their report of this Site visit, their main concern was with two invasive tree species: bradford pear and mimosa. The F&WS recommended that these trees should all be cut and the stumps treated with a systemic herbicide. This work was completed. In November 2011, VPI performed the year ten inspection of Wetland Area A to assess the conditions within the mitigation area. Based on the results of this vegetation assessment, Wetland Area A satisfied the vegetation cover and stem density success criteria developed by F&WS and approved by EPA. Since site performance criteria were satisfied during all of the monitoring years and this was year ten of the mitigation plan, VPI has satisfied this requirement and no further monitoring is required.

The selected remedy for the Site includes leaving waste in place at levels that do not allow for unlimited use and unrestricted exposure. As such, EPA included institutional controls as part of the selected remedy to prevent exposure to contamination as well as to prevent damage to the cap. As indicated previously, the institutional controls (in the form of a Restrictive Covenant) have been properly implemented. The Restrictive Covenant remains effective in preventing exposure to contamination and preventing damage to the cap.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

There have been no changes in the physical conditions of the Site that would affect the protectiveness of the remedy. Land and resource use has not changed at or near the Site, although a developer has purchased former Wetland Area B (this will be further discussed below).

Changes in Standards and To Be Considereds

Have standards identified in the ROD been revised, and does this call into question the protectiveness of the remedy? Do newly promulgated standards call into question the protectiveness of the remedy? Have To Be Considereds (TBCs) used in selecting cleanup levels at the Site changed, and could this affect the protectiveness of the remedy?

All Applicable or Relevant and Appropriate Regulations (ARARs) for the Site are reflected in the 1993 ROD, as superseded by the 1996 ROD Amendment. As the remedial work has been completed, most ARARs for soil contamination cited in the ROD and the ROD Amendment have been met for human exposure. However, ecological exposures were not evaluated in the ROD so these must be addressed in the FFS. ARARs that still must be met and that have been evaluated include the Safe Drinking Water Act (SDWA) from which many of the ground water clean-up levels were derived.

The 1993 ROD identifies MCL's as the performance standards. Although the specific numerical standards were not provided in the ROD, the following standards are currently in effect: benzo(a)pyrene (PAHs)-0.2 ug/L, pentachlorophenol (PCP)-1 ug/L, dioxin (2,3,7,8-TCDD)-3E-05 ug/L, arsenic-10 ug/L, chromium(CrVI)-100 ug/L, and copper-1,300 ug/L.

On February 17, 2012, EPA released the final non-cancer dioxin reassessment, publishing a non-cancer toxicity value, or reference dose, for 2,3,7,8- tetrachlorodibenzo-p-dioxin in EPA's Integrated Risk Information System. The new reference dose is now the recommended value "to be considered" for use in developing site-specific dioxin preliminary remediation goals and cleanup levels under CERCLA and the NCP. EPA's Office of Solid Waste and Emergency Response has proposed to revise the interim preliminary remediation goals for dioxin and dioxin-like compounds, based on technical assessment of scientific and environmental data. The new preliminary remediation goals calculated using the new reference dose of 0.7 picograms per kilogram-day and EPA non-adjusted exposure factors are 0.051 µg/kg for residential soil and 0.6654 µg/kg for commercial/industrial soil (both based on toxicity equivalence quotients, which add up the toxicity of all dioxin-like contaminants).

EPA has evaluated the impact of this dioxin reassessment on the Site, and found that it is highly unlikely to impact the protectiveness at the Site. The dioxin detected at the Site is from the manufacturing of PCP. As such, dioxin would be expected to be co-located with PCP. EPA has no evidence that air deposition would be a transport factor (such as burning of PCP sludge) so any possible dioxin would occur due to drippage from drying wood, spills, and the associated surface drainage. Since all of the processing area and most of the drying areas were capped as part of the RA, those areas do not have a direct contact risk. Former Wetland Areas B and C were excavated during the RA and the material consolidated under the cap. As part of the FFS, VPI sampled the soils in the area north of the capped area and only detected PCP in one sampling location. Even though EPA does not believe it is likely to detect dioxin in the area north of the capped area, this area should be sampled to assure it is protective.

