4910X

First Five-Year Review Report
For
Buckingham County Landfill Superfund Site

Dillwyn, Virginia

Prepared By:

U.S. Environmental Protection Agency

Region III

Philadelphia, Pennsylvania

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9/30/03
Date

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Appendices

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List of Acronyms

ARAR	Applicable or Relevant and Appropriate Requirement
BCL	Buckingham County Landfill
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
EPA	Environmental Protection Agency
FS	Feasability Study
HRS	Hazard Ranking System
LTGMP	Long Term Groundwater Monitoring Program
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
PCOR	Preliminary Closeout Report
PRP	Potentially Responsible Party
RA	Remedial Action
RAO	Remedial Action Objective
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
SDWA	Safe Drinking Water Act
VDEQ	Virginia Department of Environmental Protection
VOC	Volatile Organic Compound

Executive Summary

This is the first five-year review for the Buckingham County Landfill Site. The triggering action for this statutory review is the initiation of on-Site construction activities on April 13, 1998. 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.

The remedy for the Buckingham County Landfill Superfund Site in Dillwyn, Virginia included regrading and capping of the hazardous waste disposal area (Option 1 in the Record of Decision (ROD)), institutional controls, and quarterly groundwater monitoring. The Site achieved construction completion with the signing of the Preliminary Closeout Report (PCOR) dated September 21, 1998.

The remedy currently protects human health and the environment because none of the action levels identified in the ROD have been exceeded. Institutional controls as called for in the ROD are in place and are meant to prevent the installation of any wells in the area of the Site. Based upon available data, no human or environmental receptors are being exposed to Site contaminants. Institutional controls in the form of deed restrictions have been put in place by the County. However, in order for the remedy to be protective in the long-term uncertainties associated with the location and migration of the contaminant plume need to be further evaluated. Additional data is necessary to determine if contaminants are migrating toward human or ecological receptors and to determine if the remedy, as implemented, is fully protective of human health and the environment as required by the ROD.

Five-Year Review Summary Form

SITE IDENTIFICATION

Site name: Buckingham County Landfill

EPA ID: VAD089027973

Region: 3	**State:** VA	**City/County:** Dillwyn/Buckingham 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:** September 21, 1998

Has site been put into reuse? YES ❑ NO ■ NA ❑

REVIEW STATUS

Lead agency: EPA ■ State ❑ Tribe ❑ Other Federal Agency _____

Author name: *Christian Matta w/CDM Federal Programs Corporation technical assistance*

Author title: Remedial Project Manager	**Author Affiliation:** U.S. EPA - Region 3

Review period:** April 23, 2002 - September 30, 2003

Date(s) of site inspection: September 17, 2003

Type of review: ■ *Post-SARA* ❑ *Pre-SARA* ❑ *NPL-Removal only* ❑ *Non-NPL Remedial Action Site* ❑ *NPL State/Tribe-lead* ❑ *Regional Discretion*

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

Triggering action:

✓ Actual RA Onsite Construction ❑ Actual RA Start at OU# _____

❑ Construction Completion ❑ Previous Five-Year Review Report

❑ Other (specify)

Triggering action date: April 13, 1998

Due date (five years after triggering action date): April 13, 2003

* ("OU" referes to operable unit.)
** (If a contractor writes the report, the author name should be written as, "RPM w/ (contractor name) assistance.)
*** (Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.)

Five-Year Review Summary Form, cont'd

Issues

- The LTGMP may not be effectively monitoring groundwater contaminants. The remedy as implemented may not be preventing the migration of contaminant away from the Site.
- Cap Erosion, control of vegetative growth and general cap maintenance.

Recommendations and Follow-up Actions

The following recommendations and follow-up actions are based upon EPA's review of related documents, the Site inspection and the conclusion and recommendations described in the CDM report "Hydrogeological Analysis on the Effectiveness of Long Term Ground Water Monitoring", dated February 2003 (see Appendix A).