The MCL for arsenic under the SDWA was changed in 2001. The change in the arsenic MCL does change the protectiveness of the cleanup standard; however the MCL change results in a reduction of risk. The remaining standards are at current Federal MCLs.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics

Has land use or expected land use on or near the site changed?

A developer has purchased former Wetland Area B, although no construction has taken place to date. The developer has been made fully aware of the institutional controls placed on these parcels. The Restrictive Covenant prohibits using the groundwater at former Wetland Area B to prevent possibly pulling the contaminated groundwater to that area. EPA deleted former Wetland Areas B and C from the NPL in 2009 to accommodate this purchase.

Have human health or ecological routes of exposure or receptor been newly identified or changed in a way that could affect the protectiveness of the remedy? Are there newly identified contaminants or contaminant sources? Are there unanticipated toxic byproducts of the remedy not previously addressed by the decision documents? Have physical site conditions or the understanding of these conditions changed in a way that could affect the protectiveness of the remedy?

The major new route of concern would be vapor intrusion into local residences. EPA is aware that vapors from subsurface contamination can infiltrate buildings located on or near contamination. Although the Groundwater Monitoring Reports clearly identify volatile organic compounds (VOCs) at detectable concentrations (mainly within the extraction wells), the reported concentrations are low (trace) and do not exceed EPA's screening values, with the exception of a few contaminants: 1,2-dichlorobenzene, 1,4-dichlorobenzene, and benzene. Vapor intrusion is not a pathway of concern because the only existing building on the Site is the water building, which is rarely used, and the ground water in former Wetland Areas B and C is not contaminated. However, the Site groundwater VOC concentrations should be re-screened, using EPA's most current table, when performance standards are believed to have been achieved.

According to the ground water sampling results over the past five years, pentachlorophenol and arsenic continue to exceed MCLs and EPA's screening values both in monitoring and extraction wells. In addition, monitoring well VPMW-2 and delineation wells VPDW-3 and VPDW-4 continue to exhibit high detections of PCP. Therefore, continued ground water monitoring is recommended until cumulative performance standards for all detectable contaminants have been achieved.

Changes in Toxicity and Other Contaminants Characteristics

Have toxicity factors for contaminants of concern at the Site changed in a way that could affect the protectiveness of the remedy? Have other contaminants characteristics

changed in a way that could affect the protectiveness of the remedy?

Of the toxicity changes, some have increased while others have decreased, making it impossible to generalize about whether the risks would be higher or lower if recalculated today. Since all indicator contaminants were not included in the historical monitoring, a final determination as to whether performance standards are protective can not be assessed. Current toxicity values may change again in the coming years, and protectiveness is best assessed at the time when it is believed that groundwater cleanup has been achieved. Therefore, it is recommended that the groundwater risks be evaluated at the end of the remedy to ensure protectiveness at that time.

On February 17, 2012, EPA issued the non-cancer component of the dioxin reassessment. The new non-cancer risk-based levels for dioxin in soil (Hazard Index = 1) are

- 51 parts per trillion (ppt) toxicity equivalents (TEQ) for residential soil
- 597 ppt for commercial/industrial soil (composite indoor/outdoor worker)
- 664 ppt for commercial/industrial outdoor worker

EPA had developed a 2010 Preliminary Remediation Goal for residential soils of 72 ppt and it has now been replaced with the new 51 ppt (Hazard Index = 1).

Changes in Risk Assessment Methods

Have standardized risk assessment methodologies changed in a way that could affect the protectiveness of the remedy?

There have been significant changes in EPA's risk assessment guidance since 1992. These include changes in dermal guidance, inhalation methodologies, exposure factors, and a change in the way early-life exposure is assessed for vinyl chloride.

An evaluation of current groundwater performance standards (MCLs) using updated risk guidance is included in Attachment I. Risk from vapor intrusion is not included since none of the 1993 ROD identified COCs are VOCs.

Expected Progress towards meeting RAOs

Is the remedy progressing as expected?

In general, it appears the remedy is progressing as expected, with these possible exceptions:

- *Change in federal MCL for arsenic from 50ug/L to 10ug/L.
- *Ground water monitoring does not include dioxin, an identified COC in the 1993

ROD.

*Ground water monitoring continues to exhibit high detections of PCP, especially in wells VPMW-2, VPDW-3, and VPDW-4.