- Installation of additional monitoring wells.
- Perform cap maintenance

Protectiveness Statement(s)

The remedy currently protects human health and the environment because none of the action levels identified in the ROD have been exceeded. Institutional controls as called for in the ROD are in place and are meant to prevent the installation of any wells in the area of the Site. Based upon available data, no current human or environmental receptors have been exposed or currently are being exposed to Site contaminants. Institutional controls in the form of deed restrictions have been put in place by the County. However, in order for the remedy to be protective in the long-term uncertainties associated with the location and migration of the contaminant plume need to be further evaluated. Additional data is necessary to determine if contaminants are migrating toward human or ecological receptors and to determine if the remedy, as implemented, is fully protective of human health and the environment as required by the ROD.

Long-term Protectiveness

The long-term protectiveness of the remedial action will be verified by implementing the recommendations detailed in section 9 of the Five-Year Review Report. At this time it is not possible to determine if the remedy is providing long-term protection as called for the ROD. Current data indicate that groundwater contamination exists below the cap over the hazardous waste disposal area as well as outside the hazardous waste disposal area. Implementation of actions necessary to address these recommendation will begin within the next year.

Other Comments

No other comments.

Section 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 recommendations to address them.

The Environmental Protection Agency (EPA) is preparing this Five-Year Review Report pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) § 121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA §121states:

> *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 judgement 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.*

EPA Region III, has conducted a five-year review of the Remedial Action (RA) implemented at the Buckingham County Landfill Superfund Site ("the Site" or "Site") in Dillwyn, Buckingham County, Virginia. Technical support for this review was provided by CDM Federal Programs Corporation (CDM). This report documents the results of the five-year review.

This is the first five-year review for the Buckingham County Landfill Site. The triggering action for this statutory review is the initiation of on-Site construction activities on April 13, 1998. 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.

Section 2
Chronology

Table 2-1 lists the chronology of events for the Buckingham Site.

Table 2-1: Chronology of Site Events

Event	Date
Site began operating as an open dump disposing municipal solid waste	1962
Virginia State Board of Health (VSBH) issues Sanitary Landfill Permit	November 1972
Sanitary landfill permit modified to allow for disposal of 50 gallons per week of industrial furniture making waste	1977
Municipal solid waste operations ceased and solid waste portion of landfill covered and closed under supervision of VSBH	1979
VSBH approved increase in the quantity of "special" waste to 30,000 to 40,000 gallons per month	1979
Site owner applies for interim status	1980
EPA performed a Preliminary Assessment of the Site	June 1, 1980
Buckingham County purchases Site and begins closure	April 1982
Hazardous waste portion of landfill closed	1983
EPA performed a Site Inspection	July 1, 1983
Hazard Ranking System package completed	November 1984
Site proposed to the National Priorities List	April 10, 1985
First removal assessment completed	September 29, 1989
Finalization on the National Priorities List	October 4, 1989
Administrative Order on Consent issued for Remedial Investigation and Feasability Study (RI/FS)	January 31, 1991
Second Removal Assessment completed	March 26, 1991
Third Removal Assessment completed	June 28, 1991

Section 2
Chronology

Table 2-1: Chronology of Site Events (continued)

Event	Date
Human Health Risk Assessment completed	January 15, 1993
Ecological Risk Assessment completed	April 20, 1993
RI/FS completed	May 1993
EPA issues Proposed Plan	May 1993
Record of Decision (ROD) signature	September 30, 1994
EPA issued first Unilateral Administrative Order (UAO) to the PRPs to implement the September 30, 1994 ROD	September 29, 1995
De minimis Consent Decree for settlement with de minimis parties	December 13, 1995
PRPs complete Remedial Design	July 2, 1997
PRPs begin on-Site construction of Remedial Action	April 13, 1998
PRPs initiate first round of sampling for the Long-Term Groundwater Monitoring Program (LTGMP)	September 1998
PRPs complete RA construction	February 16, 1999
Preliminary Closeout Report (PCOR)	September 21, 1998
EPA issues second UAO to Buckingham County for implementation of institutional controls and minor Operation and Maintenance requirements	March 20, 2000

Section 3
Background

3.1 Physical Characteristics

The Site is located along County Road 640 in central Buckingham County, Virginia approximately 3.5 miles southeast of the town of Buckingham. The intersection of U.S. Route 60 and U.S. Route 15 is approximately 1.5 miles northeast of the Site.

The Site is located in the Appalachian Piedmont Physiographic Province. The surface topography of the area is gently rolling. Elevations in the Site area vary between approximately 540 and 660 feet above sea level. Elevations in the immediate vicinity of the landfill range from approximately 580 to 620 feet above sea level.

3.2 Land and Resource Use

The Site consists of a 2-acre hazardous waste disposal area. A 7-acre domestic waste landfill is located adjacent to the southern border of the Site. The Buckingham County dog pound is located at the entrance to the property on which the hazardous waste landfill and domestic landfill are located. The Site is fenced and is primarily grassy, surrounded by forest. The Horsepen Wildlife Management Area is located approximately three quarters of a mile west of the Site. The land and resource use in the immediate vicinity of the Site is unlikely to change from its current use as rural residential and farming property. Several companies, including Thomasville Furniture Industries, Inc., used the Site to dispose of various wastes between 1962 and 1983. As a result of these disposal activities, the Site groundwater is contaminated with volatile organic compounds (VOCs).

The area of Buckingham County totals 371,771 acres, of which 75,854 acres, or 20 percent, was farms in 1997. The general vicinity of the Site is primarily rural, with several residences near the Site property. The residences obtain their potable water from either private wells or from the Troublesome Creek Reservoir. Since there are no large urban centers in the County, the population is classified as mostly rural-urban, and in the 2000 census totaled 15,623.

Agriculture is an integral part of Buckingham County's economy, and cash farm income totaled $17.2 million in 1997. According to the 1997 Census of Agriculture, there were 370 farms in the county, averaging 205 acres in size.

Forestry is also important for the County economy. The production of saw timber, railroad ties, and other items provides an important source of income and employment. Other jobs are provided by the area's thriving mineral industry, as Buckingham County slate is well known throughout the country as superior roofing material.

3.3 History of Contamination

From 1962 to 1982, the area encompassing the Site was owned and operated by Joseph Love. Initially it was used for disposal of municipal solid waste and received a sanitary landfill permit by the VSBH. In 1977, the sanitary landfill permit was modified to allow for disposal of 50 gallons per week of industrial furniture-making waste. In 1979, the VSBH approved an increase in the quantity of "special" waste to 30,000 to 40,000 gallons per month.

The area known as the Site is comprised of a number of trenches known to include an evaporation trench, two disposal trenches, a barrel trench and a "barrow" pit. This approximately two acre area is identified in the ROD as the hazardous waste disposal area. In general, operations in the hazardous waste disposal area involved the receipt of drummed liquid wastes which were poured into the evaporation trench. The trench was periodically cleared of solid residues that remained after evaporation and/or percolation. These residues were transferred to one of the two disposal trenches. The empty drums were then crushed and placed in the barrel trench where they remain. The borrow pit supplied cover soil for the entire operation.

3.4 Initial Response

The solid waste landfill was covered and closed in 1979 under the supervision of the VSBH; however, the hazardous waste disposal operations continued. In April 1982, the County purchased the Site and contracted Schnabel Engineering Associates to close the hazardous waste disposal area.

In November 1984, the Hazard Ranking System scoring package was completed and the Site was finalized on the NPL on October 4, 1989. On January 31, 1991, several Potentially Responsible Parties (PRPs) and EPA entered into an Administrative Order on Consent to conduct a Remedial Investigation and Feasability Study (RI/FS) at the Site. Field work for the Remedial Investigation (RI) was conducted March through July 1992. The RI was accepted on March 24, 1993. The FS was accepted on May 3, 1993.