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

EPA has issued the non-cancer component of the dioxin reassessment and is working on completing the cancer component.

No other information has come to light that could call the protectiveness of the remedy into question. A developer has purchased former Wetland Area B. The developer has been made fully aware of the institutional controls placed on this parcel. Vapor intrusion is not considered a real or potential issue in these areas because neither the soil nor the ground water at these parcels is contaminated. The Restrictive Covenant prohibits using the ground water at former Wetland Area B to prevent possibly pulling the contaminated ground water to that area.

Technical Assessment Summary

According to the data reviewed and the Site inspection, the remedy is functioning as intended by the ROD and ROD Amendment. From the investigations performed in the vicinity of VPMW-2 since the first Five-Year Review, it appears the contamination at VPMW-2 was present before the remedy was constructed and the institutional controls implemented as part of the remedy prevent any exposure to it. VPI must assure that any development of the Site complies with the Restrictive Covenant and does not damage the remedy. Otherwise, there have been no changes in the physical conditions of the Site that would affect the protectiveness of the remedy. The ARARs for soil contamination cited in the ROD have been met. There have been no changes in the toxicity factors for the contaminants of concern that were used in the baseline risk assessment, and there has been no change to the standardized risk assessment methodology that could affect the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedy.

VIII. ISSUES

The purpose of this section is to detail any issues related to the current Site operations, conditions, or activities which would prevent the remedy from being protective.

Table 3 - Issues

Issue	Currently Affects Protectiveness	Affects Future Protectiveness
Continued high levels of ground water contamination in the vicinity of VPMW-2, VPDW-3, and VPDW-4	No	Yes
EPA released the final non-cancer dioxin reassessment, publishing a non-cancer toxicity value, or reference dose (RfD), for 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in EPA's Integrated Risk Information System (IRIS). Based on this new RfD, today's levels would be lower than levels that were considered protective at the time the soil remediation was conducted at the Site. Therefore the protectiveness of the remedy needs to be reevaluated.	No	Yes
Ecological exposures were not evaluated in the ROD.	No	Yes
Former Wetland Area B has been sold to a developer	No	Yes

IX. Recommendations and Follow-up Actions

The purpose of this section is to specify the required and suggested improvements to current Site operations, activities, remedy, or conditions.

Table 4 - Recommendations and Follow-Up Actions

Issue	Recommendation/ Follow-up Action	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
High levels of PCP contamination still present in the vicinity of VPMW-2, VPDW-3, and VPDW-4	Issue a Decision Document to address this contamination	EPA	VDEQ	September 2013	No	Yes
EPA released the final non-cancer dioxin reassessment, publishing a non-cancer toxicity value, RfD, for 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in IRIS. Based on this new RfD, today's levels would be lower than levels that were considered protective at the time the soil remediation was conducted at the Site. The protectiveness of the remedy needs to be reevaluated.	Evaluate existing Site data for dioxin to confirm that implemented soil remedy is protective. Conduct sampling if needed.	VPI	EPA/ VDEQ	Within one year of when they are promulgated	No	Yes
Ecological exposures were not evaluated in the ROD.	Evaluate surface soil data. Conduct sampling if needed.	VPI	EPA/ VDEQ	June 2014	No	Yes
Former Wetland Area B has been sold to a developer.	Until construction takes place, assure it complies with Restrictive Covenant and does not damage the existing remedy	VPI	EPA/ VDEQ	2014	No	Yes

X. Protectiveness Statement

The remedy is protective of human health and the environment. All threats at the Site associated with ingestion or dermal contact with contaminated soil and sediments have been addressed through capping of the Site and excavation and consolidation of those areas of contaminated soil and sediments previously located beyond the extent of the cap. The capped area is presently fenced to protect the integrity of the cap.