3.5 Basis for Taking Action

Contaminants in groundwater are primarily volatile organic compounds, and include 1,2-bromoethane, 1,2-dibromo-3-chloropropane, 1,1-dichloroethylene, 1,2-dichloropropane, cis- and trans-1,3-dichloropropylene, 1,1,2,2-tetrachloroethane, acetone, methylene chloride, tetrachloroethylene, trichloroethylene, vinyl chloride, 1,1,2-trichlorothane, and 1,2-dichloroethane.

As previously noted, contaminants in groundwater are primarily volatile organic compounds. The apparent source of contamination was the waste buried and dumped in the hazardous waste disposal area. Unacceptable cancer and systemic health risks were identified with respect to the future residential use scenario (i.e., hypothetical future residents living adjacent to the Site and using groundwater for drinking, or migration of contaminated groundwater to existing residential wells). The excess lifetime cancer risk determined under the future use exposure scenario from incidental inhalation, incidental ingestion, and dermal absorption of contaminants in groundwater was determined to be 2.6×10^{-1}. This exceeded EPA's target range of 1×10^{-4} to 1×10^{-6}. Most of the risk was determined to be associated with the ingestion of VOCs in the contaminated groundwater.

With respect to noncarcinogenic systemic risks a total Hazard Index (HI) of greater than one was calculated based on a number of VOC's. The HI under a future residential exposure scenario for an adult was determined to be 58 and 112 for a child. The calculated Hazard Indices were based on a combined exposure due to the groundwater ingestion and volatile inhalation.

Section 4
Remedial Actions

4.1 Remedy Selection

The ROD for the Site was signed on September 30, 1994. The ROD specified the following components:

- Groundwater monitoring
- RCRA multilayer cap
- Optional excavation and off-Site incineration
- Preparation of a focused FS for the barrel trench
- A contingency provision for pump and treat with air stripping, if needed
- Perimeter fencing
- Deed notice

The Remedial Action Objectives (RAOs) for this Site were to protect human health and the environment from potential current and future risks associated with the following exposure scenarios:

- Exposure via incidental ingestion of surface soil and dermal absorption of contaminants from surface soil;
- Incidental ingestion of surface water and dermal absorption of contaminants from surface water;
- Incidental ingestion of sediments and dermal absorption of contaminants from sediment;
- Incidental ingestion of groundwater, dermal absorption of contaminants from groundwater, and inhalation of VOCs from bathing in groundwater; and,
- Incidental ingestion of leachate and dermal absorption of contaminants from leachate.

4.2 Remedy Implementation

In September 1995, EPA issued a Unilateral Administrative Order (UAO), EPA Docket No. III-95-65-DC to the PRPs after negotiations to implement the RD/RA were unsuccessful. The UAO required the PRPs to implement the remedy described in the ROD. The RD was approved by EPA in July 1997.

The Remedial Action (RA) began in April 13, 1998. The components of the constructed RA included the following:

- Regrading to achieve the grades and slopes for the acceptance of the cover system and subgrade preparation which involved grading and placement of compacted general fill;
- Installation of the first geosynthetic element on the prepared landfill;

- Construction of a gas vent layer made of geocomposite drainage material on top of the hazardous waste disposal area. The passive gas venting layer consisted of installation of a peripheral gas collection trench just beyond the lateral extent of the hazardous waste disposal area. The trench is designed to minimize the subsurface lateral migration of any gas to areas outside the landfill limits;
- A geocomposite clay liner was placed, followed by a linear low density polyethylene liner;
- A geocomposite drainage layer was placed, followed by an 18-inch thick protective layer of compacted general fill on the cover system with a 6-inch thick topsoil layer. The capped area was then planted with grass to keep the soil cover from eroding thereby protecting the cap components;
- Surface water diversion ditches were installed to convey surface water away from the hazardous waste disposal area;
- Perimeter fencing was installed around the edge of the cap to limit access.

The Site achieved construction completion status when the Preliminary Close Out Report was signed on September 21, 1998. Initially the EPA tried to negotiate implementation of the institutional controls with Buckingham County, the owner of the Site. After over a year of failed negotiations aimed at agreement on the terms of a Consent Decree, a Unilateral Administrative Order (UAO) was issued to Buckingham County on March 20, 2000. The UAO required them to implement the deed restrictions called for in the ROD, conduct minor operation and maintenance activities such as mowing the cap and posting signs around the landfill. EPA received notification from Buckingham County that the deed restrictions had been entered into the County records and have received quarterly progress reports documenting activities associated with the operation and maintenance of the cap and associated drainage components and fence.

4.3 System Operation/Operation and Maintenance

The PRPs are conducting long-term monitoring and maintenance activities at the Site in accordance with the Long Term Groundwater Monitoring Program (LTGMP) Work Plan, submitted in February 1998 by Parsons Engineering Science. The LTGMP calls for quarterly groundwater monitoring, which includes monitoring of the landfill point of compliance wells and the two nearest downgradient private potable water supply wells.

In addition to the groundwater monitoring, operation and maintenance (O&M) activities are also being conducted. The primary activities include:

- Visual inspection of the cap with regard to vegetative cover, settlement, stability, and any need for corrective action;
- Periodic mowing of the vegetation on the cap surface;
- Inspection of the drainage swales for blockage, erosion and instability, and any need for corrective action, and;
- Inspection of the condition of the groundwater monitoring wells.

There have been issues related to O&M for the hazardous waste disposal area. There has been limited maintenance of the cap, and there are erosion concerns at the northwestern corner of the capped area. Further information is presented in Section 6.5.

Groundwater monitoring is being conducted in accordance with the ROD. Samples have been collected on a quarterly basis from point of compliance wells located not farther than 150 feet from the edge of the cap, a downgradient well located at a residence and a downgradient well located at a church. This quarterly sampling has been conducted by the PRPs, with split samples being accepted by EPA. To date, no VOC action level has been exceeded in groundwater samples collected from the point of compliance wells or the two downgradient wells. However, low levels of VOC contamination has been found in point of compliance wells with increasing concentration trends in VOC levels being identified.

Section 5
Progress Since Last Five-Year Review

This is the first five-year review for the Site.

Section 6
Five-Year Review Process

6.1 Administrative Components

The Buckingham Five-Year Review team was lead by the EPA Remedial Project Manager Christian W. Matta. Technical support was provided by CDM Corporation. The EPA RPM conferred with the EPA Toxicologist, EPA hydrogeologist and Virginia Department of Environmental Quality Project Manger as needed.

The Site inspection occurred on September 17, 2003 and was conducted by the EPA RPM in conjunction with CDM personnel.

6.2 Community Involvement

A Fact Sheet was sent to residents of the community during September 2003, to inform them of the current status of the Site and to obtain their involvement in the five-year review process. The Fact Sheet updated the Site progress and announced the initiation of the Five-Year Review. Point of contact information was provided.

A public notice announcing the start of the Five-Year Review at the Buckingham County Landfill Superfund Site appeared in the *Farmville Herald* on August 7, 2003. The notice explained the Five-Year Review process, provided point of contact information, and identified the location of the information repository for the Site. In addition, notices announcing the Five-Year Review and seeking public comment were hand-delivered to several residences and two churches near the Site.

A second public notice will be run in the newspaper announcing the completion of the Five-Year Review and the availability of the Five-Year Review Report in the information repository at the Buckingham County Library. In addition, a fact sheet will be prepared and distributed summarizing the process and findings of the Five-Year Review.

No feedback from the community was received as a result of either the Fact Sheet or advertisement.

6.3 Document Review

The Five-Year Review consisted of a review of relevant documents including the FS, Proposed Plan, ROD, RD/RA Report, the Long Term Ground Water Monitoring Work Plan, Quarterly Groundwater Monitoring Reports, and the Hydrogeological Analysis on the Effectiveness of Long Term Ground Water Monitoring Report.