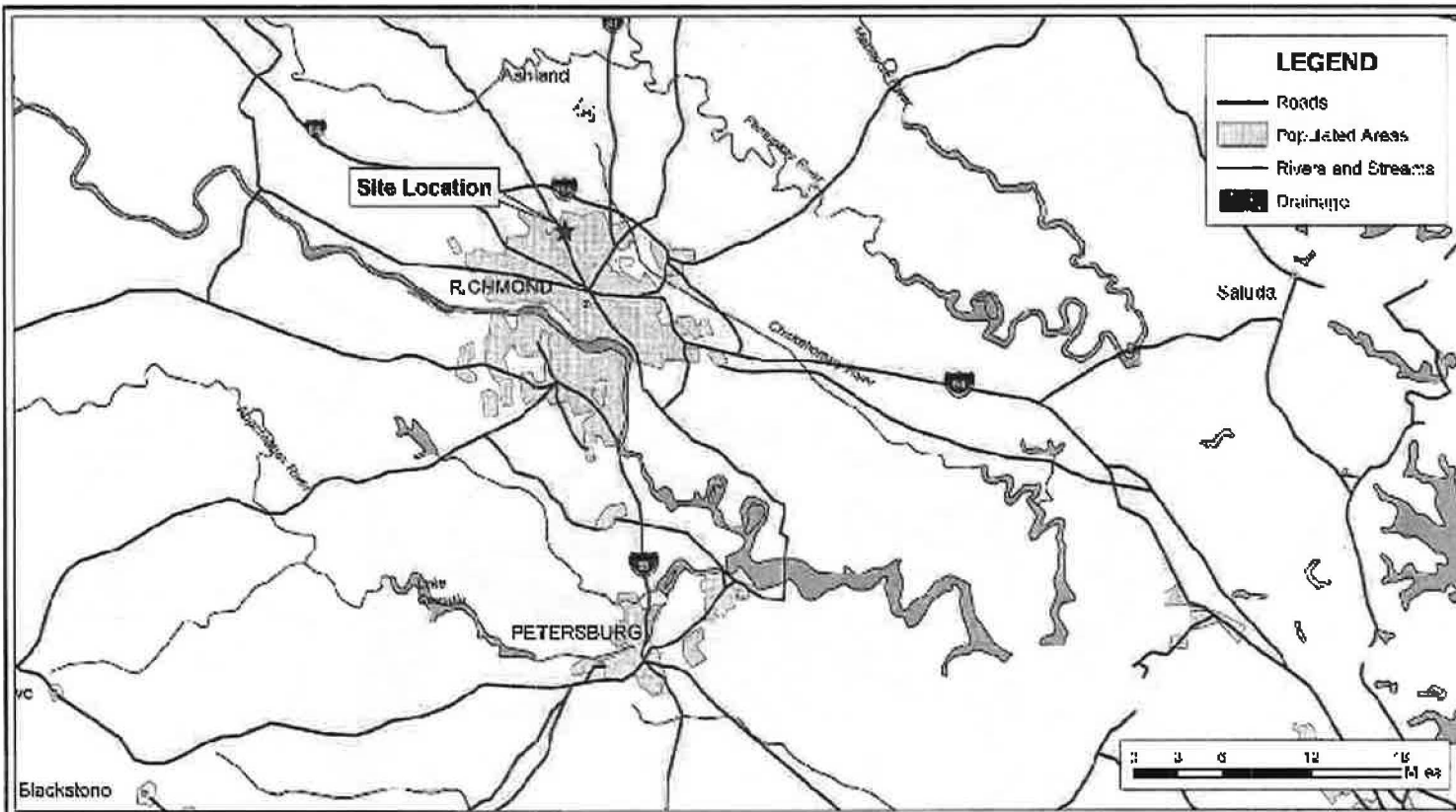
The ground water clean-up goals selected for the Site are protective of human health. In the interim, exposure pathways that could result in unacceptable risks are being controlled. Even though no one currently uses the contaminated ground water, institutional controls have been implemented to prevent exposure to, or ingestion of, contaminated ground water.

Long-term protectiveness of the remedial action will be verified by obtaining ground water samples to fully evaluate potential migration of the contaminant plume downgradient of the slurry wall. Current data indicate that the bulk of the plume remains in the area of VPMW-02, VPDW-3, and VPDW-4 and is not expanding.

XI. Next Five-Year Review

Since Site conditions do not allow for unlimited use and unrestricted exposure, EPA will need to conduct another five-year review of the Rentokil, Inc. Site by July 2018, five years from the date of this review.

ATTACHMENTS



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Virginia Properties, Inc., a Rentokil Initial company
Richmond, Virginia Site
Operation, Maintenance, and Monitoring
Summary Report for 2011

Figure 1
Vicinity Map