6.4 Data Review

An evaluation of the data collected during the LTGMP, relevant documents listed above as well as other historical Site data, was completed in the CDM report "Hydrogeological Analysis on the Effectiveness of Long Term Ground Water Monitoring" (HA Report), dated February 2003. The HA Report is included as Appendix A.

The intent of the HA Report was to review all relevant documentation regarding the LTGMP and determine if it is performing as required to intercept any contamination that may be migrating away from the hazardous waste disposal area. The overall findings of this report suggest that there may be deficiencies in the LTGMP, and that contamination may be migrating to areas not being monitored by the LTGMP.

The State reviewed key data for this Five-Year Review and has concurred with EPA's findings.

6.5 Site Inspection

The EPA RPM directed CDM personnel to conduct a technical assessment of the Site on August 29, 2003, in order to assess the physical status of the capped area. On September 17, 2003, the EPA RPM in conjunction with CDM personnel conducted a follow-up Site inspection. The purpose of the Site inspection was to review the findings of the CDM assessment of the cap system and review the conclusions and recommendations of the CDM HA Report Analysis in relation to the physical setting of the Site.

The assessment concluded that the cap and associated drainage features had not been recently maintained by Buckingham County. Failure to perform the required maintenance activities can adversely impact the cap. During the assessment it was noted that:

- The vegetated cap has not been mowed recently; overgrowth is evident. Improperly maintained vegetation can cause a reduction in the drainage off the cap surface and may lead to infiltration under the cap. At the time of the Site inspection saplings were noted as being present on the cap, indicating that the cap has not been mowed recently. However, the vegetation was not determined to be exceedingly overgrown and appeared to be preventing erosion of the soil cover except for the north west corner which has bare spots and evidence of erosion.

- The drainage swale running southeast to northwest on the cap is not adequately conveying water flow off the cap surface. Pools of water and saturated soil and vegetation due to ponding water was noted during the assessment. This condition may lead to infiltration

of water through the cap and/or may indicate that the drainage layer is not properly conveying water off the cap. The condition was not observed during the follow-up Site Inspection.

- Riprap check dams located in the drainage swales are smothered with vegetation. This condition may impede drainage away from and off of the cap leading to areas of ponding.

- Surface runoff from the landfill is directed to a perimeter drainage ditch, which then flows off-Site to the Warner Branch of Cooper Creek. Drainage features in place for runoff management include small riprap check dams, located at the entrance and exit points of the perimeter ditch. Although vegetative overgrowth is apparent on the perimeter ditch, the perimeter drainage features are in good condition.

- Due to soil erosion and/or animals burrowing over an extended time period, a gap between the bottom of the Site security fence and the ground surface has remained. At the time of the technical assessment numerous holes were noted in the security fence surrounding the cap. During the Site inspection it was noted that maintenance had been done on the fence and the holes were patched with wire.

6.6 Interviews

Interviews were conducted with a small number of residents near the Site. Additional residents and Buckingham County officials were also contacted, but declined the opportunity to meet with EPA as part of the Five-Year Review community involvement process.

Residents that were interviewed noted that there has not been much discussion about the Site in the community for several years. Concerns about the Site's potential impact on property values were conveyed. One of the residents interviewed, whose property had been for sale, was questioned about the Site by a potential buyer. No incidents of vandalism or trespassing at the Site were reported.

The cleanup implemented at the Site was not the remedy initially recommended by EPA. In response to extensive community comment on the Proposed Plan, EPA removed the excavation and groundwater treatment components of the remedy. Residents living downgradient of the Site expressed doubts about the protectiveness of the cleanup and concern about remaining health threats possibly posed by the Site. They referred to recent groundwater monitoring results when noting the opinion that monitoring wells may not be properly located to determine the location of the contaminant plume. The residents also believed that EPA's excavation remedy would have been better than the current containment remedy.

The residents interviewed had mixed feelings about how well they have been kept informed about the Site during the past 5 years. One resident felt well informed and expressed confidence in EPA's management of the Site. Others did not feel that they had been provided the information they needed and requested. In particular, after having been warned not to drink their water in 1984, they were unsure if their well water was now safe to drink and have been awaiting a written response to this question. In response to these concerns, EPA explained that additional investigation at the Site would be done if determined necessary during the Five-Year Review.

All those interviewed felt that Buckingham County should take care of any additional work that might be needed at the Site, regardless of cost.

Information gathered during the interviews is included in Appendix B.

Section 7
Technical Assessment

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

Our review of the relevant documents and the results of the Site inspection indicate that the remedy is not currently functioning as intended by the ROD. The capping of the disposal areas have achieved the remedial objectives containing contaminated soil and waste material, preventing dermal contact and incidental ingestion, and preventing leaching of precipitation through the contaminated material. However, it is unclear if the cap has prevented the migration of contaminants from the source area (see Appendix A).

As part of the Five-Year Review effort CDM was tasked by the EPA RPM to analyze the effectiveness of the LTGMP and identify if the point of compliance monitoring wells are properly located to effectively monitor or intercept groundwater contaminants that may be migrating from beneath the landfill. CDM presented the analysis of the LTGMP in a February 2003 report entitled Hydrogeological Analysis on the Effectiveness of Long Term Groundwater Monitoring, Buckingham County Landfill, Buckingham, Virginia and it is provided in Appendix A. The overall conclusion of the report is that the LTGMP is not effective in monitoring groundwater contamination at the Site. Based on the data reviewed for the hydrogeological analysis, it appears that contamination is migrating to a location that is not being monitored by the LTGMP point of compliance wells. Furthermore, it appears no data are available that describes the location or movement of a contaminant plume or possible contaminant plume.

In addition, there are issues with the O&M of the cap and the drainage system. These issues include erosion underneath the security fence, lack of maintenance/mowing of the cap area, and brush growing on the cap. Due to the high level of vegetative overgrowth, drainage may be impeded which may lead to conditions that promote water infiltration underneath the cap. Tree roots may compromise the integrity of the cap. These conditions all contribute to weakening the protectiveness of the remedy.

The institutional controls were put into place following issuance of the May 20, 2000, UAO to Buckingham County by EPA. The UAO called for implementation of deed restrictions as institutional controls to prevent exposure to, or ingestion of, contaminated groundwater, as outlined in the ROD. The UAO also required the County to perform minor operation and maintenance activities such as access control, posting of signs, mowing of the cap, maintaining locks on the wells and access gates, and providing inspection reports to the EPA.

The quarterly residential well sampling has been operating as intended. The remedial objective to prevent contact with contaminated groundwater has been met. No action levels, as determined in the ROD, have been exceeded in the residential well samples or in the point of compliance wells.

7.2 *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 major changes in the physical conditions of the Site that would affect the protectiveness of the remedy.

Changes in Standards and To Be Considereds
There are no changes to note.

Many of the Applicable or Relevan and Appropriate Regulations (ARARs) identified in the ROD have been complied with during the implementation of the work already conducted at the site. The remaining ARARs will be complied with during the ongoing monitoring and O&M activities, or during implementation of the contingent remedy.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics
There are no changes to note. Information to date indicates that the contaminants have remained within the 150 foot point of compliance.

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

Analytical data that has been collected during the LTGMP was evaluated in conjunction with other historical analytical and hydrogeological data. The data review is presented in Appendix A. Based on the information, it can not be determined if the remedy will provide the long term protection required by the ROD. The remedy has been determined to be protective in the short term because no action levels identified in the ROD have been exceeded.

In summary, the functionality of the current compliance well network to monitor Site contaminant migration is uncertain and the position of the groundwater contaminant plume is unknown. While no ROD contaminant levels have been exceeded in either the point of compliance wells or the two downgradient residential wells, it can not be determined if this is due to remedy effectiveness, the contaminants migrating along pathways not being intercepted by the point of compliance wells, or simply because the contaminants have not had sufficient time to migrate to the point of compliance wells.

7.4 *Technical Assessment*

Based on review of the quarterly monitoring data gathered over the last five years, the HA Report and information identified in the RI/FS, adequate measures may not be in place to ensure that the point of compliance wells are actually monitoring the contaminated groundwater plume in a manner that would provide warning that the plume is moving off-Site. Data reviewed indicates that the groundwater plume is not fully delineated and the lack of sample collection from Site wells, other than those located 150 feet from the edge of the cap, has created a situation that does not allow tracking of the contaminated groundwater. Data presented in the HA Report indicates that the contaminated groundwater may be migrating to areas not monitored by the long term groundwater monitoring program and some point of compliance wells may not even be placed at a depth that will allow interception of contaminated groundwater because the well is not deep enough.

The recommendations identified in the Five-Year Review should be implemented as a first step toward achieving an effective LTGMP that will track the contaminated groundwater located on-Site. Adjustments to the LTGMP as well as additional data needs can then be identified and addressed as needed.

Section 8
Issues

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
LTGMP may not be effectively monitoring groundwater contaminants. The remedy as implemented may not be preventing the migration of contaminant away from the Site.	N	Y
Erosion/vegetative growth/cap maintenance	N	Y

Section 9

Recommendations and Follow-Up Actions

The recommendations and follow-up actions are based upon our review of related documents, the Site inspection and the findings and conclusions described in the CDM report "Hydrogeological Analysis on the Effectiveness of Long Term Ground Water Monitoring", dated February 2003 (see Appendix A).

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Mile-stone Date	Affects Protectiveness? (Y/N)	
					Curren t	Future
The functionality of the current compliance well network to monitor contaminant migration is uncertain and the position of the groundwater contaminant plume is unknown. Monitoring wells should be installed in areas where hydraulic gradients and/or contaminant trends suggest the presence of additional groundwater contamination	-Installation of MW-4SL adjacent to MW-4S and screen immediately above bedrock (see figure in Appendix A for well locations) -Installation of MW-5BR and screen at a depth below MW-5B -Installation of MW-7B and screen in bedrock -Installation of MW-22BR and screen at a depth below MW-22B -Installation of MW-23BR and screen at a depth below MW-23B -Installation of MW-25SL and screen right above bedrock surface -The six new wells, in addition to the existing 15 wells, should be sampled during each quarterly groundwater monitoring event. -During two quarterly events (a high-flow and low-flow period) within a 12-month period, groundwater samples should be collected from all wells and data used to delineate the plume.	PRP	EPA	12/2004	N	Y

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Mile-stone Date	Affects Protectiveness? (Y/N)	
					Curren t	Future
Erosion/Vegetative Growth/Cap Maintenance	Seed and mulch eroded areas, perform maintenance per schedule and monitor unwanted plant species for removal. Drainage channels need to be maintained so that vegetation does not impede the conveyance of water away from the capped area.	DDD	EPA	12/2004	N	Y

Section 10
Protectiveness Statement

The remedy currently protects human health and the environment because none of the action levels identified in the ROD have been exceeded. Institutional controls as called for in the ROD are in place and are meant to prevent the installation of any wells in the area of the Site. Based upon available data, no current human or environmental receptors have been exposed or currently are being exposed to Site contaminants. Institutional controls in the form of deed restrictions have been put in place by the County. However, in order for the remedy to be protective in the long-term uncertainties associated with the location and migration of the contaminant plume need to be further evaluated. Additional data is necessary to determine if contaminants are migrating toward human or ecological receptors and to determine if the remedy, as implemented, is fully protective of human health and the environment as required by the ROD.

Section 11
Next Review

The next five-year review for the Buckingham County Landfill Site is required by September 2008, five years from the date of this review.